Chapter 7. Codification, Distribution, and Publication of Rules and Other Agency Statements

4-22-7-1 Application of chapter

Sec. 1. This chapter applies to all rules adopted under IC 4-22-2. *As added by P.L.31-1985, SEC.34.*

4-22-7-2 Definitions

Sec. 2. The definitions in IC 4-22-2-3 apply throughout this chapter. *As added by P.L.31-1985, SEC.34.*

4-22-7-3 Updating of rules; style standards; correction of errors

Sec. 3. An agency shall add, amend, and repeal its rules, as necessary, to:

(1) eliminate obsolete or unenforceable provisions;

(2) eliminate deviations from the format, numbering system, standards, and techniques established under IC 4-22-2-42; and

(3) eliminate other typographical, clerical, or spelling errors.

As added by P.L.31-1985, SEC.34.

4-22-7-4 Retention of duplicate copy of rule by agency

Sec. 4. An agency shall maintain a duplicate original copy of each rule that has been filed with the secretary of state (including documents filed with the secretary of state under IC 4-22-2-21) under a retention schedule established by the commission on public records. *As added by P.L.31-1985, SEC.34.*

4-22-7-5 Retention of duplicate copy of rule by secretary of state; distribution to publisher

Sec. 5. (a) The secretary of state shall retain a duplicate original copy of each rule that has been accepted for filing by the secretary of state (including documents filed with the secretary of state under IC 4-22-2-21). The secretary of state has official custody of an agency's adopted rules.

(b) Within one (1) business day after the date that the secretary of state accepts a rule for filing, the secretary of state shall distribute two (2) duplicate copies of the rule to the publisher in paper form. However, the secretary of state may distribute one (1) copy of the rule without including the full text of any matter incorporated into the rule.

(c) After December 31, 1987, the secretary of state shall distribute copies of a rule to the publisher under subsection (b) without distributing a copy of the full text of any matter incorporated by reference in the rule. When the copies are distributed under subsection (b), the secretary of state shall include a notice briefly describing the incorporated matters. Additionally, the secretary of state shall distribute one (1) copy of each rule (complete with the filed text of matters incorporated by reference into the rule) that has been micrographically copied under IC 4-5-1-2 to the publisher within ninety (90) days after it is copied.

(d) Within ninety (90) days after the secretary of state accepts a rule for filing, the secretary of state shall distribute duplicate originals of the rule, as follows:

(1) To the governor, one (1) copy.

(2) To the attorney general, one (1) copy.

(3) To the Indiana library and historical department, two (2) copies.

(4) After December 31, 1987, to the commission on public records, the number of copies needed by the commission for its archive program under IC 5-15-5.1.

(e) After December 31, 1987, the secretary of state shall distribute copies under subsection (d) in micrographic form. The micrographic copies shall be prepared under IC 4-5-1-2. *As added by P.L.31-1985, SEC.34. Amended by P.L.19-1986, SEC.2.*

4-22-7-6 Publication of rules by individual agency

Sec. 6. An agency may publish its rules under IC 4-13-4.1. A publication containing rules also may include any other matter that may assist the public in conducting its business with the agency. *As added by P.L.31-1985, SEC.34.*

4-22-7-7 Certain statements, orders and official opinions; distribution of copies; maintenance of current list

Sec. 7. (a) This section applies to the following agency statements:

(1) Executive orders issued by the governor.

(2) Notices that a rule has been disapproved or objected to by the attorney general under IC 4-22-2-32 or IC 4-22-2-38, or disapproved or objected to by the governor under IC 4-22-2-34 or IC 4-22-2-38.

(3) Official opinions of the attorney general (excluding advisory letters).

(4) Official explanatory opinions of the state board of accounts based on an official opinion of the attorney general.

(5) Any other statement that:

(A) interprets, supplements, or implements a statute;

(B) has not been adopted in compliance with IC 4-22-2;

(C) is not intended by its issuing agency to have the effect of law; and

(D) may be used in conducting the agency's external affairs.

(6) A statement of the governor concerning extension of an approval period under IC 4-22-2-34.

(b) Whenever an agency adopts a statement described by subsection (a), the agency shall distribute two (2) duplicate copies of the statement to the publisher for publication in the Indiana Register and the copies required by IC 4-23-7.1-26 to the Indiana library and historical department.

(c) Every agency that adopts a statement described under subsection (a) also shall maintain a current list of all agency statements described in subsection (a) that it may use in its external affairs. The agency shall update the listing at least every thirty (30) days. The agency shall include on the list the name of the agency and the following information for each statement:

(1) Title.

(2) Identification number.

(3) Date originally adopted.

(4) Date of last revision.

(5) Reference to all other statements described in subsection (a) that are repealed or amended by the statement.

(6) Brief description of the subject matter of the statement.

(d) At least quarterly, every agency that maintains a list under subsection (c) shall distribute two (2) copies of the list to the publisher and two (2) copies to the Indiana library and historical department. *As added by P.L.31-1985, SEC.34.*

Chapter 8. Publication of Indiana Register and Indiana Administrative Code

4-22-8-1 Definitions applicable

Sec. 1. The definitions in IC 4-22-2-3 apply throughout this chapter. *As added by P.L.31-1985, SEC.35.*

4-22-8-2 Indiana Register; publication

Sec. 2. The publisher shall publish a serial publication with the name Indiana Register at least six (6) times each year. *As added by P.L.31-1985, SEC.35.*

4-22-8-3 Contents of Indiana Register

Sec. 3. The publisher shall include in the Indiana Register every rule or other agency statement distributed under IC 4-22-2-40, IC 4-22-2-41, IC 4-22-7-5, IC 4-22-7-7, or another statute that requires the matter to be published in the Indiana Register. However, the publisher may publish a rule without publishing the full text of a matter incorporated by reference in the rule and may publish any other statement in summary form. *As added by P.L.31-1985, SEC.35.*

4-22-8-4 Modifications by publisher

Sec. 4. (a) The publisher may:

(1) reformat, renumber, or revise any rule or other agency statement published in the Indiana Register to conform to the typographical style and layout standards established under section 10 of this chapter; and

(2) reformat, renumber, or revise a rule adopted under IC 4-22-2 to conform to the format, numbering system, standards, and techniques established under IC 4-22-2-42, at any time before the rule is finally published in the Indiana Register.

(b) When published as part of a rule, an action to bring the rule into conformity with the format, numbering system, standards, and techniques established under IC 4-22-2-42 is effective to the same extent as if the agency had adopted the action under IC 4-22-2-38. However, if the governor or the agency adopting the affected rule objects in writing to the publisher concerning a specifically described action and the action does not conform to the format, numbering system, standards, or techniques established under IC 4-22-2-42, the action is voided, and the publisher shall publish a correction under subsection (c).

(c) The publisher may correct its own typographical, clerical, or spelling error in the Indiana Register by publishing an errata notice that identifies the error and its correction. *As added by P.L.31-1985, SEC.35.*

4-22-8-5 Indiana Administrative Code; publication

Sec. 5. (a) The publisher shall compile, computerize, index, and print a codification of the general and permanent rules of the agencies with the name Indiana Administrative Code. The publisher may publish, with the Indiana Administrative Code, any tables, explanatory material, or other documents that the publisher considers appropriate.

(b) The publisher shall establish a system to maintain, supplement, and recompile the Indiana Administrative Code when necessary or appropriate. *As added by P.L.31-1985, SEC.35.*

4-22-8-6 Modifications and corrections by publisher

Sec. 6. (a) The publisher may reformat, renumber, or revise at any time any rule codified in the Indiana Administrative Code to conform to the typographical style and layout standards established under section 10 of this chapter.

(b) The publisher may correct its own typographical, clerical, or spelling error in a rule published in the Indiana Administrative Code by publishing an errata notice in the Indiana Register that identifies the error and its correction. *As added by P.L.31-1985, SEC.35.*

4-22-8-7 Annual publication

Sec. 7. The publisher shall publish an edition of or a supplement to the Indiana Administrative Code at least annually. *As added by P.L.31-1985, SEC.35.*

4-22-8-8 Affidavit of correctness by publisher; delivery to secretary of state

Sec. 8. (a) Before an edition or supplement of the Indiana Administrative Code is printed, the publisher shall deliver an affidavit to the secretary of state attesting that the text to be published in the edition or supplement has been compared with the preceding edition, the preceding supplement (if applicable), and the appropriate original versions of recently adopted rules and has been found to be correct and complete.

(b) Upon delivery of an affidavit under this section, the secretary of state shall certify the receipt of the affidavit and the publisher's assertions for the edition or supplement to which they apply. *As added by P.L.31-1985, SEC.35.*

4-22-8-9 Number of copies of Indiana Administrative Code and Indiana Register; price

Sec. 9. The publisher shall determine the number of copies of the Indiana Administrative Code and the Indiana Register to be published, to whom they shall be distributed, and the price of copies to be made available for sale. *As added by P.L.31-1985, SEC.35.*

4-22-8-10 Typographical style; layout standards

Sec. 10. The publisher shall establish typographical style and layout standards for the Indiana Administrative Code and the Indiana Register. *As added by P.L.31-1985, SEC.35.*

4-22-8-11 Assistance by code revision committee

Sec. 11. The code revision commission shall assist the publisher with the publication of the Indiana Register and with the compilation, computerization, indexing, and printing of the Indiana Administrative Code. *As added by P.L.31-1985, SEC.35.*

4-22-8-12 Failure to comply with chapter

Sec. 12. Failure of an agency, the publisher, or the code revision commission to comply with this chapter does not invalidate a rule or other agency statement. *As added by P.L.31-1985, SEC.35.*

Chapter 9. Evidence; Judicial Notice of Rules

4-22-9-1 Application of chapter

Sec. 1. This chapter applies to all rules that have been accepted for filing by the secretary of state under IC 4-22-2. *As added by P.L.31-1985, SEC.36.*

4-22-9-2 Definitions applicable

Sec. 2. The definitions in IC 4-22-2-3 apply throughout this chapter. *As added by P.L.31-1985, SEC.36.*

4-22-9-3 Judicial notice of rules

Sec. 3. (a) Any rule that has been adopted in conformity with IC 4-22-2 (including a matter incorporated by reference into a rule) shall be judicially noticed by all courts and agencies of this state.

(b) Subject to subsection (c), the official publication of a rule in the Indiana Register or the Indiana Administrative Code shall be considered prima facie evidence that the rule was adopted in conformity with IC 4-22-2 and that the text published is the text adopted.

(c) The 1979 edition of the Indiana Administrative Code shall be conclusively presumed to contain the accurate, correct, and complete text of all rules in effect on December 31, 1978. All rules filed with the secretary of state before December 31, 1978, and not compiled in the 1979 edition of the Indiana Administrative Code are void. *As added by P.L.31-1985, SEC.36.*

4-22-9-4 Matters not part of official text

Sec. 4. The following, as they appear in an adopted version of a rule filed with the secretary of state, in the Indiana Register, or in the Indiana Administrative Code, are not part of the official text of any rule, are not intended to affect the meaning, application, or construction of any rule, and may be altered at any time by the publisher of the Indiana Register or Indiana Administrative Code:

(1) Digests.

(2) Title, article, rule, and section headings.

(3) Title, article, and rule analyses (listings of article, rule, and section headings).

(4) Statutory authority citation lines.

(5) Statutes affected citation lines.

(6) Bracketed internal references.

(7) Cited in lines.

(8) History lines or history blocks.

(9) Revisor's notes.

As added by P.L.31-1985, SEC.36.

4-22-9-5 References to Indiana Administrative Code; incorporation by reference

Sec. 5. (a) A reference in a rule to the Indiana Administrative Code (IAC) in the form of an IAC citation, if unaccompanied by a reference to a specific edition or supplement to the Indiana Administrative Code, shall be construed to include any amendment to the cited provision occurring after the date that the reference is written.

(b) If a matter that is incorporated by reference into a rule is amended after the effective date of the rule, the rule includes the amendment to the incorporated matter only if the incorporated matter is:

(1) an Indiana statute codified with an Indiana Code (IC) citation number; or

(2) an Indiana rule codified with an Indiana Administrative Code (IAC) number.

As added by P.L.31-1985, SEC.36.

4-22-9-6 Citation of rules

Sec. 6. Any rule may be cited or pleaded by citation reference to the Indiana Administrative Code or the Indiana Register, without copying the cited provision in full. A reference to the Indiana Administrative Code (IAC) in the form of an IAC citation shall be construed

to include all amendments as of the date the reference is written, unless accompanied by a reference to a specific edition or supplement of the Indiana Administrative Code. *As added by P.L.31-1985, SEC.36.*

4-22-9-7 Determination and construction of rules

Sec. 7. The determination and construction of rules in all civil actions shall be made by the court as a matter of law and not by the jury. *As added by P.L.31-1985, SEC.36.*

ARTICLE 23. BOARDS AND COMMISSIONS

Chapter 1. Repealed

(Repealed by P.L.238-1987, SEC.3).

Chapter 2. Indiana Arts Commission

4-23-2-1 Creation; membership; contracts; meetings; quorum

Sec. 1. (a) There is hereby created a commission to be known as the Indiana arts commission. On and after July 1, 1967, the commission shall consist of fifteen (15) members who shall be appointed by the governor and shall serve for a term of four (4) years and until their successors are appointed and qualified. In event of a vacancy, the governor shall appoint a successor to complete the unexpired term.

(b) Insofar as practicable, the members of the commission shall be selected so as to give representation to the various geographical areas of the state and to all fields of the performing and fine arts. Members shall be selected from among the residents of Indiana who have competence, experience, and interest in connection with the performing and fine

ARTICLE 22. ADMINISTRATIVE RULES AND PROCEDURES

Chapter 2. Adoption of Administrative Rules

4-22-2-13 Application of chapter

Sec. 13. (a) Subject to subsections (b) and (c), this chapter applies to the addition, amendment, or repeal of a rule in every rulemaking action.

(b) This chapter does not apply to the following agencies:

(1) Any military officer or board.

(2) Any state educational institution, as defined in IC 20-12-0.5-1.

(c) This chapter does not apply to a rulemaking action that results in any of the following rules:

(1) A resolution or directive of any agency that relates solely to internal policy, internal agency organization, or internal procedure and does not have the effect of law.

(2) A restriction or traffic control determination of a purely local nature that:

(A) is ordered by the commissioner of the Indiana department of transportation;

(B) is adopted under IC 9-20-1-3(d), IC 9-27-3-8, or IC 9-20-7; and

(C) applies only to one (1) or more particularly described intersections, highway portions, bridge causeways, or viaduct areas.

(3) A rule adopted by the secretary of state under IC 26-1-9-408.

(4) An executive order or proclamation issued by the governor.

As added by P.L.31-1985, SEC.2. Amended by P.L.18-1990, SEC.8; P.L.2-1991, SEC.21.

4-22-2-15 Delegation of rulemaking actions

Sec. 15. Any rulemaking action that this chapter allows or requires an agency to perform, other than final adoption of a rule under section 29 or 37.1 of this chapter, may be performed by the individual or group of individuals with the statutory authority to adopt rules for the agency, a member of the agency's staff, or another agent of the agency. Final adoption of a rule under section 29 or 37.1 of this chapter, including readoption of a rule that is subject to sections 24 through 36 or to section 37.1 of this chapter and recalled for further consideration under section 40 of this chapter, may be performed only by the individual or group of individuals with the statutory authority to adopt rules for the agency. *As added by P.L.31-1985, SEC.4. Amended by P.L.1-1991, SEC.15.*

4-22-2-32 Review of rule by attorney general; approval or disapproval

Sec. 32. (a) The attorney general shall review each rule submitted under section 31 of this chapter for legality.

(b) In the review, the attorney general shall determine whether the rule adopted by the

agency under section 29 of this chapter substantially differs from the proposed rule or rules published under section 24 of this chapter on which the adopted rule is based. The attorney general shall consider the following:

(1) The extent to which all persons affected by the adopted rule should have understood from the published rule or rules that their interests would be affected.

(2) The extent to which the subject matter of the adopted rule or the issues determined in the adopted rule are different from the subject matter or issues that were involved in the published rule or rules.

(3) The extent to which the effects of the adopted rule differ from the effects that would have occurred if the published rule or rules had been adopted instead.

(c) Except as provided in subsection (d), the attorney general shall disapprove a rule under this section only if it:

(1) has been adopted without statutory authority;

(2) has been adopted without complying with this chapter;

(3) substantially differs from the proposed rule or rules published under section 24 of this chapter on which the adopted rule is based; or

(4) violates another law.

Otherwise, the attorney general shall approve the rule without making a specific finding of fact concerning the subjects.

(d) If an agency submits a rule to the attorney general without complying with section 20(2) of this chapter, the attorney general may:

(1) disapprove the rule; or

(2) return the rule to the agency without disapproving the rule.

(e) If the attorney general returns a rule under subsection (d)(2), the agency may bring the rule into compliance with section 20(2) of this chapter and resubmit the rule to the attorney general without readopting the rule.

(f) The attorney general has forty-five (45) days from the date that an agency:

(1) submits a rule under section 31 of this chapter; or

(2) resubmits a rule under subsection (e);

to approve or disapprove the rule. If the attorney general neither approves nor disapproves the rule, the rule is deemed approved, and the agency may submit it to the governor for approval under section 33 of this chapter without the approval of the attorney general. *As added by P.L.31-1985, SEC.21. Amended by P.L.36-1989, SEC.1.*

4-22-2-37 Repealed

(Repealed by P.L.1-1990, SEC.35).

4-22-2-37.1 Rulemaking; duties of agency

Note: This version of section effective until 7-1-91. See also following version of this section, effective 7-1-91.

Sec. 37.1. (a) This section applies to a rulemaking action resulting in any of the following rules:

(1) An order adopted by the commissioner of the Indiana department of transportation under IC 9-4-1-125 and designated by the commissioner as an emergency rule.

(2) An action taken by the director of natural resources under IC 14-2-3-3(d).

(3) An emergency temporary standard adopted by the occupational safety standards commission under IC 22-8-1.1-16.1.

(4) An emergency rule adopted by the solid waste management board under IC

13-7-8.5-3 and classifying a waste as hazardous.

(5) A rule, other than a rule described in subdivision (6), adopted by the department of financial institutions under IC 24-4.5-6-107 and declared necessary to meet an emergency.

(6) A rule required under IC 24-4.5-1-106 that is adopted by the department of financial institutions and declared necessary to meet an emergency under IC 24-4.5-6-107.

(7) A rule adopted by the Indiana utility regulatory commission to address an emergency under IC 8-1-2-113.

(8) An emergency rule adopted by the water pollution control board under IC 4-23-21-12.

(9) An emergency rule adopted by the state lottery commission under IC 4-30-3-9.

(10) A rule adopted under IC 16-1-3-22 that the executive board, as described under IC 16-1-36-1, of the state board of health declares is necessary to meet an emergency.

(b) Sections 24 through 36 of this chapter do not apply to rules described in subsection (a).

(c) After a rule described in subsection (a) has been adopted by the agency, the agency shall submit the rule to the publisher for the assignment of a document control number. The agency shall submit the rule in the form required by section 20 of this chapter and with the documents required by section 21 of this chapter. The publisher shall determine the number of copies of the rule and other documents to be submitted under this subsection.

(d) After the document control number has been assigned, the agency shall submit the rule to the secretary of state for filing. The agency shall submit the rule in the form required by section 20 of this chapter and with the documents required by section 21 of this chapter. The secretary of state shall determine the number of copies of the rule and other documents to be submitted under this subsection.

(e) Subject to section 39 of this chapter, the secretary of state shall:

(1) accept the rule for filing; and

(2) file stamp and indicate the date and time that the rule is accepted on every duplicate original copy submitted.

(f) A rule described in subsection (a) takes effect on the latest of the following dates:

(1) The effective date of the statute delegating authority to the agency to adopt the rule.

(2) The date and time that the rule is accepted for filing under subsection (e).

(3) The effective date stated by the adopting agency in the rule.

(4) The date of compliance with every requirement established by law as a prerequisite to the adoption or effectiveness of the rule.

(g) Subject to subsection (h), IC 14-2-3-3, and IC 22-8-1.1-16.1, a rule adopted under this section expires not later than ninety (90) days after the rule is accepted for filing under subsection (e). The rule may be extended by adopting another rule under this section, but only for one (1) extension period. For a rule adopted under this section to be effective after one (1) extension period, the rule must be adopted under sections 24 through 36 of this chapter.

(h) A rule described in subsection (a)(6) or (a)(9) expires on the earlier of the following dates:

(1) The expiration date stated by the adopting agency in the rule.

(2) The date that the rule is amended or repealed by a later rule adopted under sections 24 through 36 of this chapter or this section.

As added by P.L.1-1990, SEC.36. Amended by P.L.24-1990, SEC.1; P.L.27-1991, SEC.1.

Note: See also following version of this section, effective 7-1-91.

4-22-2-37.1 Rulemaking; duties of agency (later effective date)

Note: This version of section effective 7-1-91. See also preceding version of this section, effective until 7-1-91.

Sec. 37.1. (a) This section applies to a rulemaking action resulting in any of the following rules:

(1) An order adopted by the commissioner of the Indiana department of transportation under IC 9-20-1-3(d) or IC 9-27-3-8 and designated by the commissioner as an emergency rule.

(2) An action taken by the director of natural resources under IC 14-2-3-3(d).

(3) An emergency temporary standard adopted by the occupational safety standards commission under IC 22-8-1.1-16.1.

(4) An emergency rule adopted by the solid waste management board under IC 13-7-8.5-3 and classifying a waste as hazardous.

(5) A rule, other than a rule described in subdivision (6), adopted by the department of financial institutions under IC 24-4.5-6-107 and declared necessary to meet an emergency.

(6) A rule required under IC 24-4.5-1-106 that is adopted by the department of financial institutions and declared necessary to meet an emergency under IC 24-4.5-6-107.

(7) A rule adopted by the Indiana utility regulatory commission to address an emergency under IC 8-1-2-113.

(8) An emergency rule jointly adopted by the water pollution control board and the budget agency under IC 4-23-21-12.

(9) An emergency rule adopted by the state lottery commission under IC 4-30-3-9.

(10) A rule adopted under IC 16-1-3-22 that the executive board, as described under IC 16-1-36-1, of the state board of health declares is necessary to meet an emergency.

(11) An emergency rule adopted by the transportation finance authority under IC 8-21-12.

(12) An emergency rule adopted by the insurance commissioner under IC 27-1-23-7.

(b) Sections 24 through 36 of this chapter do not apply to rules described in subsection (a).

(c) After a rule described in subsection (a) has been adopted by the agency, the agency shall submit the rule to the publisher for the assignment of a document control number. The agency shall submit the rule in the form required by section 20 of this chapter and with the documents required by section 21 of this chapter. The publisher shall determine the number of copies of the rule and other documents to be submitted under this subsection.

(d) After the document control number has been assigned, the agency shall submit the rule to the secretary of state for filing. The agency shall submit the rule in the form required by section 20 of this chapter and with the documents required by section 21 of this chapter. The secretary of state shall determine the number of copies of the rule and other documents to be submitted under this subsection.

(e) Subject to section 39 of this chapter, the secretary of state shall:

(1) accept the rule for filing; and

(2) file stamp and indicate the date and time that the rule is accepted on every duplicate original copy submitted.

(f) A rule described in subsection (a) takes effect on the latest of the following dates:

(1) The effective date of the statute delegating authority to the agency to adopt the rule.

(2) The date and time that the rule is accepted for filing under subsection (e).

(3) The effective date stated by the adopting agency in the rule.

(4) The date of compliance with every requirement established by law as a prerequisite to the adoption or effectiveness of the rule.

(g) Subject to subsection (h), IC 14-2-3-3, and IC 22-8-1.1-16.1, a rule adopted under this section expires not later than ninety (90) days after the rule is accepted for filing under subsection (e). The rule may be extended by adopting another rule under this section, but only for one (1) extension period. For a rule adopted under this section to be effective after one (1) extension period, the rule must be adopted under sections 24 through 36 of this chapter.

(h) A rule described in subsection (a)(6) or (a)(9) expires on the earlier of the following dates:

(1) The expiration date stated by the adopting agency in the rule.

(2) The date that the rule is amended or repealed by a later rule adopted under sections 24 through 36 of this chapter or this section.

As added by P.L.1-1990, SEC.36. Amended by P.L.24-1990, SEC.1; P.L.27-1991, SEC.1; P.L.2-1991, SEC.22; P.L.28-1991, SEC.1; P.L.29-1991, SEC.1; P.L.26-1991, SEC.1.

Note: See also preceding version of this section, effective until 7-1-91.

4-22-2-38 Certain nonsubstantive rules; adoption; submission to publisher; document control number; submission to secretary of state; effective date; objections

Sec. 38. (a) This section applies to a rulemaking action resulting in any of the following rules:

(1) A rule that brings another rule into conformity with section 20 of this chapter.

(2) A rule that amends another rule to replace an inaccurate reference to a statute, rule, regulation, other text, governmental entity, or location with an accurate reference, when the inaccuracy is the result of the rearrangement of a federal or state statute, rule, or regulation under a different citation number, a federal or state transfer of functions from one (1) governmental entity to another, a change in the name of a federal or state governmental entity, or a change in the address of an entity.

(3) A rule correcting any other typographical, clerical, or spelling error in another rule.

(b) Sections 24 through 37.1 of this chapter do not apply to rules described in subsection (a).

(c) Notwithstanding any other statute, an agency may adopt a rule described by subsection (a) without complying with any statutory notice, hearing, adoption, or approval requirement. In addition, the governor may adopt a rule described in subsection (a) for an agency without the agency's consent or action.

(d) A rule described in subsection (a) shall be submitted to the publisher for the assignment of a document control number. The agency (or the governor, for the agency) shall submit the rule in the form required by section 20 of this chapter and with the documents required by section 21 of this chapter. The publisher shall determine the number of copies of the rule and

other documents to be submitted under this subsection.

(e) After a document control number is assigned, the agency (or the governor, for the agency) shall submit the rule to the secretary of state for filing. The agency (or the governor, for the agency) shall submit the rule in the form required by section 20 of this chapter and with the documents required by section 21 of this chapter. The secretary of state shall determine the number of copies of the rule and other documents to be submitted under this subsection.

(f) Subject to section 39 of this chapter, the secretary of state shall:

(1) accept the rule for filing; and

(2) file stamp and indicate the date and time that it is accepted on every duplicate original copy that is submitted.

(g) Subject to subsection (h), a rule described in subsection (a) takes effect on the latest of the following dates:

(1) The date that the rule being corrected by a rule adopted under this section becomes effective.

(2) The date that is forty-five (45) days from the date and time that the rule adopted under this section is accepted for filing under subsection (f).

(h) The governor or the attorney general may file an objection to a rule that is adopted under this section before the date that is forty-five (45) days from the date and time that the rule is accepted for filing under subsection (f). When filed with the secretary of state, the objection has the effect of invalidating the rule. *As added by P.L.31-1985, SEC.27. Amended by P.L.1-1991, SEC.16.*

4-22-2-39 Acceptance of rule for filing by secretary of state

Sec. 39. (a) When an agency submits a rule for filing under section 35, 37.1, or 38 of this chapter, the secretary of state may accept the rule for filing only if the following conditions are met:

(1) A sufficient number of duplicate original copies of the rule are submitted to allow the secretary of state to comply with IC 4-22-7-5.

(2) Each submitted copy includes a reference to the document control number assigned to the rule by the publisher.

(3) Each submitted copy indicates that the agency has conducted its rulemaking action in conformity with all procedures required by law. However, if section 31 of this chapter applies to the rule, the secretary of state shall rely on the approval of the attorney general as the basis for determining that the agency has complied with all procedures required before the date of the approval.

(b) If a rule includes a statement that the rule is not effective until:

(1) an agency has complied with requirements established by the federal or state government;

(2) a specific period of time has elapsed; or

(3) a date has occurred;

the agency has complied with subsection (a)(3) even if the described event or time has not occurred before the secretary of state reviews the rule under this section.

(c) The secretary of state shall take no more than three (3) business days to complete the review of a rule under this section. *As added by P.L.31-1985, SEC.28. Amended by P.L.19-1986, SEC.1; P.L.1-1991, SEC.17.*

4-22-2-40 Recall of rule; readoption

Sec. 40. (a) At any time before a rule is accepted for filing by the secretary of state under section 35, 37.1, or 38 of this chapter, the agency that adopted the rule may recall it. A rule may be recalled regardless of whether it has been disapproved by the attorney general under section 32 of this chapter or disapproved by the governor under section 34 of this chapter.

(b) Sections 24 through 38 of this chapter do not apply to a recall action under this section. However, the agency shall distribute a notice of its recall action to the publisher for publication in the Indiana Register. Sections 24 and 26 of this chapter do not apply to a readoption action under subsection (c).

(c) After an agency recalls a rule, the agency may reconsider its adoption action and adopt an identical rule or a revised rule. However, if sections 24 through 36 of this chapter apply to the recalled rule, the readopted rule may not substantially differ from the version or versions of the rule published under section 24 of this chapter.

(d) The recall of a rule under this section voids any approval given after the rule was adopted and before the rule was recalled.

(e) If a rule is:

(1) subject to sections 31 and 33 of this chapter;

(2) recalled under subsection (a); and

(3) readopted under subsection (c);

the agency shall resubmit the readopted version of the recalled rule to the attorney general and the governor for approval. The attorney general and the governor have the full statutory period to approve or disapprove the readopted rule. The agency also shall comply with any other applicable approval requirement provided by statute.

(f) The readopted version of a recalled rule is effective only after the agency has complied with section 35, 37.1, or 38 of this chapter. *As added by P.L.31-1985, SEC.29. Amended by P.L.1-1991, SEC.18.*

4-22-2-41 Withdrawal of rule

Sec. 41. (a) At any time before a rule is accepted by the secretary of state for filing under section 35, 37.1, or 38 of this chapter, the agency that adopted the rule may withdraw it.

(b) Sections 24 through 40 of this chapter do not apply to a withdrawal action. However, the withdrawing agency shall distribute a notice of the withdrawal to the publisher for publication in the Indiana Register.

(c) The withdrawal of a rule under this section terminates the rulemaking action, and the withdrawn rule may become effective only through another rulemaking action initiated under this chapter. *As added by P.L.31-1985, SEC.30. Amended by P.L.1-1991, SEC.19.*

4-22-2-44 Failure to comply with provisions of this chapter

Sec. 44. A rulemaking action that does not conform with this chapter is invalid, and a rule that is the subject of a noncomplying rulemaking action does not have the effect of law until it is adopted in conformity with this chapter. However, the failure of an agency to comply with section 20(2) of this chapter does not invalidate the rulemaking action. *As added by P.L.31-1985, SEC.33. Amended by P.L.36-1989, SEC.2.*

ARTICLE 23. BOARDS AND COMMISSIONS

Chapter 5.5. Indiana Energy Development Board

4-23-5.5-1 Definitions

Sec. 1. As used in this chapter:

(1) "board" means the Indiana recycling and energy development board created by this chapter;

(2) "department" means the Indiana department of commerce.

As added by Acts 1980, P.L.20, SEC.1. Amended by P.L.10-1990, SEC.3.

4-23-5.5-2 Creation; membership; vacancies; advisory members

Sec. 2. (a) The Indiana recycling and energy development board is created and constitutes a public instrumentality of the state. The exercise by the board of the powers conferred by this chapter is an essential governmental function.

(b) The board consists of thirteen (13) members, one (1) of whom shall be the lieutenant governor or the lieutenant governor's designee and twelve (12) of whom shall be appointed by the governor for four (4) year terms. The governor's appointees shall be chosen from among representatives of:

(1) the coal industry;

(2) other regulated and nonregulated energy-related industries;

(3) Indiana universities and colleges with expertise in:

(A) recycling research and development; or

(B) energy research and development;

(4) agriculture;

(5) labor;

(6) industrial and commercial consumers;

(7) environmental groups; and

(8) private citizens with a special interest in:

(A) recycling; or

(B) energy resources development.

No more than six (6) appointive members shall be of the same political party.

(c) A vacancy in the office of an appointive member, other than by expiration, shall be filled in like manner as the original appointment for the remainder of the term of that retiring member. Appointed members may be removed by the governor for cause.

(d) The board shall have eight (8) ex officio advisory members as follows:

(1) The governor.

(2) The director of the energy division of the department.

(3) The director of the department of natural resources.

(4) The commissioner of the department of environmental management.

(5) Two (2) members from the house of representatives of opposite political parties appointed by the speaker of the house of representatives for two (2) year terms.

(6) Two (2) members from the senate of opposite political parties appointed by the

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jurisdiction over state-owned recreational lands, provided such lands are located adjacent to or within the boundaries of the lands of the United States described in such application.

(d) Such application shall show, to the satisfaction of the governor, that the cession of such concurrent criminal jurisdiction is necessary for the public safety and the proper maintenance and control of such lands and shall be accompanied by an accurate description and plat showing the boundaries within which such concurrent criminal jurisdiction is to be exercised. *(Formerly: Acts 1937, c.52, s.4). As amended by Acts 1977, P.L.37, SEC.1; Acts 1978, P.L.2, SEC.416.*

4-21-8-5 Validation

Sec. 5. The acts and proceedings of any and all public officials pursuant to any Act of Congress authorizing the purchase of any land for fish hatcheries, wild life preserves, forest preserves, or for agricultural, recreational, or experimental uses are hereby legalized and validated, and are hereby declared to be as legal, valid, and binding as though express authority for the performance of such acts, as provided in this chapter, had in fact existed at the time when such acts were performed. *(Formerly: Acts 1937, c.52, s.5). As amended by P.L.5-1984, SEC.155.*

4-21-8-6 Records

Sec. 6. The department of natural resources of the state of Indiana shall separate and keep a record of all profits and revenues derived from any lands which it acquires from the United States government or any land which it administers or supervises under agreement with the federal government, and such revenues and profits shall be paid into the state treasury and placed in the forestry fund, and may be expended for the purpose of purchase, development, administration, and supervision of lands, or purchase of surrounding lands acquired by the United States under the provisions of this chapter. *(Formerly: Acts 1937, c.52, s.6). As amended by P.L.5-1984, SEC.156.*

4-21-8-7 Open fires restricted; permit

Sec. 7. It is a Class B misdemeanor for a person to knowingly burn any brush, grass, or debris, or set or kindle any open fire, within one-half (1/2) mile of any land acquired by the United States under a statute without procuring a written permit from the supervisor in charge of the land. The permit shall be issued under such regulations and rules as may be deemed necessary or proper for the protection of such lands from uncontrolled fire in consideration of the weather conditions. *(Formerly: Acts 1937, c.52, s.7). As amended by Acts 1978, P.L.2, SEC.416.*

Chapter 9. Retrocession of Jurisdiction Over Land by the United States and Acceptance Thereof by the State of Indiana

4-21-9-1 Consent; perfection

Sec. 1. (a) The consent of the state of Indiana is hereby given to the retrocession of jurisdiction, either partially or wholly, by the United States over land within the boundaries of Indiana over which the United States exercises jurisdiction exclusively or concurrently with the state of Indiana; and the governor of the state is hereby authorized to accept for the state the retrocession of this jurisdiction, if he deems such retrocession to be in the best interest of the state.

(b) Retrocession of jurisdiction shall be perfected by:

(1) written notice by the officer of the United States having authority to dispose of the land to the governor;

(2) acceptance on behalf of the state of Indiana endorsed in writing by the governor on the written notice from the officer of the United States; and

(3) recording of the written notice and acceptance in the office of the recorder of the county where the land is located, followed by a filing of the written instrument in the office of the secretary of state of Indiana. *(Formerly: Acts 1975, P.L.29, SEC.1).*

ARTICLE 21.5. ADMINISTRATIVE ORDERS AND PROCEDURES

Chapter 1. Definitions

4-21.5-1-1 Application

Sec. 1. The definitions in this chapter apply throughout this article. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-2 Administrative law judge

Sec. 2. "Administrative law judge" refers to an individual or panel of individuals acting in the capacity of an administrative law judge in a proceeding. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-3 Agency

Sec. 3. "Agency" means any officer, board, commission, department division, bureau, or committee of state government that is responsible for any stage of a proceeding under this article. The term does not include the judicial department of state government, the legislative department of state government, or a political subdivision. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-4 Agency action

Sec. 4. "Agency action" means any of the following:

(1) The whole or a part of an order.

(2) The failure to issue an order.

(3) An agency's performance of, or failure to perform, any other duty, function, or activity under this article.

As added by P.L.18-1986, SEC.1.

4-21.5-1-5 Court

Sec. 5. "Court" means a circuit or superior court responsible for taking any action under this article. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-6 Final agency action

Sec. 6. "Final agency action" means:

(1) the entry of an order designated as a final order under this article; or

(2) any other agency action that disposes of all issues in a proceeding for all parties after the exhaustion of all available administrative remedies concerning the action.

As added by P.L.18-1986, SEC.1.

4-21.5-1-7 Law

Sec. 7. "Law" means the federal or state constitution, any federal or state statute, a rule of an agency, or a federal regulation. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-8 License

Sec. 8. "License" means a franchise, permit, certification, approval, registration, charter, or similar form of authorization required by law. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-9 Order

Sec. 9. "Order" means an agency action of particular applicability that determines the legal rights, duties, privileges, immunities, or other legal interests of one (1) or more specific persons. The term includes a license. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-10 Party

Sec. 10. "Party" means:

(1) a person to whom the agency action is specifically directed; or

(2) a person expressly designated in the record of the proceeding as a party to the proceeding.

As added by P.L.18-1986, SEC.1.

4-21.5-1-11 Person

Sec. 11. "Person" means an individual, agency, political subdivision, partnership, corporation, association, or other entity of any character. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-12 Political subdivision

Sec. 12. "Political subdivision" has the meaning set forth in IC 36-1-2-13. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-13 Proceeding

Sec. 13. "Proceeding" refers to a proceeding under this article. *As added by P.L.18-1986, SEC.1.*

4-21.5-1-14 Rule

Sec. 14. "Rule" means the whole or any part of an agency statement of general applicability that:

(1) has or is designed to have the effect of law; and

(2) implements, interprets, or prescribes:

(A) law or policy; or

(B) the organization, procedure, or practice requirements of an agency.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.1.

4-21.5-1-15 Ultimate authority

Sec. 15. "Ultimate authority" means an individual or panel of individuals in whom the final authority of an agency is vested by law or executive order. *As added by P.L.18-1986, SEC.1.*

Chapter 2. Application

4-21.5-2-1 Minimum rights and duties

Sec. 1. This article creates minimum procedural rights and imposes minimum procedural duties. *As added by P.L.18-1986, SEC.1.*

4-21.5-2-2 Waiver of rights and duties

Sec. 2. Except to the extent precluded by a law, a person may waive any right conferred upon that person by this article. This section

does not permit the waiver of any procedural duty imposed by this article. *As added by P.L.18-1986, SEC.1.*

4-21.5-2-3 Application of law

Sec. 3. This article applies to an agency, except to the extent that a statute clearly and specifically provides otherwise. This article applies (to the extent that a statute other than this article specifically applies this article) to a class of otherwise exempt orders or one (1) or more stages of an otherwise exempt proceeding. *As added by P.L.18-1986, SEC.1.*

4-21.5-2-4 Exemptions; agencies

Sec. 4. (a) This article does not apply to any of the following agencies:

(1) The governor.

(2) The state board of accounts.

(3) The state educational institutions (as defined by IC 20-12-0.5-1(b)).

(4) The department of employment and training services.

(5) The unemployment insurance review board of the department of employment and training services.

(6) The worker's compensation board.

(7) The military officers or boards.

(8) The utility regulatory commission.

(9) The department of state revenue (excluding an agency action related to the licensure of private employment agencies).

(10) The state board of tax commissioners.

(b) This article does not apply to action related to railroad rate and tariff regulation by the department of transportation. *As added by P.L.18-1986, SEC.1. Amended by P.L.18-1987, SEC.5; P.L.28-1988, SEC.1.*

4-21.5-2-5 Exemptions; agency actions

Sec. 5. This article does not apply to any of the following agency actions:

(1) The issuance of a warrant or jeopardy warrant for the collection of taxes.

(2) A determination of probable cause or no probable cause by the state civil rights commission.

(3) A determination in a factfinding conference of the state civil rights commission.

(4) A personnel action (except review of a personnel action by the state employees appeals commission under IC 4-15-2 or a personnel action that is not covered by IC 4-15-2 but may be taken only for cause).

(5) A resolution, directive, or other action of any agency that relates solely to the internal policy, organization, or procedure of that agency or another agency and is not a licensing or enforcement action. (Actions to which this exemption applies include the statutory obligations of an agency to approve or ratify an action of another agency.)

(6) An agency action related to an offender within the jurisdiction of the department of correction.

(7) A decision of the department of commerce, the enterprise zone board, the tourist information and grant fund review committee, the employment development commission, the agricultural development corporation, the corporation for science and technology, the corporation for innovative development, the institute for new business ventures, or the lieutenant governor, that concerns a grant, loan, bond, tax incentive, or financial guarantee.

(8) A decision to issue or not issue a complaint, summons, or similar accusation.

(9) A decision to initiate or not initiate an inspection, investigation, or other similar inquiry that will be conducted by the agency,

another agency, a political subdivision (including a prosecuting attorney), a court, or another person.

(10) A decision concerning the conduct of an inspection, investigation, or other similar inquiry by an agency.

(11) The acquisition, leasing, or disposition of property or procurement of goods or services by contract.

(12) Determinations of the office of occupational development in the administration of the Comprehensive Employment and Training Act or Vocational Education Act.

(13) A decision under IC 9-5-4 of the bureau of motor vehicles to suspend or revoke the driver's license, a driver's permit, a vehicle title, or a vehicle registration of an individual who presents a dishonored check.

As added by P.L.18-1986, SEC.1. Amended by P.L.29-1988, SEC.1.

4-21.5-2-6 Exemptions; determinations

Sec. 6. This article does not apply to the formulation, issuance, or administrative review (but does apply to the judicial review and civil enforcement) of any of the following:

(1) Determinations by the state department of public welfare.

(2) Determinations by the Indiana alcoholic beverage commission.

As added by P.L.18-1986, SEC.1.

Chapter 3. Adjudicative Proceedings

4-21.5-3-1 Service of process; notice by publication

Sec. 1. (a) This section applies to the giving of any notice and the service of any motion, ruling, order, or other filed item in an administrative proceeding under this article.

(b) Except as otherwise provided by law, a person shall serve papers by United States mail or personal service. If an agency mails or personally serves a paper, the agency shall keep a

record of the time, date, and circumstances of the service.

(c) Service shall be made on a person or on the person's counsel or other authorized representative of record in the proceeding. Service on an artificial person or an incompetent person shall be made on a person allowed to receive service under the rules governing civil actions in the courts. Service on an ultimate authority that consists of more than one (1) individual must be made on the chairperson or secretary of the ultimate authority.

(d) If the current address of a person is not ascertainable, service shall be mailed to the last known address where the person resides or has a principal place of business. If the identity, address, or existence of a person is not ascertainable, or a law other than a rule allows, service shall be made by a single publication in a newspaper of general circulation in:

(1) the county in which the person resides, has a principal place of business, or has property that is the subject of the proceeding; or

(2) Marion County, if the place described in subdivision (1) is not ascertainable or the place described in subdivision (1) is outside Indiana and the person does not have a resident agent or other representative of record in Indiana.

(e) A notice given by publication must include a statement advising a person how the person may receive written notice of the proceedings. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.2.*

4-21.5-3-2 Time computation

Sec. 2. (a) In computing any period of time under this article, the day of the act, event, or default from which the designated period of time begins to run is not included. The last day of the computed period is to be included unless it is:

(1) a Saturday;

(2) a Sunday;

(3) a legal holiday under a state statute; or

(4) a day that the office in which the act is to be done is closed during regular business hours.

(b) A period runs until the end of the next day after a day described in subdivisions (1) through (4). If the period allowed is less than seven (7) days, intermediate Saturdays, Sundays, state holidays, and days on which the office in which the act is to be done is closed during regular business hours are excluded from the calculation.

(c) A period of time under this article that commences when a person is served with a paper, including the period in which a person may petition for judicial review, commences with respect to a particular person on the earlier of the date that:

(1) the person is personally served with the notice; or

(2) a notice for the person is deposited in the United States mail.

(d) If section 1(d) of this chapter applies, a period of time under this article commences when a notice for the person is published in a newspaper.

(e) If a notice is served through the United States mail, three (3) days must be added to a period that commences upon service of that notice. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-3 Notice of orders; additional proceedings; effectiveness; stays

Sec. 3. (a) An agency shall give notice concerning an order under section 4, 5, 6, or 8 of this chapter. An agency shall conduct additional proceedings under this chapter if required by section 7 or 8 of this chapter. However, IC 4-21.5-4 applies to the notice and proceedings necessary for emergency and other temporary orders.

(b) Notwithstanding IC 1-1-4-1, if:

(1) a panel of individuals responsible for an agency action has a quorum of its members present, as specified by law; and

(2) a statute other than IC 1-1-4-1 does not specify the number of votes necessary to take an agency action;

the panel may take the action by an affirmative vote of a majority of the members present and voting. For the purposes of this subsection, a member abstaining on a vote is not voting on the action.

(c) An order is effective when it is issued as a final order under this chapter, except to the extent that:

(1) a different date is set by this article;

(2) a later date is set by an agency in its order; or

(3) an order is stayed.

(d) After an order becomes effective, an agency may suspend the effect of an order, in whole or in part, by staying the order under this chapter.

(e) A party to an order may be required to comply with an order only after the party has been served with the order or has actual knowledge of the order. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.3.*

4-21.5-3-4 Notice required; licenses and personnel decisions; persons who must be notified; contents

Sec. 4. (a) Notice must be given under this section concerning the following:

(1) The grant, renewal, restoration, transfer, or denial of a license by the bureau of motor vehicles under IC 9.

(2) The grant, renewal, restoration, transfer, or denial of a noncommercial fishing or hunting license by the department of natural resources under IC 14.

(3) The grant, renewal, restoration, transfer, or denial of a license by a board described in IC 25-1-8-1 or the committee of podiatric medicine.

(4) A personnel decision by an agency.

(b) When an agency issues an order described by subsection (a), the agency shall give a written notice of the order to the following persons:

(1) Each person to whom the order is specifically directed.

(2) Each person to whom a law requires notice to be given.

A person who is entitled to notice under this subsection is not a party to any proceeding resulting from the grant of a petition for review under section 7 of this chapter unless the person is designated as a party on the record of the proceeding.

(c) The notice must include the following:

(1) A brief description of the order.

(2) A brief explanation of the available procedures and the time limit for seeking administrative review of the order under section 7 of this chapter.

(3) Any information required by law.

(d) An order under this section is effective when it is served. However, if a timely and sufficient application has been made for renewal of a license described by subsection (a)(3) and review is granted under section 7 of this chapter, the existing license does not expire until the agency has disposed of the proceeding under this chapter concerning the renewal, unless a statute other than this article provides otherwise. This subsection does not preclude an agency from issuing, under IC 4-21.5-4, an emergency or other temporary order with respect to the license.

(e) If a petition for review of an order described in subsection (a) is filed within the period set by section 7 of this chapter and a petition for stay of effectiveness of the order is filed by a party or another person who has a pending petition for intervention in the proceeding, an administrative law judge shall, as soon as practicable, conduct a preliminary hearing to determine whether the order should be stayed in whole or in part. The burden of proof in the preliminary hearing is on the person seeking the stay. The administrative law judge may stay the order in whole or in part. The order concerning the stay may be issued after an order described in subsection (a) becomes effective. The resulting order concerning the stay shall be served on the parties and any person who has a pending petition for intervention in the proceeding. It must include a statement of the facts and law on which it is based. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-5 Notice required; certain licensing and other decisions; persons who must be notified; contents; effectiveness of order; stays

Sec. 5. (a) Notice shall be given under this section concerning the following:

(1) The grant, renewal, restoration, transfer, or denial of a license not described by section 4 of this chapter.

(2) The approval, renewal, or denial of a loan, grant of property or services, bond, financial guarantee, or tax incentive.

(3) The grant or denial of a license in the nature of a variance or exemption from a law.

(4) The determination of tax due or other liability.

(5) A determination of status.

(6) Any order that does not impose a sanction or terminate a legal right, duty, privilege, immunity, or other legal interest.

(b) When an agency issues an order described in subsection (a), the agency shall give a written notice of the order to the following persons:

(1) Each person to whom the order is specifically directed.

(2) Each person to whom a law requires notice to be given.

(3) Each competitor who has applied to the agency for a mutually exclusive license, if issuance is the subject of the order and the competitor's application has not been denied in an order for which all rights to judicial review have been waived or exhausted.

(4) Each person who has provided the agency with a written request for notification of the order, if the request:

(A) describes the subject of the order with reasonable particularity; and

(B) is delivered to the agency at least seven (7) days before the day that notice is given under this section.

(5) Each person who has a substantial and direct proprietary interest in the subject of the order.

(6) Each person whose absence as a party in the proceeding concerning the order would deny another party complete relief in the proceeding or who claims an interest related to the subject of the order and is so situated that the disposition of the matter, in the person's absence, may:

(A) as a practical matter impair or impede the person's ability to protect that interest; or

(B) leave any other person who is a party to a proceeding concerning the order subject to a substantial risk of incurring multiple or otherwise inconsistent obligations by reason of the person's claimed interest.

A person who is entitled to notice under this subsection is not a party to any proceeding resulting from the grant of a petition for review under section 7 of this chapter unless the person is designated as a party in the record of the proceeding.

(c) The notice required by subsection (a) must include the following:

(1) A brief description of the order.

(2) A brief explanation of the available procedures and the time limit for seeking administrative review of the order under section 7 of this chapter.

(3) A brief explanation of how the person may obtain notices of any prehearing conferences, preliminary hearings, hearings, stays, and any orders disposing of the proceedings without intervening in the proceeding, if a petition for review is granted under section 7 of this chapter.

(4) Any other information required by law.

(d) An agency issuing an order under this section or conducting an administrative review of the order shall give notice of any:

(1) prehearing conference;

(2) preliminary hearing;

(3) hearing;

(4) stay; or

(5) order disposing of all proceedings;

concerning the order to a person notified under subsection (b) who requests these notices in the manner specified under subsection (c)(3).

(e) If a statute requires an agency to solicit comments from the public in a nonevidentiary public hearing before issuing an order described by subsection (a), the agency shall announce at the opening and the close of the public hearing how a person may receive notice of the order under subsection (b)(4).

(f) If a petition for review and a petition for stay of effectiveness of an order described in subsection (a) has not been filed, the order is effective fifteen (15) days (or any longer period during which a person may, by statute, seek administrative review of the order) after the order is served. If both a petition for review and a petition for stay of effectiveness are filed before the order becomes effective, any part of the order that is within the scope of the petition for stay is stayed for an additional fifteen (15) days. Any part of the order that is not within the scope of the petition is not stayed. The order takes effect regardless of whether the persons described by subsection (b)(5) or (b)(6) have been served. An agency shall make a good faith effort to identify and notify these persons, and the agency has the burden of persuasion that it has done so. The agency may request that the applicant for the order assist in the identification of these persons. Failure to notify any of these persons is not grounds for invalidating an order, unless an unnotified person is substantially prejudiced by the lack of notice. The burden of persuasion as to substantial prejudice is on the unnotified person.

(g) If a timely and sufficient application has been made for renewal of a license with reference to any activity of a continuing nature and review is granted under section 7 of this chapter, the existing license does not expire until the agency has disposed of a proceeding under this chapter concerning the renewal, unless a statute other than this article provides otherwise. This subsection does not preclude an agency from issuing, under IC 4-21.5-4, an emergency or other temporary order with respect to the license.

(h) On the motion of any party or other person having a pending petition for intervention in the proceeding, an administrative law judge shall, as soon as practicable, conduct a preliminary hearing to determine whether the order should be stayed. The burden of proof in the preliminary hearing is on the person seeking the stay. The administrative law judge may stay the order in whole or in part. The order concerning the stay may be issued before or after the order described in subsection (a) becomes effective. The resulting order concerning the stay shall be served on the parties, any person who has a pending petition for intervention in the proceeding, and any person who has requested notice under subsection (d). It must include a statement of the facts and law on which it is based. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.4.*

4-21.5-3-6 Notice required; safety and other orders; persons who must receive notice; contents; effectiveness of order; stay; preliminary hearing; resulting order

Sec. 6. (a) Notice shall be given under this section concerning the following:

(1) A safety order under IC 22-8-1.1.

(2) Any order that:

(A) imposes a sanction on a person or terminates a legal right, duty, privilege, immunity, or other legal interest of a person;

(B) is not described in section 4 or 5 of this chapter or IC 4-21.5-4; and

(C) by statute, becomes effective without a proceeding under this chapter if there is no request for a review of the order within a specified period after the order is issued or served.

(b) When an agency issues an order described by subsection (a), the agency shall give notice to the following persons:

(1) Each person to whom the order is specifically directed.

(2) Each person to whom a law requires notice to be given.

A person who is entitled to notice under this subsection is not a party to any proceeding resulting from the grant of a petition for review under section 7 of this chapter unless the person is designated as a party in the record of the proceeding.

(c) The notice must include the following:

(1) A brief description of the order.

(2) A brief explanation of the available procedures and the time limit for seeking administrative review of the order under section 7 of this chapter.

(3) Any other information required by law.

(d) An order described in subsection (a) is effective fifteen (15) days after the order is served, unless a statute other than this article specifies a different date or the agency specifies a later date in its order. This subsection does not preclude an agency from issuing, under IC 4-21.5-4, an emergency or other temporary order concerning the subject of an order described in subsection (a).

(e) If a petition for review of an order described in subsection (a) is filed within the period set by section 7 of this chapter and a petition for stay of effectiveness of the order is filed by a party or another person who has a pending petition for intervention in the proceeding, an administrative law judge shall, as soon as practicable, conduct a preliminary hearing to determine whether the order should be stayed in whole or in part. The burden of proof in the preliminary hearing is on the person seeking the stay. The administrative law judge may stay the order in whole or in part. The order concerning the stay may be issued after an order described in subsection (a) becomes effective. The resulting order concerning the stay shall be served on the parties and any person who has a pending petition for intervention in the proceeding. It must include a statement of the facts and law on which it is based. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.5.*

4-21.5-3-7 Review; petition; denial of petition; preliminary hearing

Sec. 7. (a) To qualify for review of a personnel action to which IC 4-15-2 applies, a person must comply with IC 4-15-2-35. To qualify for review of any other order described in section 4, 5, or 6 of this chapter, a person must petition for review in a writing that:

(1) states facts demonstrating that:

(A) the petitioner is a person to whom the order is specifically directed;

(B) the petitioner is aggrieved or adversely affected by the order; or

(C) the petitioner is entitled to review under any law; and

(2) is filed with the ultimate authority for the agency issuing the order within fifteen (15) days after the person is given notice of the order or any longer period set by statute.

If the petition for review is denied, the petition shall be treated as a petition for intervention in any review initiated under subsection (d).

(b) If an agency denies a petition for review under subsection (a) and the petitioner is not allowed to intervene as a party in a proceeding resulting from the grant of the petition for review of another person, the agency shall serve a written notice on the petitioner that includes the following:

(1) A statement that the petition for review is denied.

(2) A brief explanation of the available procedures and the time limit for seeking administrative review of the denial under subsection (c).

(c) An agency shall assign an administrative law judge to conduct a preliminary hearing on the issue of whether a person is qualified under subsection (a) to obtain review of an order when a person requests reconsideration of the denial of review in a writing that:

(1) states facts demonstrating that the person filed a petition for review of an order described in section 4, 5, or 6 of this chapter;

(2) states facts demonstrating that the person was denied review without an evidentiary hearing; and

(3) is filed with the ultimate authority for the agency denying the review within fifteen (15) days after the notice required by subsection (b) was served on the petitioner.

Notice of the preliminary hearing shall be given to the parties, each person who has a pending petition for intervention in the proceeding, and any other person described by section 5(d) of this chapter. The resulting order must be served on the persons to whom notice of the preliminary hearing must be given and include a statement of the facts and law on which it is based.

(d) If a petition for review is granted, the petitioner becomes a party to the proceeding and the agency shall assign the matter to an administrative law judge or certify the matter to another agency for the assignment of an administrative law judge (if a statute transfers responsibility for a hearing on the matter to another agency). The agency granting the administrative review or the agency to which the matter is transferred may conduct informal proceedings to settle the matter to the extent allowed by law. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.6.*

4-21.5-3-8 Sanctions; temporary orders

Sec. 8. (a) An agency may issue a sanction or terminate a legal right, duty, privilege, immunity, or other legal interest not described by section 4, 5, or 6 of this chapter only after conducting a proceeding under this chapter: However, this subsection does not preclude an agency from issuing, under IC 4-21.5-4, an emergency or other temporary order concerning the subject of the proceeding.

(b) When an agency seeks to issue an order that is described by subsection (a), the agency shall serve a complaint upon:

(1) each person to whom any resulting order will be specifically directed; and

(2) any other person required by law to be notified.

A person notified under this subsection is not a party to the proceeding unless the person is a

person against whom any resulting order will be specifically directed or the person is designated by the agency as a party in the record of the proceeding.

(c) The complaint required by subsection (b) must include the following:

(1) A short, plain statement showing that the pleader is entitled to an order.

(2) A demand for the order that the pleader seeks.

As added by P.L.18-1986, SEC.1.

4-21.5-3-9 Ultimate authority of agency; acting as, or designating, an administrative judge; disqualification; procedures

Sec. 9. (a) Except to the extent that a statute other than this article limits an agency's discretion to select an administrative law judge, the ultimate authority for an agency may:

(1) act as an administrative law judge;

(2) designate one (1) or more members of the ultimate authority (if the ultimate authority is a panel of individuals) to act as an administrative law judge; or

(3) designate one (1) or more other individuals, not necessarily employees of the agency, to act as an administrative law judge.

A designation under subdivision (2) or (3) may be made in advance of the commencement of any particular proceeding for a generally described class of proceedings or may be made for a particular proceeding. A general designation may provide procedures for the assignment of designated individuals to particular proceedings.

(b) An agency may not knowingly assign an individual to serve alone or with others as an administrative law judge who is subject to disqualification under this chapter.

(c) If the judge believes that the judge's impartiality might reasonably be questioned, or believes that the judge's personal bias, prejudice, or knowledge of a disputed evidentiary fact might influence the decision, an individual assigned to serve alone or with others as an administrative law judge shall:

(1) withdraw as the administrative law judge; or

(2) inform the parties of the potential basis for disqualification, place a brief statement of this basis on the record of the proceeding, and allow the parties an opportunity to petition for disqualification under subsection (d).

(d) Any party to a proceeding may petition for the disqualification of an individual serving alone or with others as an administrative law judge upon discovering facts establishing grounds for disqualification under this chapter. The administrative law judge assigned to the proceeding shall determine whether to grant the petition, stating facts and reasons for the determination. If the administrative law judge ruling on the disqualification issue is not the ultimate authority for the agency, the party petitioning for disqualification may petition the ultimate authority in writing for review of the ruling within ten (10) days after notice of the ruling is served. The ultimate authority shall conduct proceedings described by section 28 of this chapter to review the petition and affirm, modify, or dissolve the ruling within thirty (30) days after the petition is filed. A determination by the ultimate authority under this subsection is a final order subject to judicial review under IC 4-21.5-5.

(e) If a substitute is required for an administrative law judge who is disqualified or becomes unavailable for any other reason, the substitute must be appointed in accordance with subsection (a).

(f) Any action taken by a duly appointed substitute for a disqualified or unavailable administrative law judge is as effective as if taken by the latter. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987 SEC.7.*

4-21.5-3-10 Disqualification of administrative law judge

Sec. 10. Any individual serving or designated to serve alone or with others as an administrative law judge is subject to disqualification for:

(1) bias, prejudice, or interest in the outcome of a proceeding;

(2) failure to dispose of the subject of a proceeding in an orderly and reasonably prompt manner after a written request by a party; or

(3) any cause for which a judge of a court may be disqualified.

Nothing in this subsection prohibits an individual who is an employee of an agency from serving as an administrative law judge. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-11 Ex parte communications; violations

Sec. 11. (a) Except as provided in subsection (b) or unless required for the disposition of ex parte matters specifically authorized by statute, an administrative law judge serving in a proceeding may not communicate, directly or indirectly, regarding any issue in the proceeding while the proceeding is pending, with:

(1) any party;

(2) any individual who has a direct or indirect interest in the outcome of the proceeding;

(3) any individual who presided at a previous stage of the proceeding; or

(4) any individual who is prohibited from assisting the administrative law judge under section 13 of this chapter.

without notice and opportunity for all parties to participate in the communication

(b) A member of a multimember panel of administrative law judges may communicate with other members of the panel regarding a matter pen[illegible]before the panel, and any administrative law judge may receive aid from staff assistants. However, a staff assistant may not communicate to an administrative law judge any:

(1) ex parte communications of a type that the administrative law judge would be prohibited from receiving under subsection (a); or

(2) information that would furnish, augment, diminish, or modify the evidence in the record.

(c) Unless required for the disposition of ex parte matters specifically authorized by statute, a person described by subsection (a)(1), (a)(2), (a)(3), or (a)(4) may not communicate, directly or indirectly, in connection with any issue in that proceeding while the proceeding is pending, with any person serving as administrative law judge without notice and opportunity for all parties to participate in the communication.

(d) If, before serving as administrative law judge in a proceeding, an individual receives an ex parte communication of a type that would not properly be received while serving, the individual, promptly after starting to serve, shall disclose the communication in the manner prescribed in subsection (e).

(e) An administrative law judge who receives an ex parte communication in violation of this section shall:

(1) place on the record of the pending matter all written communications received, all written responses to the communications, and a memorandum stating the substance of all oral communications received, all responses made, and the identity of each individual from whom the administrative law judge received an ex parte communication; and

(2) advise all parties that these matters have been placed on the record.

Any person described by subsection (a)(1), (a)(2), (a)(3), or (a)(4) shall be allowed to rebut

a charge of wrongful ex parte communication upon requesting the opportunity for rebuttal within fifteen (15) days after notice of the communication.

(f) If necessary to eliminate the effect of an ex parte communication received in violation of this section, an administrative law judge who receives the communication may be disqualified and the portions of the record pertaining to the communication may be corrected, modified, or preserved by protective order.

(g) A violation of this section is subject to the sanctions under sections 36 and 37 of this chapter. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.8.*

4-21.5-3-12 Administrative law judge; prohibited acts; disqualification

Sec. 12. An administrative law judge who:

(1) comments publicly, except as to hearing schedules or procedures, about pending or impending proceedings; or

(2) engages in financial or business dealings that tend to:

(A) reflect adversely on the administrative law judge's impartiality;

(B) interfere with the proper performance of the administrative law judge's duties;

(C) exploit the administrative law judge's position; or

(D) involve the administrative law judge in frequent financial or business dealings with attorneys or other persons who are likely to come before the administrative law judge;

is subject to disqualification. A violation of this section is subject to the sanctions under sections 36 and 37 of this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-13 Disqualification; involvement in preadjudicative stage

Sec. 13. (a) An individual who has served as investigator, prosecutor, or advocate in a proceeding or in its preadjudicative stage may not serve as an administrative law judge or assist or advise the administrative law judge in the same proceeding.

(b) An individual who is subject to the authority, direction, or discretion of an individual who has served as investigator, prosecutor, or advocate in a proceeding or in its preadjudicative stage may not serve as an administrative law judge or assist or advise the administrative law judge in the same proceeding.

(c) An individual who has made a determination of probable cause or other equivalent preliminary determination in a proceeding may serve as an administrative law judge or assist or advise the administrative law judge in the same proceeding, unless a party demonstrates grounds for disqualification under section 10 of this chapter.

(d) An individual may serve as an administrative law judge or a person presiding under sections 28, 29, 30, and 31 of this chapter at successive stages of the same proceeding, unless a party demonstrates grounds for disqualification under section 10 of this chapter.

(e) A violation of this section is subject to the sanctions under sections 36 and 37 of this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-14 Record; hearing on motion; burden of persuasion

Sec. 14. (a) An administrative law judge conducting a proceeding shall keep a record of the administrative law judge's proceedings under this article.

(b) If a motion is based on facts not otherwise appearing in the record for the proceeding, the administrative law judge may hear the matter on affidavits presented by the respective parties or the adm[illegible]tive law judge may direct that the matter be heard wholly or partly on oral testimony or depositions.

(c) At each stage of the proceeding, the agency or other person requesting that an agency take action or asserting an affirmative defense specified by law has the burden of persuasion and the burden of going forward with the proof of the request or affirmative defense. Before the hearing on which the party intends to assert it, a party shall, to the extent possible, disclose any affirmative defense specified by law on which the party intends to rely. If a prehearing conference is held in the proceeding, a party notified of the conference shall disclose the party's affirmative defense in the conference. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.9.*

4-21.5-3-15 Participation in proceeding

Sec. 15. (a) Any party may participate in a proceeding in person or, if the party is not an individual or is incompetent, by a duly authorized representative.

(b) Whether or not participating in person, any party may be advised and represented at the party's own expense by counsel or, unless prohibited by law, by another representative. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-16 Interpreters

Sec. 16. (a) A person who:

(1) cannot speak or understand the English language or who because of hearing, speaking, or other impairment has difficulty in communicating with other persons; and

(2) is a party or witness in any proceeding under this article;

is entitled to an interpreter to assist the person throughout the proceeding under this article.

(b) The interpreter may be retained by the person or may be appointed by the agency before which the proceeding is pending. If an interpreter is appointed by the agency, the fee for the services of the interpreter shall be set by the agency. The fee shall be paid from any funds available to the agency or be paid in any other manner ordered by the agency.

(c) Any agency may inquire into the qualifications and integrity of any interpreter and may disqualify any person from serving as an interpreter.

(d) Every interpreter for another person in a proceeding shall take the following oath:

Do you affirm, under penalties of perjury, that you will justly, truly, and impartially interpret to ____ the oath about to be administered to him (her), the questions that may be asked him (her), and the answers that he (she) shall give to the questions, relative to the cause now under consideration before this agency?

(e) IC 35-44-2-1 concerning perjury applies to an interpreter. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-17 Opportunity to file documents; copies

Sec. 17. (a) The administrative law judge, at appropriate stages of a proceeding, shall give all parties full opportunity to file pleadings, motions, and objections and submit offers of settlement.

(b) The administrative law judge, at appropriate stages of a proceeding, may give all parties full opportunity to file briefs, proposed findings of fact, and proposed orders.

(c) A party shall serve copies of any filed item on all parties.

(d) The administrative law judge shall serve copies of all notices, orders, and other papers generated by the administrative law judge on all parties. The administrative law judge shall give notice of preliminary hearings, prehearing conferences, hearings, stays, and orders disposing of the proceeding to persons described by section 5(d) of this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-18 Prehearing conference; notice

Sec. 18. (a) The administrative law judge for the hearing, subject to the agency's rules, may, on the administrative law judge's own motion, and shall, on the motion of a party, conduct a prehearing conference. The administrative law judge may deny a motion for a prehearing conference if the administrative law judge has previously conducted a prehearing conference in the proceeding.

(b) This section and section 19 of this chapter apply if the conference is conducted.

(c) The administrative law judge for the prehearing conference shall set the time and place of the conference and give reasonable written notice to the following:

(1) All parties.

(2) All persons who have filed written petitions to intervene in the matter.

(3) All persons entitled to notice under any law.

(d) The initial prehearing conference notice in a proceeding must include the following:

(1) The names and mailing addresses of all known parties and other persons to whom notice is being given by the administrative law judge.

(2) The names and mailing addresses of all publications used to provide notice under this section.

(3) The name, official title, and mailing address of any counsel or employee who has been designated to appear for the agency and a telephone number through which the counsel or employee can be reached.

(4) The official file or other reference number, the name of the proceeding, and a general description of the subject matter.

(5) A statement of the time, place, and nature of the prehearing conference.

(6) A statement of the legal authority an[d] jurisdiction under which the prehearing co[n]ference and the hearing are to be held.

(7) The name, official title, and mailin[g] address of the administrative law judge fo[r] the prehearing conference and a telephon[e] number through which information concern[-]ing hearing schedules and procedures may b[e] obtained.

(8) A statement that a party who fails t[o] attend or participate in a prehearing confer[-]ence, hearing, or other later stage of the pro[-]ceeding may be held in default or have a pro[-]ceeding dismissed under section 24 of this chapter.

(e) Any subsequent prehearing conference notice in the proceeding may omit the information described in subsections (d)(1), (d)(2), (d)(3), (d)(6), and (d)(8).

(f) Any notice under this section may include any other matters that the administrative law judge considers desirable to expedite the proceedings. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.10.*

4-21.5-3-19 Prehearing conference; electronic means; matters considered; prehearing order on pleadings

Sec. 19. (a) This section and section 18 of this chapter apply to prehearing conferences.

(b) To expedite a decision on pending motions and other issues, the administrative law judge may conduct all or part of the prehearing conference by telephone, television, or other electronic means if each participant in the conference has an opportunity:

(1) to participate in;

(2) to hear; and

(3) if technically feasi[ble], to see;

the entire proceeding w[hile i]t is taking place.

(c) The administrative law judge shall conduct the prehearing conference, as may be appropriate, to deal with such matters as the following:

(1) Resolution of the issues in the proceeding under section 23 of this chapter.

(2) Exploration of settlement possibilities.

(3) Preparation of stipulations.

(4) Clarification of issues.

(5) Rulings on identity and limitation of the number of witnesses.

(6) Objections to proffers of evidence.

(7) A determination of the extent to which direct evidence, rebuttal evidence, or cross-examination will be presented in written form.

(8) The order of presentation of evidence and cross-examination.

(9) Rulings regarding issuance of subpoenas, discovery orders, and protective orders.

(10) Such other matters as will promote the orderly and prompt conduct of the hearing.

The administrative law judge shall issue a prehearing order incorporating the matters determined at the prehearing conference.

(d) If a prehearing conference is not held, the administrative law judge for the hearing may issue a prehearing order, based on the pleadings, to regulate the conduct of the proceedings. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-20 Hearing; time and place; notice

Sec. 20. (a) The administrative law judge for the hearing shall set the time and place of the hearing and give reasonable written notice to all parties and to all persons who have filed written petitions to intervene in the matter. Unless a shorter notice is required to comply with any law or is stipulated by all parties and persons filing w[illegible] requests for intervention, an agency shall give at least five (5) days notice of the hearing.

(b) The notice must include a copy of any prehearing order rendered in the matter.

(c) To the extent not included in a prehearing order accompanying it the initial hearing notice in a proceeding must include the following:

(1) The names and mailing addresses of all parties and other persons to whom notice is being given by the administrative law judge.

(2) The name, official title, and mailing address of any counsel or employee who has been designated to appear for the agency and a telephone number through which the counsel or employee can be reached.

(3) The official file or other reference number, the name of the proceeding, and a general description of the subject matter.

(4). A statement of the time, place, and nature of the hearing.

(5) A statement of the legal authority and jurisdiction under which the hearing is to be held.

(6) The name, official title, and mailing address of the administrative law judge and a telephone number through which information concerning hearing schedules and procedures may be obtained.

(7) A statement of the issues involved and, to the extent known to the administrative law judge, of the matters asserted by the parties.

(8) A statement that a party who fails to attend or participate in a prehearing conference, hearing, or other later stage of the proceeding may be held in default or have a proceeding dismissed under section 24 of this chapter.

(d) Subsequent hearing notices in the proceeding may omit the information described in subsections (c)(1), (c)(2), (c)(5), and (c)(8).

(e) Any notice under this section may include any other matters the administrative law judge considers desirable to expedite the proceedings.

(f) The administrative law judge shall give notice to persons other than parties and petitioners for intervention who are entitled to notice under any law. Notice under this subsection may include all types of information provided in subsections (a) through (e) or may consist of a brief statement indicating:

(1) the subject matter, parties, time, place, and nature of the hearing;

(2) the manner in which copies of the notice to the parties may be inspected and copied;

(3) the name of the administrative law judge; and

(4) a telephone number through which information concerning proceeding hearing schedules and procedures may be obtained.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.11.

4-21.5-3-21 Petition for intervention

Sec. 21. (a) Before the beginning of the hearing on the subject of the proceeding, the administrative law judge shall grant a petition for intervention in a proceeding and identify the petitioner in the record of the proceeding as a party if:

(1) the petition:

(A) is submitted in writing to the administrative law judge, with copies mailed to all parties named in the record of the proceeding; and

(B) states facts demonstrating that a statute gives the petitioner an unconditional right to intervene in the proceeding; or

(2) the petition:

(A) is submitted in writing to the administrative law judge, with copies mailed to all parties named in the record of the proceeding, at least three (3) days before the hearing; and

(B) states facts demonstrating that the petitioner is aggrieved or adversely affected by the order or a statute gives the petitioner a conditional right to intervene in the proceeding.

(b) The administrative law judge, at least twenty-four (24) hours before the beginning of the hearing, shall issue an order granting or denying each pending petition for intervention.

(c) After the beginning of the hearing on the subject of the proceeding, but before the close of evidence in the hearing, anyone may be permitted to intervene in the proceeding if:

(1) a statute confers a conditional right to intervene or an applicant's claim or defense and the main action have a question of law or fact in common; and

(2) the administrative law judge determines that the interests of justice and the orderly and prompt conduct of the proceedings will not be impaired by allowing the intervention.

In exercising its discretion, the administrative law judge shall consider whether the intervention will unduly delay or prejudice the adjudication of the legal interests of any of the parties.

(d) An order granting or denying a petition for intervention must specify any condition and briefly state the reasons for the order. The administrative law judge may modify the order at any time, stating the reasons for the modification. The administrative law judge shall promptly give notice of an order granting, denying, or modifying intervention to the petitioner for intervention and to all parties. *As added by P.L.18-1986[illegible]C.1. Amended by P.L.35-1987, SEC.12.*

4-21.5-3-22 Administrative orders; enforcement

Sec. 22. (a) The administrative law judge at the request of any party or an agency shall, and upon the administrative law judge's own motion may, issue:

(1) subpoenas;

(2) discovery orders; and

(3) protective orders;

in accordance with the rules of procedure governing discovery, depositions, and subpoenas in civil actions in the courts.

(b) The party seeking the order shall serve the order in accordance with these rules of procedure. If ordered by the administrative law judge, the sheriff in the county in which the order is to be served shall serve the subpoena, discovery order, or protective order.

(c) Subpoenas and orders issued under this section may be enforced under IC 4-21.5-6. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-23 Summary judgment

Sec. 23. (a) A party may, at any time after a matter is assigned to an administrative law judge, move for a summary judgment in the party's favor as to all or any part of the issues in a proceeding. The motion must be supported with affidavits or other evidence permitted under this section and set forth specific facts showing that there is not a genuine issue in dispute.

(b) The motion must be served at least five (5) days before the time fixed for the hearing on the motion. The adverse party may serve opposing affidavits before the day of hearing. The administrative law judge may direct the parties to give oral argument on the motion. The judgment sought shall be rendered immediately if the pleadings, depositions, answers to interrogatories, and admissions on file, together with " - affidavits and testimony, if any, show that a genuine issue as to any material fact does not exist and that the moving party is entitled to a judgment as a matter of law. A summary judgment may be rendered upon fewer than all the issues or claims (such as the issue of penalties alone) although there is a genuine issue as to damages or liability, as the case may be. A summary judgment upon fewer than all the issues involved in a proceeding or with respect to fewer than all the claims or parties is not a final order. The administrative law judge shall designate the issues or claims upon which the judge finds no genuine issue as to any material facts. Summary judgment may not be granted as a matter of course because the opposing party fails to offer opposing affidavits or evidence, but the administrative law judge shall make a determination from the affidavits and testimony offered upon the matters placed in issue by the pleadings or the evidence. If it appears from the affidavits of a party opposing the motion that the party cannot for reasons stated present by affidavit facts essential to justify the party's opposition, the administrative law judge may make any order that is just.

(c) If on motion under this section no order is rendered upon the whole case or for all the relief asked and a hearing is necessary, the administrative law judge at the hearing of the motion, by examining the pleadings and the evidence before it and by interrogating any person, shall if practicable ascertain:

(1) what material facts exist without substantial controversy; and

(2) what material facts are actually and in good faith controverted.

The administrative law judge shall then make an order specifying the facts that appear without substantial controversy, including the extent to which the amount of damages or other relief is not in controversy, and directing further proceedings in the action as are just.

Upon the hearing of the action, the facts specified are established in the judge's order under this subsection.

(d) Supporting and opposing affidavits must:

(1) be made on personal knowledge;

(2) set forth facts that are admissible in evidence; and

(3) show affirmatively that the affiant is competent to testify to the matters stated in the affidavit.

(e) The administrative law judge may permit affidavits to be supplemented or opposed by depositions, answers to interrogatories, further affidavits, or testimony of witnesses.

(f) If a motion for summary judgment is made and supported under this section, an adverse party may not rely upon the mere allegations or denials made in the adverse party's pleadings as a response to the motion. The adverse party shall respond to the motion with affidavits or other evidence permitted under this section and set forth specific facts showing that there is a genuine issue in dispute. If the adverse party does not respond as required by this subsection, the administrative law judge may enter summary judgment against the adverse party. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.13; P.L.5-1988, SEC.27.*

4-21.5-3-24 Default or dismissal

Sec. 24. (a) At any stage of a proceeding, if a party fails to:

(1) file a responsive pleading required by statute or rule;

(2) attend or participate in a prehearing conference, hearing, or other stage of the proceeding; or

(3) take action on a matter for a period of sixty (60) days, if the party is responsible for taking the action;

the administrative law judge may serve upon all parties written notice of a proposed default or dismissal order, including a statement of the grounds.

(b) Within seven (7) days after service of a proposed default or dismissal order, the party against whom it was issued may file a written motion requesting that the proposed default order not be imposed and stating the grounds relied upon. During the time within which a party may file a written motion under this subsection, the administrative law judge may adjourn the proceedings or conduct them without the participation of the party against whom a proposed default order was issued, having due regard for the interest of justice and the orderly and prompt conduct of the proceedings.

(c) If the party has failed to file a written motion under subsection (b), the administrative law judge shall issue the default or dismissal order. If the party has filed a written motion under subsection (b), the administrative law judge may either enter the order or refuse to enter the order.

(d) After issuing a default order, the administrative law judge shall conduct any further proceedings necessary to complete the proceeding without the participation of the party in default and shall determine all issues in the adjudication, including those affecting the defaulting party. The administrative law judge may conduct proceedings in accordance with section 23 of this chapter to resolve any issue of fact. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-25 Conduct of hearing; procedure

Sec. 25. (a) This section and section 26 of this chapter govern the conduct of any hearing held by an administrative law judge.

(b) The administrative law judge shall regulate the course of the proceedings in conformity with any prehearing order and in an informal manner without recourse to the technical, common law rules of evidence applicable to civil actions in the courts.

(c) To the extent necessary for full disclosure of all relevant facts and issues, the administrative law judge shall afford to all parties the opportunity to respond, present evidence and argument, conduct cross-examination, and submit rebuttal evidence, except as restricted by a limitation under subsection (d) or by the prehearing order.

(d) The administrative law judge may, after a prehearing order is issued under section 19 of this chapter, impose conditions upon a party necessary to avoid unreasonably burdensome or repetitious presentations by the party, such as the following:

(1) Limiting the party's participation to designated issues in which the party has a particular interest demonstrated by the petition.

(2) Limiting the party's use of discovery, cross-examination, and other procedures so as to promote the orderly, prompt, and just conduct of the proceeding.

(3) Requiring two (2) or more parties to combine their presentations of evidence and argument, cross-examination, discovery, and other participation in the proceedings.

If a person is allowed to intervene in the proceeding after the commencement of a hearing under this section, the administrative law judge may prohibit the intervener from recalling any witness who has been heard or reopening any matter that has been resolved, unless the intervener did not receive a notice required by this chapter or the intervener presents facts that demonstrate that fraud, perjury, or an abuse of discretion has occurred. Any proceedings conducted before the giving of a notice required by this chapter are voidable upon the motion of the party who failed to receive the notice.

(e) The administrative law judge may administer oaths and affirmations and rule on any offer of proof or other motion.

(f) The administrative law judge may give nonparties an opportunity to present oral or written statements. If the administrative law judge proposes to consider a statement by a nonparty, the judge shall give all parties an opportunity to challenge or rebut it and, on motion of any party, the judge shall require the statement to be given under oath or affirmation.

(g) The administrative law judge shall have the hearing recorded at the agency's expense. The agency is not required, at its expense, to prepare a transcript, unless required to do so by law. Any party, at the party's expense, may cause a reporter approved by the agency to prepare a transcript from the agency's record, or cause additional recordings to be made during the hearing if the making of the additional recordings does not cause distraction or disruption. Notwithstanding IC 5-14-3-8, an agency may charge a person who requests that an agency provide a transcript (other than for judicial review under IC 4-21.5-5-13) the reasonable costs of preparing the transcript. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-26 Conduct of hearing; evidence

Sec. 26. (a) This section and section 25 of this chapter govern the conduct of any hearing conducted by an administrative law judge. Upon proper objection, the administrative law judge shall exclude evidence that is irrelevant, immaterial, unduly repetitious, or excludable on constitutional or statutory grounds or on the basis of evidentiary privilege recognized in the courts. In the absence of proper objection, the administrative law judge may exclude objectionable evidence. The administrative law judge may admit hearsay evidence. If not objected to, the hearsay evidence may form the basis for an order. However, if the evidence is properly objected to and does not fall within a recognized exception to the hearsay rule, the resulting order may not be based solely upon the hearsay evidence.

(b) All testimony of parties and witnesses must be made under oath or affirmation.

(c) Statements presented by nonparties in accordance with section 25 of this chapter may be received as evidence.

(d) Any part of the evidence may be received in written form if doing so will expedite the hearing without substantial prejudice to the interests of any party.

(e) Documentary evidence may be received in the form of a copy or excerpt. Upon request, parties shall be given an opportunity to compare the copy with the original if available.

(f) Official notice may be taken of the following:

(1) Any fact that could be judicially noticed in the courts.

(2) The record of other proceedings before the agency.

(3) Technical or scientific matters within the agency's specialized knowledge.

(4) Codes or standards that have been adopted by an agency of the United States or this state.

(g) Parties must be:

(1) notified before or during the hearing, or before the issuance of any order that is based in whole or in part on facts or material noticed under subsection (f), of the specific facts or material noticed, and the source of the facts or material noticed, including any staff memoranda and data; and

(2) afforded an opportunity to contest and rebut the facts or material noticed under subsection (f).

As added by P.L.18-1986, SEC.1.

4-21.5-3-27 Final orders; findings

Sec. 27. (a) If the administrative law judge is the ultimate authority for the agency, the ultimate authority's order disposing of a proceeding is a final order. If the administrative law judge is not the ultimate authority, the administrative law judge's order disposing of the proceeding becomes a final order when affirmed under section 29 of this chapter. Regardless of whether the order is final, it must comply with this section.

(b) The order must include, separately stated, findings of fact for all aspects of the order, including the remedy prescribed and, if applicable, the action taken on a petition for stay of effectiveness. Findings of ultimate fact must be accompanied by a concise statement of the underlying basic facts of record to support the findings. The order must also include a statement of the available procedures and time limit for seeking administrative review of the order (if administrative review is available).

(c) Findings must be based exclusively upon the evidence of record in the proceeding and on matters officially noticed in that proceeding. Findings must be based upon the kind of evidence that is substantial and reliable. The administrative law judge's experience, technical competence, and specialized knowledge may be used in evaluating evidence.

(d) A substitute administrative law judge may issue the order under this section upon the record that was generated by a previous administrative law judge.

(e) The administrative law judge may allow the parties a designated amount of time after conclusion of the hearing for the submission of proposed findings.

(f) An order under this section shall be issued in writing within ninety (90) days after conclusion of the hearing or after submission of proposed findings in accordance with subsection (e), unless this period is waived or extended with the written consent of all parties or for good cause shown.

(g) The administrative law judge shall have copies of the order under this section delivered to each party and to the ultimate authority for the agency (if it is not rendered by the ultimate authority). *As added by P.L.18-1986, SEC.1.*

4-21.5-3-28 Final order; authority to issue; proceedings

Sec. 28. (a) This section applies to proceedings under sections 29, 30, and 31 of this chapter.

(b) The ultimate authority or its designee shall conduct proceedings to issue a final order. A designee may be selected in advance of the commencement of any particular proceeding for a generally described class of proceedings or may be selected for a particular proceeding. A general designation may provide procedures for the assignment of designated individuals to particular proceedings.

(c) Any individual serving alone or with others in a proceeding may be disqualified for any of the reasons that an administrative law judge may be disqualified. The procedures in section 9 of this chapter apply to the disqualification and substitution of the individual.

(d) Motions and petitions submitted by a party to the ultimate authority shall be served on each party to the proceeding and to any person described by section 5(d) of this chapter.

(e) In the conduct of its proceedings, the ultimate authority or its designee shall afford each party an opportunity to present briefs. The ultimate authority or its designee may:

(1) afford each party an opportunity to present oral argument;

(2) have a transcript prepared, at the agency's expense, of any portion of the record of a proceeding that the ultimate authority or its designee considers necessary;

(3) exercise the powers of an administrative law judge to hear additional evidence under sections 25 ar[illegible] of this chapter; or

(4) allow nonparties to participate in a proceeding in accordance with section 25 of this chapter.

Sections 15 and 16 of this chapter concerning representation and interpreters apply to the proceedings of the ultimate authority or its designee.

(f) Notices and orders of the ultimate authority or its designee shall be served on all parties and all other persons who have requested notice under section 5 of this chapter.

(g) The final order of the ultimate authority or its designee must:

(1) identify any differences between the final order and the nonfinal order issued by the administrative law judge under section 27 of this chapter;

(2) include findings of fact meeting the standards of section 27 of this chapter or incorporate the findings of fact in the administrative law judge's order by express reference to the order; and

(3) briefly explain the available procedures and time limit for seeking administrative review of the final order by another agency under section 30 of this chapter (if any is available).

As added by P.L.18-1986, SEC.1.

4-21.5-3-29 Orders from other than ultimate authority; review by ultimate authority; objections

Sec. 29. (a) This section does not apply if the administrative law judge issuing an order under section 27 of this chapter is the ultimate authority for the agency.

(b) After an administrative law judge issues an order under section 27 of this chapter, the ultimate authority or its designee shall issue a final order:

(1) affirming;

(2) modifying; or

(3) dissolving;

the administrative law judge's order. The ultimate authority or its designee may remand the matter, with or without instructions, to an administrative law judge for further proceedings.

(c) In the absence of an objection or notice under subsection (d) or (e), the ultimate authority or its designee shall affirm the order.

(d) To preserve an objection to an order of an administrative law judge for judicial review, a party must not be in default under this chapter and must object to the order in a writing that:

(1) identifies the basis of the objection with reasonable particularity; and

(2) is filed with the ultimate authority responsible for reviewing the order within fifteen (15) days (or any longer period set by statute) after the order is served on the petitioner.

(e) Without an objection under subsection (d), the ultimate authority or its designee may serve written notice of its intent to review any issue related to the order. The notice shall be served on all parties and all other persons described by section 5(d) of this chapter. The notice must identify the issues that the ultimate authority or its designee intends to review.

(f) A final order disposing of a proceeding or an order remanding an order to an administrative law judge for further proceedings shall be issued within sixty (60) days after the latter of:

(1) the date that the order was issued under section 27 of this chapter;

(2) the receipt of briefs; or

(3) the close of oral argument;

unless the period is waived or extended with the written consent of all parties or for good cause shown.

(g) After remand of an order under this section to an administrative law judge, the judge's order is also subject to review under this section. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-30 Review by other agency

Sec. 30. If, under a statute, an agency may review the final order of another agency, the review shall be treated as if it was a continuous proceeding before a single agency. For the purposes of this review and the application of section 3 of this chapter concerning the effectiveness of an order, a final order of the first agency shall be treated as a nonfinal order of an administrative law judge, and the second agency shall review the order under section 29 of this chapter. To preserve an issue for judicial review, a party must comply with section 29(d) of this chapter before the second agency. The ultimate authority for the second agency or its designee may conduct proceedings under section 31 of this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-31 Modification of final order

Sec. 31. (a) An agency has jurisdiction to modify a final order under this section before the earlier of the following:

(1) Thirty (30) days after the agency has served the final order under section 27, 29, or 30 of this chapter.

(2) Another agency assumes jurisdiction over the final order under section 30 of this chapter.

(3) A court assumes jurisdiction over the final order under IC 4-21.5-5.

(b) A party may petition the ultimate authority for an agency for a stay of effectiveness of a final order. The ultimate authority or its designee may, before or after the order becomes effective, stay the final order in whole or in part.

(c) A party may petition the ultimate authority for an agency for a [illegible] ring of a final order. The ultimate authority or its designee may grant a petition for rehearing only if the petitioning party demonstrates that:

(1) the party is not in default under this chapter;

(2) newly discovered material evidence exists; and

(3) the evidence could not, by due diligence, have been discovered and produced at the hearing in the proceeding.

The rehearing may be limited to the issues directly affected by the newly discovered evidence. If the rehearing is conducted by a person other than the ultimate authority, section 29 of this chapter applies to review of the order resulting from the rehearing.

(d) Clerical mistakes and other errors resulting from oversight or omission in a final order or other part of the record of a proceeding may be corrected by an ultimate authority or its designee on the motion of any party or on the motion of the ultimate authority or its designee.

(e) An action of a petitioning party or an agency under this section neither tolls the period in which a party may object to a second agency under section 30 of this chapter nor tolls the period in which a party may petition for judicial review under IC 4-21.5-5. However, if a rehearing is granted under subsection (c), these periods are tolled and a new period begins on the date that a new final order is served. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.14.*

4-21.5-3-32 Final orders; public inspection; indexing; deletions; precedential effect

Sec. 32. (a) Each agency shall make all written final orders available for public inspection and copying under IC 5-14-3. The agency shall index final orders that are issued after June 30, 1987, by name and subject. An agency shall index an order issued before July 1, 1987, if a person submits a written request to the agency that the order be indexed. An agency shall delete from these orders identifying details to the extent required by IC 5-14-3 or other law. In each case, the justification for the deletion must be explained in writing and attached to the order.

(b) An agency may not rely on a written final order as precedent to the detriment of any person until the order has been made available for public inspection and indexed in the manner described in subsection (a). However, this subsection does not apply to any person who has actual timely knowledge of the order. The burden of proving that knowledge is on the agency. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.15.*

4-21.5-3-33 Records

Sec. 33. (a) An agency shall maintain an official record of each proceeding under this chapter.

(b) The agency record of the proceeding consists only of the following:

(1) Notices of all proceedings.

(2) Any prehearing order.

(3) Any motions, pleadings, briefs, petitions, requests, and intermediate rulings.

(4) Evidence received or considered.

(5) A statement of matters officially noticed.

(6) Proffers of proof and objections and rulings on them.

(7) Proposed findings, requested orders, and exceptions.

(8) The record prepared for the administrative law judge or for the ultimate authority or its designee under sections 28 through 31 of this chapter, at a hearing, and any transcript of the record considered before final disposition of the proceeding.

(9) Any final order, nonfinal order, or order on rehearing.

(10) Staff memoranda or data submitted to the administrative law judge or a person presiding in a proceeding under sections 28 through 31 of this chapter.

(11) Matters placed on the record after an ex parte communication.

(c) Except to the extent that a statute provides otherwise, the agency record described by subsection (b) constitutes the exclusive basis for agency action in proceedings under this chapter and for judicial review of a proceeding under this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-34 Informal procedures; rules

Sec. 34. An agency is encouraged to develop informal procedures that are consistent with this article and make unnecessary more elaborate proceedings under this article. An agency may adopt rules, under IC 4-22-2, setting specific procedures to facilitate informal settlement of matters. This section does not require any person to settle a matter under the agency's informal procedures. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.16.*

4-21.5-3-35 Additional procedural rights; rules

Sec. 35. An agency may grant procedural rights to persons in addition to those conferred by this article so long as the rights conferred upon other persons by any law are not substantially prejudiced. The agency may adopt rules, under IC 4-22-2, concerning the nature and requirements of all procedures for requesting a proceeding or engaging in a proceeding, so long as the rules are not inconsistent with this article. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-36 Persons presiding in proceedings; violations

Sec. 36. An individual who:

(1) is serving alone or with others as an administrative law judge or as a person presiding in a proceeding under sections 28 through 31 of this chapter; and

(2) knowingly or intentionally violates section 11, 12, or 13 of this chapter;

commits a Class A misdemeanor. *As added by P.L.18-1986, SEC.1.*

4-21.5-3-37 Aiding in violation

Sec. 37. A person who:

(1) aids, induces, or causes an individual serving alone or with others as an administrative law judge or as a person presiding in a proceeding under sections 28 through 31 of this chapter to violate section 11, 12, or 13 of this chapter; and

(2) acts with the intent to:

(A) have the individual described in subdivision (1) disqualified from serving in a proceeding; or

(B) influence the individual described in subdivision (1) with respect to any issue in a proceeding;

commits a Class A misdemeanor. *As added by P.L.18-1986, SEC.1.*

Chapter 4. Special Proceedings; Emergency and Other Temporary Orders

4-21.5-4-1 Circumstances warranting special proceedings

Sec. 1. An agency may conduct proceedings under this chapter if:

(1) an emergency exi[illegible]or

(2) a statute authorizes the agency to issue a temporary order or otherwise take immediate agency action.

As added by P.L.18-1986, SEC.1.

4-21.5-4-2 Procedures; orders

Sec. 2. (a) The agency shall issue the order under this chapter by one (1) of the following procedures:

(1) Without notice or an evidentiary proceeding, by any authorized individual or panel of individuals.

(2) After a hearing conducted by an administrative law judge.

(b) The resulting order must include a brief statement of the facts and the law that justifies the agency's decision to take the specific action under this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-4-3 Notice; effectiveness of order

Sec. 3. The agency shall give such notice as is practicable to persons who are required to comply with the order under this chapter. The order is effective when issued. *As added by P.L.18-1986, SEC.1.*

4-21.5-4-4 Hearings

Sec. 4. Upon a request by a party for a hearing on an order rendered under section 2(a)(1) of this chapter, the agency shall, as quickly as is practicable, set the matter for an evidentiary hearing. An administrative law judge shall determine whether the order under this chapter should be voided, terminated, modified, stayed, or continued. *As added by P.L.18-1986, SEC.1.*

4-21.5-4-5 Expiration of order

Sec. 5. (a) An order issued under this chapter expires on the earliest of the following:

(1) The date set in the order.

(2) The date set by a statute other than this article.

(3) The elapse of ninety (90) days.

(b) During the pendency of any related proceedings under IC 4-21.5-3, the agency responsible for the proceeding may renew the order for successive ninety (90) day periods unless a statute other than this article prohibits the renewal of the order. *As added by P.L.18-1986, SEC.1.*

4-21.5-4-6 Records

Sec. 6. The agency record in a proceeding under this chapter consists of any documents regarding the matter that were considered or prepared by the agency in a proceeding under section 2(a)(1) of this chapter and, if a hearing is conducted under section 2(a)(2) or 4 of this chapter, the items described in IC 4-21.5-3-33. *As added by P.L.18-1986, SEC.1.*

Chapter 5. Judicial Review

4-21.5-5-1 Exclusive means

Sec. 1. This chapter establishes the exclusive means for judicial review of an agency action. However, a subpoena, discovery order, or protective order issued under this article may be contested only in an action for civil enforcement under IC 4-21.5-6-2. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.17.*

4-21.5-5-2 Petition; persons entitled to judicial review

Sec. 2. (a) Judicial review is initiated by filing a petition for review in the appropriate court.

(b) Only a person who qualifies under:

(1) section 3 of this chapter concerning standing;

(2) section 4 of this chapter concerning exhaustion of administrative remedies;

(3) section 5 of this chapter concerning the time for filing a petition for review;

(4) section 13 of this chapter concerning the time for filing the agency record for review; and

(5) any other statute that sets conditions for the availability of judicial review;

is entitled to review of a final agency action.

(c) A person is entitled to judicial review of a nonfinal agency action only if the person establishes both of the following:

(1) Immediate and irreparable harm.

(2) No adequate remedy exists at law. (The failure of a person to comply with the procedural requirements of this article may not be the basis for a finding of an inadequate remedy at law.)

As added by P.L.18-1986, SEC.1.

4-21.5-5-3 Standing

Sec. 3. (a) The following persons have standing to obtain judicial review of an agency action:

(1) A person to whom the agency action is specifically directed.

(2) A person who was a party to the agency proceedings that led to the agency action.

(3) A person eligible for standing under a law applicable to the agency action.

(4) A person otherwise aggrieved or adversely affected by the agency action.

(b) A person has standing under subsection (a)(4) only if:

(1) the agency action has prejudiced or is likely to prejudice the interests of the person;

(2) the person:

(A) was eligible for an initial notice of an order or proceeding under this article, was not notified of the order or proceeding in substantial compliance with this article, and did not have actual notice of the order or proceeding before the last date in the proceeding that the person could object or otherwise intervene to contest the agency action; or

(B) was qualified to intervene to contest an agency action under IC 4-21.5-3-21(a), petitioned for intervention in the proceeding, and was denied party status;

(3) the person's asserted interests are among those that the agency was required to consider when it engaged in the agency action challenged; and

(4) a judgment in favor of the person would substantially eliminate or redress the prejudice to the person caused or likely to be caused by the agency action.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.18.

4-21.5-5-4 Exhaustion of administrative remedies; waiver of right to review

Sec. 4. (a) A person may file a petition [illegible] judicial review under this chapter only aft[illegible] exhausting all administrative remedies available within the agency whose action is being challenged and within any other agency authorized to exercise administrative review.

(b) A person who:

(1) fails to timely object to an order or timely petition for review of an order within the period prescribed by this article; or

(2) is in default under this article;

has waived the person's right to judicial review under this chapter. *As added by P.L.18-1986, SEC.1.*

4-21.5-5-5 Time for filing

Sec. 5. Except as otherwise provided, a petition for review is timely only if it is filed within thirty (30) days after the date that notice of the agency action that is the subject of the petition for judicial review was served. *As added by P.L.18-1986, SEC.1.*

4-21.5-5-6 Venue

Sec. 6. (a) Venue is in the judicial district where:

(1) the petitioner resides or maintains a principal place of business;

(2) the agency action is to be carried out or enforced; or

(3) the principal office of the agency taking the agency action is located.

(b) If more than one (1) person may be aggrieved by the agency action, only one (1) proceeding for review may be had, and the court in which a petition for review is first properly filed has jurisdiction.

(c) The rules of procedure governing civil actions in the courts govern pleadings and requests under this chapter for a change of judge or change of venue to another judicial district described in subsection (a).

(d) Each person who was a party to the proceeding before the agency is a party to the petition for review. *As added by P.L.18-1986, SEC.1.*

4-21.5-5-7 Petition; filing; contents

Sec. 7. (a) A petition for review must be filed with the clerk of the court.

(b) A petition for review must be verified and set forth the following:

(1) The name and mailing address of the petitioner.

(2) The name and mailing address of the agency whose action is at issue.

(3) Identification of the agency action at issue, together with a copy, summary, or brief description of the agency action.

(4) Identification of persons who were parties in any proceedings that led to the agency action.

(5) Specific facts to demonstrate that the petitioner is entitled to obtain judicial review under section 2 of this chapter.

(6) Specific facts to demonstrate that the petitioner has been prejudiced by one (1) or more of the grounds described in section 14 of this chapter.

(7) A request for relief, specifying the type and extent of relief requested.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.19.

4-21.5-5-8 Service; rules of procedure

Sec. 8. (a) A petitioner for judicial review shall serve a copy of the petition upon:

(1) the ultimate authority issuing the order;

(2) the ultimate authority for each other agency exercising administrative review of the order;

(3) the attorney general; and

(4) each party to the proceeding before an agency;

in the manner provided by the rules of procedure governing civil actions in the courts. If the

ultimate authority consists of more than one (1) individual, service on the ultimate authority must be made to the secretary or chairperson of the ultimate authority.

(b) The petitioner shall use means provided by the rules of procedure governing civil actions in the courts to give notice of the petition for review to all other parties in any proceedings that led to the agency action. *As added by P.L.18-1986, SEC.1.*

4-21.5-5-9 Stay of order pending court decision

Sec. 9. (a) If a petition for judicial review concerns a matter other than an assessment or determination of tax due or claimed to be due the state, and the law concerning the agency whose order is being reviewed does not preclude a stay of the order by the court, the person seeking the review may seek, by filing a verified petition, an order of the court staying the action of the agency pending decision by the court. The court may enter an order staying the agency order pending a final determination if:

(1) the court finds that the petition for review and the petition for a stay order show a reasonable probability that the order or determination appealed from is invalid or illegal; and

(2) a bond is filed that is conditioned upon the due prosecution of the proceeding for review and that the petitioner will pay all court costs and abide by the order of the agency if it is not set aside. The bond must be in the amount and with the surety approved by the court. However, the amount of the bond must be at least five hundred dollars ($500).

(b) If a petition for review concerns a revocation or suspension of a license and the law governing the agency permits a staying of the action of the agency by court order pending judicial review, any stay ordered under subsection (a) is effective during the period of the review and any appeal from the review and until the review is finally determined, unless otherwise ordered by the court granting the stay. If the stay is granted as provided in this section and the determination of the agency is approved on final determination, the revocation or suspension of the license immediately becomes effective. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.20.*

4-21.5-5-10 Issues not raised before agency

Sec. 10. A person may obtain judicial review of an issue that was not raised before the agency, only to the extent that:

(1) the issue concerns whether a person who was required to be notified by this article of the commencement of a proceeding was notified in substantial compliance with this article; or

(2) the interests of justice would be served by judicial resolution of an issue arising from a change in controlling law occurring after the agency action.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.21.

4-21.5-5-11 Fact issues confined to record

Sec. 11. Judicial review of disputed issues of fact must be confined to the agency record for the agency action supplemented by additional evidence taken under section 12 of this chapter. The court may not try the cause de novo or substitute its judgment for that of the agency. *As added by P.L.18-1986, SEC.1.*

4-21.5-5-12 Evidence; remand to agency for further factfinding

Sec. 12. (a) The court may receive evidence, in addition to that contained in the agency record for judicial review, only if it relates to the validity of the agency action at the time it was taken and is need[illegible] decide disputed issues regarding one [illegible]r both of the following:

(1) Improper constitution as a decision-making body or grounds for disqualification of those taking the agency action.

(2) Unlawfulness of procedure or of decision-making process.

This subsection applies only if the additional evidence could not, by due diligence, have been discovered and raised in the administrative proceeding giving rise to a proceeding for judicial review.

(b) The court may remand a matter to the agency before final disposition of a petition for review with directions that the agency conduct further factfinding or that the agency prepare an adequate record, if:

(1) the agency failed to prepare or preserve an adequate record;

(2) the agency improperly excluded or omitted evidence from the record; or

(3) a relevant law changed after the agency action and the court determines that the new provision of law may control the outcome.

As added by P.L.18-1986, SEC.1.

4-21.5-5-13 Transmittal of agency record; costs; corrections or additions

Sec. 13. (a) Within thirty (30) days after the filing of the petition, or within further time allowed by the court or by other law, the petitioner shall transmit to the court the original or a certified copy of the agency record for judicial review of the agency action, consisting of:

(1) any agency documents expressing the agency action;

(2) other documents identified by the agency as having been considered by it before its action and used as a basis for its action; and

(3) any other material described in this article as the agency record for the type of agency act[illegible] issue, subject to this section.

(b) An extension of time in which to file the record shall be granted by the court for good cause shown. Inability to obtain the record from the responsible agency within the time permitted by this section is good cause. Failure to file the record within the time permitted by this subsection, including any extension period ordered by the court, is cause for dismissal of the petition for review by the court, on its own motion, or on petition of any party of record to the proceeding.

(c) Upon a written request by the petitioner, the agency taking the action being reviewed shall prepare the agency record for the petitioner. If part of the record has been preserved without a transcript, the agency shall prepare a transcript for inclusion in the record transmitted to the court, except for portions that the parties to the judicial review proceeding stipulate to omit in accordance with subsection (e).

(d) Notwithstanding IC 5-14-3-8, the agency shall charge the petitioner with the reasonable cost of preparing any necessary copies and transcripts for transmittal to the court, unless a person files with the court, under oath and in writing, the statement described by IC 33-18-19-3.

(e) By stipulation of all parties to the review proceedings, the record may be shortened, summarized, or organized.

(f) The court may tax the cost of preparing transcripts and copies for the record:

(1) against a party to the judicial review proceeding who unreasonably refuses to stipulate to shorten, summarize, or organize the record; or

(2) in accordance with the rules governing civil actions in the courts or other law.

(g) Additions to the record concerning evidence received under section 12 of this chapter must be made as ordered by the court. The court may require or permit subsequent corrections or additions to the record. *As added by P.L.18-1986, SEC.1. Amended by P.L.11-1987, SEC.6.*

4-21.5-5-14 Burden of proof; standards of review

Sec. 14. (a) The burden of demonstrating the invalidity of agency action is on the party to the judicial review proceeding asserting invalidity.

(b) The validity of agency action shall be determined in accordance with the standards of review provided in this section, as applied to the agency action at the time it was taken.

(c) The court shall make findings of fact on each material issue on which the court's decision is based.

(d) The court shall grant relief under section 15 of this chapter only if it determines that a person seeking judicial relief has been prejudiced by an agency action that is:

(1) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law;

(2) contrary to constitutional right, power, privilege, or immunity;

(3) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right;

(4) without observance of procedure required by law; or

(5) unsupported by substantial evidence.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.22.

4-21.5-5-15 Disposition

Sec. 15. If the court finds that a person has been prejudiced under section 14 of this chapter, the court may set aside an agency action and:

(1) remand the case to the agency for further proceedings; or

(2) compel agency action that has been unreasonably delayed or unlawfully withheld.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.23.

4-21.5-5-16 Decisions on petitions; appeal

Sec. 16. Decisions on petitions for review of agency action are appealable in accordance with the rules governing civil appeals from the courts. *As added by P.L.18-1986, SEC.1.*

Chapter 6. Civil Enforcement

4-21.5-6-1 Court order for enforcement

Sec. 1. In addition to any other remedy provided by law:

(1) an agency in its own name;

(2) an agency in the name of the state;

(3) the attorney general in the name of the attorney general; or

(4) the attorney general in the name of the state at the request of an agency;

may apply for a court order in a circuit or superior court to enforce an order issued under this article by a verified petition for civil enforcement. *As added by P.L.18-1986, SEC.1.*

4-21.5-6-2 Enforcement of subpoenas, discovery orders and protective orders

Sec. 2. (a) This section applies only to the enforcement of a subpoena, discovery order, or protective order issued by an agency under this article.

(b) Any party to a proceeding before an agency who has obtained an order from an administrative law judge may apply for a court order in a circuit or superior court to enforce the subpoena or order issued by an agency by a verified petition for civil enforcement. Notice of an application under this section shall be given:

(1) to the administrative law judge issuing the order;

(2) to the attorney general; and

(3) to each party to the proceeding before the agency;

by personal service or by the United States mail at the time the application is filed. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.24.*

4-21.5-6-3 Civil actions

Sec. 3. (a) This section does not apply to the enforcement of a subpoena, discovery order, or protective order issued by an agency under this article.

(b) Nothing in this chapter limits or precludes civil action under IC 13-6-1-1.

(c) Any party to a proceeding concerning an agency's order may file a petition for civil enforcement of that order.

(d) The action may not be commenced under this section if:

(1) less than sixty (60) days has elapsed since the petitioner gave notice of the alleged violation and of the petitioner's intent to seek civil enforcement to the head of the agency concerned, to the attorney general, and to each alleged violator against whom the petitioner seeks civil enforcement;

(2) the agency has filed and is diligently prosecuting a petition for civil enforcement of the same order against the same defendant; or

(3) a petition for review of the same order has been filed and is pending in court.

(e) The petition under this section must name as defendants each alleged violator against whom the petitioner seeks civil enforcement.

(f) The agency whose order is sought to be enforced is not a party to an action under this section unless the agency moves to intervene. The court shall grant an agency's motion to intervene and shall allow the agency to intervene as a plaintiff or defendant.

(g) The agency whose order is sought to be enforced under this section may move to dismiss on the grounds that the petition fails to qualify under this section or that enforcement would be contrary to the policy of the agency. The court shall grant the motion to dismiss unless the petitioner demonstrates that:

(1) the petition qualifies under this section; and

(2) the agency's failure to enforce its order is based on an exercise of discretion that is improper on one (1) or more of the grounds provided in IC 4-[illegible].5-5-14.

(h) [illegible]xcept to the extent expressly authorized by law, a petition for civil enforcement filed under this section may not request, and the court may not grant, any monetary payment apart from taxable costs. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.25.*

4-21.5-6-4 Naming violators required

Sec. 4. A petition for civil enforcement must name as defendants each alleged violator against whom the party seeks to obtain civil enforcement. *As added by P.L.18-1986, SEC.1.*

4-21.5-6-5 Venue

Sec. 5. Venue is determined in accordance with the rules governing civil actions in the courts. *As added by P.L.18-1986, SEC.1.*

4-21.5-6-6 Relief granted

Sec. 6. Upon a showing that a person has violated an order issued under this article, the court may grant:

(1) an injunction requested by any petitioner without bond;

(2) a restraining order or any appropriate relief other than an injunction requested by a petitioner under section 1 of this chapter without bond;

(3) a subpoena, discovery order, or protective order requested under section 2 of this chapter without a bond; or

(4) a restraining order or any appropriate relief other than an injunction requested by a petitioner under section 3 of this chapter with the bond specified by the court.

As added by P.L.18-1986, SEC.1.

4-21.5-6-7 Appeal

Sec. 7. Decisions on petitions for civil enforcement are appealable in accordance with the rules governing civil appeals from the courts. *As added by P.L.18-1986, SEC.1.*

ARTICLE 22. ADMINISTRATIVE RULES AND PROCEDURES

Chapter 1. Repealed

(Repealed by P.L.18-1986, SEC.2).

Chapter 2. Adoption of Administrative Rules

P.L.5-1984, SEC.95; P.L.17-1986, SEC.2; P.L.336-1989(ss), SEC.12.

Chapter 13. Lake Michigan Lands—Rights of Riparian Owners

4-18-13-1 Submerged lands; reclamation and fill permits

Sec. 1. (a) The owner of land, or the owner of any easement for public park purposes in, over, or through any land, bordering upon the waters of Lake Michigan may apply to the department of natural resources for a permit to fill in, reclaim, and own the submerged land adjacent to and within the width of the land bordering upon the lake and between the shore and the dock or harbor line established by the United States.

(b) When the land is filled in and reclaimed according to the permit, the owner of the land adjoining the filled in land becomes the owner in fee simple of the filled in land. Those holding an easement over the land and filling have the same right over the land filled as they have over the adjoining land. However, the owner of the easement acquires only a like easement over the filled in lands. *(Formerly: Acts 1907, c.91, s.1; Acts 1915, c.190, s.1). As amended by P.L.22-1990, SEC.1.*

4-18-13-4 Permits; expiration

Sec. 4. (a) A permit or other authority to fill in and reclaim land bordering Lake Michigan that was issued under this chapter before July 1, 1990, expires December 31, 1991.

(b) A permit to fill in and reclaim land bordering Lake Michigan issued under this chapter after June 30, 1990, expires five (5) years after the date the permit was issued. *As added by P.L.22-1990, SEC.2.*

ARTICLE 21. ACQUISITION OF INDIANA LAND BY THE UNITED STATES GOVERNMENT

Chapter 7. Consent to United States Acquisition of Natural Forests—Concurrent Jurisdiction Retained—Restrictions Imposed

4-21-7-1 Acquisition by purchase or gift

Sec. 1. (a) Subject to the conditions established in this chapter, the consent of the state is given the United States of America to acquire, by purchase or gift, such lands in Indiana as in the opinion of the federal government may be needed for establishment, consolidation, or extension of natural forests in Indiana.

(b) The consent given in subsection (a) terminates January 1, 2021. *(Formerly: Acts 1935, c.29, s.1). As amended by Acts 1978, P.L.2, SEC.414; Acts 1980, P.L.18, SEC.1; P.L.115-1986, SEC.21; P.L.34-1989, SEC.1.*

4-21-7-3 Breach of conditions; termination of consent

Sec. 3. In the event the United States government fails to conform to any of the conditions provided in section 2.1 of this chapter, the consent of the state of Indiana given in section 1 of this chapter is terminated, forthwith, by operation of law. *As added by Acts 1980, P.L.18, SEC.3. Amended by P.L.3-1989, SEC.22.*

Chapter 8. Consent to United States Acquisition of Land for Fish Hatcheries, Wildlife or Forest Preserves, or Agricultural, Recreational, or Experimental Uses—Acquisition and Administration by Department of Natural Resources Authorized

4-21-8-5 Repealed

(Repealed by P.L.1-1989, SEC.75.)

ARTICLE 21.5. ADMINISTRATIVE ORDERS AND PROCEDURES

Chapter 2. Application

4-21.5-2-4 Exemptions; agencies

Sec. 4. (a) This article does not apply to any of the following agencies:

(1) The governor.

(2) The state board of accounts.

(3) The state educational institutions (as defined by IC 20-12-0.5-1).

(4) The department of employment and training services.

(5) The unemployment insurance review board of the department of employment and training services.

(6) The worker's compensation board.

(7) The military officers or boards.

(8) The utility regulatory commission.

(9) The department of state revenue (excluding an agency action related to the licensure of private employment agencies).

(10) The state board of tax commissioners.

(b) This article does not apply to action related to railroad rate and tariff regulation by the Indiana department of transportation. *As added by P.L.18-1986, SEC.1. Amended by P.L.18-1987, SEC.5; P.L.28-1988, SEC.1; P.L.18-1990, SEC.7.*

4-21.5-2-5 Exemptions; agency actions

Sec. 5. This article does not apply to any of the following agency actions:

(1) The issuance of a warrant or jeopardy warrant for the collection of taxes.

(2) A determination of probable cause or no probable cause by the civil rights commission.

(3) A determination in a factfinding conference of the civil rights commission.

(4) A personnel action, except review of a personnel action by the state employees appeals commission under IC 4-15-2 or a personnel action that is not covered by IC 4-15-2 but may be taken only for cause.

(5) A resolution, directive, or other action of any agency that relates solely to the internal policy, organization, or procedure of that agency or another agency and is not a licensing or enforcement action. Actions to which this exemption applies include the statutory obligations of an agency to approve or ratify an action of another agency.

(6) An agency action related to an offender within the jurisdiction of the department of correction.

(7) A decision of the department of commerce, the department of environmental management, the enterprise zone board, the tourist information and grant fund review

committee, the Indiana development finance authority, the Indiana business modernization and technology corporation, the corporation for innovation development, the Indiana small business development corporation, or the lieutenant governor that concerns a grant, loan, bond, tax incentive, or financial guarantee.

(8) A decision to issue or not issue a complaint, summons, or similar accusation.

(9) A decision to initiate or not initiate an inspection, investigation, or other similar inquiry that will be conducted by the agency, another agency, a political subdivision, including a prosecuting attorney, a court, or another person.

(10) A decision concerning the conduct of an inspection, investigation, or other similar inquiry by an agency.

(11) The acquisition, leasing, or disposition of property or procurement of goods or services by contract.

(12) Determinations of the department of employment and training services under IC 22-4-18-1(g)(1), IC 22-4-40, or IC 22-4-41.

(13) A decision under IC 9-30-12 of the bureau of motor vehicles to suspend or revoke the driver's license, a driver's permit, a vehicle title, or a vehicle registration of an individual who presents a dishonored check.

(14) An action of the department of financial institutions under IC 28-1-3.1 or a decision of the department of financial institutions to act under IC 28-1-3.1.

As added by P.L.18-1986, SEC.1. Amended by P.L.29-1988, SEC.1; P.L.3-1989, SEC.23; P.L.38-1989, SEC.1; P.L.1-1990, SEC.34; P.L.23-1990, SEC.1; P.L.11-1990, SEC.103; P.L.10-1991, SEC.6; P.L.2-1991, SEC.20; P.L.11-1991, SEC.20.

4-21.5-2-6 Exemptions; determinations (first version)

Note: This version of section amended by P.L.2-1992, SEC.37. See also following version of this section, amended by P.L.23-1992, SEC.1.

Sec. 6. This article does not apply to the formulation, issuance, or administrative review (but does apply to the judicial review and civil enforcement) of any of the following:

(1) Determinations by the division of family and children.

(2) Determinations by the Indiana alcoholic beverage commission.

As added by P.L.18-1986, SEC.1. Amended by P.L.2-1992, SEC.37.

Note: See also following version of this section, amended by P.L.23-1992, SEC.1.

4-21.5-2-6 Exemptions; determinations (second version)

Note: This version of section amended by P.L.23-1992, SEC.1. See also preceding version of this section, amended by P.L.2-1992, SEC.37.

Sec. 6. This article does not apply to the formulation, issuance, or administrative review (but does apply to the judicial review and civil enforcement) of any of the following:

(1) Determinations by the division of family and children.

(2) Determinations by the Indiana alcoholic beverage commission.

(3) Determinations by the office of Medicaid policy and planning concerning recipients and applicants of Medicaid. However, this article does apply to determinations by the office of Medicaid policy and planning concerning providers.

As added by P.L.18-1986, SEC.1. Amended by P.L.23-1992, SEC.1.

Note: See also preceding version of this section, amended by P.L.2-1992, SEC.37.

Chapter 3. Adjudicative Proceedings

4-21.5-3-1 Service of process; notice by publication

Sec. 1. (a) This section applies to:

(1) the giving of any notice;

(2) the service of any motion, ruling, order, or other filed item; or

(3) the filing of any document with the ultimate authority;

in an administrative proceeding under this article.

(b) Except as otherwise provided by law, a person shall serve papers by United States mail or personal service. If an agency mails or personally serves a paper, the agency shall keep a record of the time, date, and circumstances of the service.

(c) Service shall be made on a person or on the person's counsel or other authorized representative of record in the proceeding. Service on an artificial person or a person incompetent to receive service shall be made on a person allowed to receive service under the rules governing civil actions in the courts. If an ultimate authority consists of more than one (1) individual, service on that ultimate authority must be made on the chairperson or secretary of the ultimate authority. A document to be filed with that ultimate authority must be filed with the chairperson or secretary of the ultimate authority.

(d) If the current address of a person is not ascertainable, service shall be mailed to the last known address where the person resides or has a principal place of business. If the identity, address, or existence of a person is not ascertainable, or a law other than a rule allows, service shall be made by a single publication in a newspaper of general circulation in:

(1) the county in which the person resides, has a principal place of business, or has property that is the subject of the proceeding; or

(2) Marion County, if the place described in subdivision (1) is not ascertainable or the place described in subdivision (1) is outside Indiana and the person does not have a resident agent or other representative of record in Indiana.

(e) A notice given by publication must include a statement advising a person how the person may receive written notice of the proceedings.

(f) The filing of a document with an ultimate authority is complete on the earliest of the following dates that apply to the filing:

(1) The date on which the document is delivered to the ultimate authority under subsection (c).

(2) The date of the postmark on the envelope containing the document, if the document is mailed to the ultimate authority by United States mail.

(3) The date on which the document is deposited with a private carrier, as shown by a receipt issued by the carrier, if the document is sent to the ultimate authority by private carrier.

As added by P.L.18-1986, SEC.1. Amended by P.L.35-1987, SEC.2; P.L.33-1989, SEC.2; P.L.35-1989, SEC.2.

4-21.5-3-4 Notice required; licenses and personnel decisions; persons who must be notified; contents

Sec. 4. (a) Notice must be given under this section concerning the following:

(1) The grant, renewal, restoration, transfer, or denial of a license by the bureau of motor vehicles under IC 9.

(2) The grant, renewal, restoration, transfer, or denial of a noncommercial fishing or hunting license by the department of natural resources under IC 14.

(3) The grant, renewal, restoration, transfer, or denial of a license by a board described in IC 25-1-8-1 or the committee of podiatric medicine.

(4) A personnel decision by an agency.

(5) The grant, renewal, restoration, transfer, or denial of a license by the department of environmental management or the commissioner of the department under the following:

(A) IC 13-7 for the construction, installation, or modification of:

(i) sewers and appurtenant facilities, devices, or structures for the collection and transport of sewage (as defined in IC 13-7-1-20) or storm water to a storage or treatment facility or to a point of discharge into the environment; or

(ii) pipes, pumps, and appurtenant facilities, devices, or structures that are part of a public water supply (as defined in IC 13-7-1-18) and that are used to transport water to a storage or treatment facility or to distribute water to the users of the public water supply;

where a federal, state, or local governmental body has given or will give public notice and has provided or will provide an opportunity for public participation concerning the activity that is the subject of the license.

(B) IC 13-7 for the registration of a device or a piece of equipment.

(C) IC 13-1-1-14 for a person to engage in the inspection, management, and abatement of asbestos containing material.

(D) IC 13-1-6 for a person to operate a wastewater treatment plant.

(E) IC 13-7-10-1.2 for a person to operate the following:

(i) A solid waste incinerator or a waste to energy facility.

(ii) A land disposal site.

(iii) A facility described under IC 13-7-10-1(e) whose operation could have an adverse impact on the environment if not operated properly.

(F) IC 13-7-31 for a person to operate a municipal waste collection and transportation vehicle.

(b) When an agency issues an order described by subsection (a), the agency shall give a written notice of the order to the following persons:

(1) Each person to whom the order is specifically directed.

(2) Each person to whom a law requires notice to be given.

A person who is entitled to notice under this subsection is not a party to any proceeding resulting from the grant of a petition for review under section 7 of this chapter unless the person is designated as a party on the record of the proceeding.

(c) The notice must include the following:

(1) A brief description of the order.

(2) A brief explanation of the available procedures and the time limit for seeking administrative review of the order under section 7 of this chapter.

(3) Any information required by law.

(d) An order under this section is effective when it is served. However, if a timely and sufficient application has been made for renewal of a license described by subsection (a)(3) and review is granted under section 7 of this chapter, the existing license does not expire until the agency has disposed of the proceeding under this chapter concerning the renewal, unless a statute other than this article provides otherwise. This subsection does not preclude an agency from issuing, under IC 4-21.5-4, an emergency or other temporary order with respect to the license.

(e) If a petition for review of an order described in subsection (a) is filed within the period set by section 7 of this chapter and a petition for stay of effectiveness of the order is filed by a party or another person who has a pending petition for intervention in the proceeding, an administrative law judge shall, as soon as practicable, conduct a preliminary hearing to determine whether the order should be stayed in whole or in part. The burden of proof in the preliminary hearing is on the person seeking the stay. The administrative law judge may stay the order in whole or in part. The order concerning the stay may be issued after an order described in subsection (a) becomes effective. The resulting order concerning the stay shall be served on the parties and any person who has a pending petition for intervention in the proceeding. It must include a statement of the facts and law on which it is based. *As added by P.L.18-1986, SEC.1. Amended by P.L.35-1989, SEC.2; P.L.25-1991, SEC.1.*

4-21.5-3-15 Participation in proceeding

Sec. 15. (a) Any party may participate in a proceeding in person or, if the party is not an individual or is incompetent to participate, by a duly authorized representative.

(b) Whether or not participating in person, any party may be advised and represented at the party's own expense by counsel or, unless prohibited by law, by another representative. *As added by P.L.18-1986, SEC.1. Amended by P.L.33-1989, SEC.3.*

Chapter 5. Judicial Review

4-21.5-5-13 Transmittal of agency record; costs; corrections or additions

Sec. 13. (a) Within thirty (30) days after the filing of the petition, or within further time allowed by the court or by other law, the petitioner shall transmit to the court the original or a certified copy of the agency record for judicial review of the agency action, consisting of:

(1) any agency documents expressing the agency action;

(2) other documents identified by the agency as having been considered by it before its action and used as a basis for its action; and

(3) any other material described in this article as the agency record for the type of agency action at issue, subject to this section.

(b) An extension of time in which to file the record shall be granted by the court for good cause shown. Inability to obtain the record from the responsible agency within the time permitted by this section is good cause. Failure to file the record within the time permitted by this subsection, including any extension period ordered by the court, is cause for dismissal of the petition for review by the court, on its own motion, or on petition of any party of record to the proceeding.

(c) Upon a written request by the petitioner, the agency taking the action being reviewed shall prepare the agency record for the petitioner. If part of the record has been preserved without a transcript, the agency shall prepare a transcript for inclusion in the record transmitted to the court, except for portions that the parties to the judicial review proceeding stipulate to omit in accordance with subsection (e).

(d) Notwithstanding IC 5-14-3-8, the agency shall charge the petitioner with the reasonable cost of preparing any necessary copies and transcripts for transmittal to the court, unless a person files with the court, under oath and in writing, the statement described by IC 33-19-3-2.

(e) By stipulation of all parties to the review proceedings, the record may be shortened, summarized, or organized.

(f) The court may tax the cost of preparing transcripts and copies for the record:

(1) against a party to the judicial review proceeding who unreasonably refuses to stipulate to shorten, summarize, or organize the record; or

(2) in accordance with the rules governing civil actions in the courts or other law.

(g) Additions to the record concerning evidence received under section 12 of this chapter must be made as ordered by the court. The court may require or permit subsequent corrections or additions to the record. *As added by P.L.18-1986, SEC.1. Amended by P.L.11-1987, SEC.6; P.L.3-1989, SEC.24.*

ARTICLE 22. ADMINISTRATIVE RULES AND PROCEDURES

Chapter 2. Adoption of Administrative Rules

4-22-2-13 Application of chapter

Sec. 13. (a) Subject to subsections (b) and (c), this chapter applies to the addition, amendment, or repeal of a rule in every rulemaking action.

(b) This chapter does not apply to the following agencies:

(1) Any military officer or board.

(2) Any state educational institution, as defined in IC 20-12-0.5-1.

(c) This chapter does not apply to a rulemaking action that results in any of the following rules:

(1) A resolution or directive of any agency that relates solely to internal policy, internal agency organization, or internal procedure and does not have the effect of law.

(2) A restriction or traffic control determination of a purely local nature that:

(A) is ordered by the commissioner of the Indiana department of transportation;

(B) is adopted under IC 9-20-1-3(d), IC 9-27-3-8, or IC 9-20-7; and

(C) applies only to one (1) or more particularly described intersections, highway portions, bridge causeways, or viaduct areas.

(3) A rule adopted by the secretary of state under IC 26-1-9-408.

(4) An executive order or proclamation issued by the governor.

As added by P.L.31-1985, SEC.2. Amended by P.L.18-1990, SEC.8; P.L.2-1991, SEC.21.

4-22-2-15 Delegation of rulemaking actions

Sec. 15. Any rulemaking action that this chapter allows or requires an agency to perform, other than final adoption of a rule under section 29 or 37.1 of this chapter, may be performed by the individual or group of individuals with the statutory authority to adopt rules for the agency, a member of the agency's staff, or another agent of the agency. Final adoption of a rule under section 29 or 37.1 of this chapter, including readoption of a rule that is subject to sections 24 through 36 or to section 37.1 of this chapter and recalled for further consideration under section 40 of this chapter, may be performed only by the individual or group of individuals with the statutory authority to adopt rules for the agency. *As added by P.L.31-1985, SEC.4. Amended by P.L.1-1991, SEC.16.*

4-22-2-32 Review of rule by attorney general; approval or disapproval

Sec. 32. (a) The attorney general shall review each rule submitted under section 31 of this chapter for legality.

(b) In the review, the attorney general shall determine whether the rule adopted by the agency under section 29 of this chapter substantially differs from the proposed rule or rules published under section 24 of this chapter on which the adopted rule is based. The attorney general shall consider the following:

(1) The extent to which all persons affected by the adopted rule should have understood from the published rule or rules that their interests would be affected.

(2) The extent to which the subject matter of the adopted rule or the issues determined in the adopted rule are different from the subject matter or issues that were involved in the published rule or rules.

(3) The extent to which the effects of the adopted rule differ from the effects that would have occurred if the published rule or rules had been adopted instead.

(c) Except as provided in subsection (d), the attorney general shall disapprove a rule under this section only if it:

(1) has been adopted without statutory authority;

(2) has been adopted without complying with this chapter;

(3) substantially differs from the proposed rule or rules published under section 24 of this chapter on which the adopted rule is based; or

(4) violates another law.

Otherwise, the attorney general shall approve the rule without making a specific finding of fact concerning the subjects.

(d) If an agency submits a rule to the attorney general without complying with section 20(2) of this chapter, the attorney general may:

(1) disapprove the rule; or

(2) return the rule to the agency without disapproving the rule.

(e) If the attorney general returns a rule under subsection (d)(2), the agency may bring the rule into compliance with section 20(2) of this chapter and resubmit the rule to the attorney general without readopting the rule.

APPENDIX R

Chapter 1. Standing to Sue

13-6-1-1 Declaratory or equitable relief in name of state; notice; hearing; intervention; judicial review

Sec. 1. (a) Under this chapter:

(1) the attorney general;

(2) a state, city, town, county, or local agency or officer vested with the authority to seek judicial relief;

(3) a citizen of Indiana; or

(4) a corporation, a partnership, or an association maintaining an office in Indiana;

may bring an action for declaratory and equitable relief in the name of the state against an individual, a partnership, a copartnership, a firm, a company, a corporation, an association, a joint stock company, a trust, an estate, a state agency, or an officer, a city, a town, a county, or a local governmental unit, an agency, or an official, or any other legal entity or their legal representative, agent, or assigns, for the protection of the environment of Indiana from significant pollution, impairment, or destruction. A citizen, a partnership, a corporation, an association, or a public officer or agency, as a condition precedent to maintaining an action, must give notice in writing by registered or certified mail to the department of natural resources, the department of environmental management, and the attorney general, who shall promptly notify all state administrative agencies having jurisdiction over or control of the pollution, impairment, destruction, or protection of the environment for which relief is sought.

(b) An individual or entity that is identified in subsection (a)(2) through (a)(4) and that brings an action under this section may not maintain the action unless:

(1) none of the agencies that receives notice of the action under subsection (a):

(A) commences an administrative proceeding or a civil action on the alleged pollution, impairment, or destruction within ninety (90) days after receiving notice under subsection (a); or

(B) takes steps within ninety (90) days after receiving notice under subsection (a) to have a criminal prosecution commenced on the alleged pollution, impairment, or destruction; or

(2) the agency that commences an administrative proceeding or a civil action on the alleged pollution, impairment, or destruction does not diligently pursue the administrative proceeding or civil action after the administrative proceeding or civil action is commenced.

The agency does not have to be joined as a party in an action under this subsection.

(c) If the administrative agency that has jurisdiction and that is given notice by the attorney general under subsection (a) holds a hearing and makes a final determination after receiving the notice, an appeal from the agency's action may be taken in the manner prescribed by law.

(d) In an administrative, a licensing, or any other proceeding, and in an action for judicial review of an administrative, a licensing, or any other proceeding that is made available by law:

(1) the attorney general;

(2) a state, city, town, county, or local agency or officer vested with the authority to seek judicial relief;

(3) a citizen of Indiana; or

(4) a corporation, a partnership, or an association maintaining an office in Indiana;

shall be permitted to intervene as a party upon the filing of a verified pleading asserting that the proceeding or action for judicial review involves conduct, programs, or products which may have the effect of significantly impairing,

polluting, or destroying the environment of the state.

(e) In the administrative, licensing, or other procedure, the agency shall consider the alleged significant impairment, pollution, or destruction of the environment of the state, and no conduct, program, or product shall be authorized, approved, or permitted to continue which does, or is reasonably likely to, have such effect so long as there is a feasible and prudent alternative consistent with the reasonable requirements of the public health, safety, and welfare.

(f) In an action for judicial review of proceedings described in subsection (c), the court shall, in addition to other duties imposed upon it by law, grant review of claims that the conduct, program, or product under review has impaired, significantly polluted, or destroyed the environment of Indiana, or is reasonably likely to impair, significantly pollute, or destroy the environment of Indiana. *(Formerly: Acts 1971, P.L.182, SEC.2). As amended by P.L.143-1985, SEC.70; P.L.41-1989, SEC.2.*

ARTICLE 7. ENVIRONMENTAL MANAGEMENT

Chapter 1. General Provisions

13-7-1-1 Purpose; policy; goal; differential treatment of solid waste in interstate commerce

Sec. 1. (a) The purpose of this article is to provide for evolving policies for comprehensive environmental development and control on a statewide basis, to unify, coordinate, and implement programs to provide for the most beneficial use of the resources of the state, and to preserve, protect, and enhance the quality of the environment so that, to the extent possible, future generations will be ensured clean air, clean water, and a healthful environment.

(b) The policy of the state is that source reduction, recycling, and other [illegible]lid waste management alternatives are [illegible]ed over initiated by the operator wherein the court orders the suspension of the abatement requirements of the citation), the director may, if a civil penalty is assessed, not assess a civil penalty of less than seven hundred fifty dollars ($750) for each day during which the failure or violation continues. In determining the amount of the civil penalty, the director shall consider the:

(1) permittee's history of previous violations at that surface coal mining and reclamation operation;

(2) seriousness of the violation, including any irreparable harm to the environment and hazard to the health and safety of the public;

(3) permittee's negligence; and

(4) demonstrated good faith of the permittee to achieve rapid compliance after notification of the violation.

(c) Each day in violation of this article may be considered a separate violation for purposes of assessing the civil penalty.

(d) Upon the issuance of a notice or order charging that a violation of this article has occurred, the director shall, within thirty (30) days, inform the permittee of the amount of penalty assessed and issue an order to the permittee to pay the penalty. The permittee then has thirty (30) days from receipt of that order to pay the penalty or request a hearing to contest the amount. If the permittee requests a hearing, he shall forward an amount equal to the assessed penalty to the director who shall place it in an escrow account. Any permittee who desires to contest the violation or amount of penalty assessed but fails to forward this amount to the director waives all legal rights to contest the violation or amount of penalty assessed. The commission shall conduct the hearing in accordance with IC 4-21.5-3 and may consolidate this hearing with a hearing conducted pursuant to IC 13-4.1-11, if appropriate. If it is determined at the hearing that the civil penalty is appropriate, the commission shall issue to the permittee a written decision and an order to pay the penalty within thirty (30) days of receipt of that order. If, through administrative or judicial review of the assessed penalty, it is determined that no violation occurred or the amount of penalty is reduced, the director shall, within thirty (30) days of that decision, remit the appropriate amount to that permittee with interest at the rate of eight percent (8%) per year.

(e) The director may request the attorney general to institute an action in an appropriate court in the county in which the permittee's surface coal mining and reclamation operation is located for recovery of civil penalties owed under this article. *As added by Acts 1980, P.L.101, SEC.3. Amended by Acts 1981, P.L.153, SEC.28; P.L.148-1985, SEC.11; P.L.7-1987, SEC.48; P.L.125-1991, SEC.37.*

Chapter 14. Designation of Lands Unsuitable for Surface Coal Mining

13-4.1-14-1 Lands on which surface mining prohibited; planning

Sec. 1. (a) Subject to valid existing rights which exist prior to August 3, 1977, and except for those operations which existed on August 3, 1977, no surface coal mining operation may exist:

(1) on any land within the boundaries of units of the National Park System, the National Wildlife Refuge Systems, the National System of Trails, the National Wilderness Preservation System, the Wild and Scenic Rivers System, including study rivers designated under P.L.90-542, as amended (the Wild and Scenic Rivers Act), and National Recreation Areas designated by any act of the United States Congress;

(2) on any federal land within the boundaries of any national forest; however, surface coal mining operations are allowed on those lands if the United States Secretary of the Interior finds that there are no significant recreational, timber, economic, or other values which are incompatible with surface mining operations and surface operations and impacts are incident to an underground coal mine;

(3) which will adversely affect any publicly owned park or any place included in the National Register of Historic Places or the Indiana state register of historic sites and structures or natural landmarks included in the National Register unless approved jointly by the director and the federal, state, or local agency with jurisdiction over the park or the historic site;

(4) within one hundred (100) feet of the outside right-of-way line of any public road, except where mine access roads or haulage roads join that right-of-way line; however, the director may permit those roads to be relocated or the area affected to lie within one hundred (100) feet of that road, if, after public notice and an opportunity for a public hearing in the locality, a written finding is made that the interests of the public and the landowners affected thereby will be protected;

(5) within three hundred (300) feet from any occupied dwelling, unless waived by its owner, any public building, school, church, community, or institutional building, public park, or within one hundred (100) feet of a cemetery; or

(6) which will violate any local zoning ordinance.

(b) If valid rights exist or joint agency approval is to be obtained under subsection (a)(3), adverse impacts of mining shall be minimized.

(c) If the director determines that the public health or safety will be endangered, the phrase "valid existing rights" shall not apply to the extraction of coal by strip mining methods within the distances for occupied dwellings set forth in subsection (a)(5), and public roads set forth in subsection (a)(4), except where a public road is vacated or closed in accordance with law.

(d) The commission shall by rule establish a planning process enabling objective decisions based upon competent and scientifically sound data and information as to which, if any, land areas of Indiana are unsuitable for all or certain types of surface coal mining operations pursuant to the standards set forth in this section, but such designation shall not prevent the mineral exploration pursuant to this article of any area so designated. *As added by Acts 1980, P.L.101, SEC.3. Amended by Acts 1981, P.L.153, SEC.32; P.L.115-1986, SEC.18; P.L.104-1990, SEC.4; P.L.125-1991, SEC.38.*

ARTICLE 5. INTERSTATE AGREEMENTS

Chapter 4. Repealed

(Repealed by P.L.28-1990, SEC.40).

Chapter 6. Repealed

(Repealed by P.L.40-1989, SEC.42).

ARTICLE 6. ENVIRONMENTAL LEGAL ACTIONS

Chapter 1. Standing to Sue

13-6-1-1 Declaratory or equitable relief in name of state; notice; hearing; intervention; judicial review

Sec. 1. (a) The attorney general of the state of Indiana, or any state, city, town, county, or local agency or officer vested with the authority to seek judicial relief, any citizen of the state of Indiana, or any corporation, partnership, or association maintaining an office in the state of Indiana may maintain an action for declaratory and equitable relief in the name of the state of Indiana against any individual, partnership, copartnership, firm, company, corporation, association, joint stock company, trust, estate, state agency, or officer, city, town, county, or local governmental unit, agency, or official, or any other legal entity or their legal representative, agent, or assigns, for the protection of the environment of the state from significant pollution, impairment, or destruction. Any citizen, partnership, corporation, association, or public officer or agency, as a condition precedent to maintaining such action, shall give notice in writing by registered or certified mail to the department of natural resources and the department of environmental management or its successor agency in environmental affairs, and to the attorney general of the state, who shall promptly notify all state administrative agencies having jurisdiction over or control of the pollution, impairment, destruction, or protection of the environment for which relief is sought.

(b) No action shall be maintained under this chapter unless the administrative agency to whom such notice was given and having jurisdiction as set out in subsection (a) fails to investigate and conduct a hearing to determine whether or not the accused is a pollutor as defined by law or rule. The complainant shall be joined as a party. If the agency fails to hold a hearing and make a final determination within one hundred eighty (180) days after receipt of notice by the attorney general as provided in subsection (a), action may be maintained and such agency need not be joined as a party defendant.

(c) If the administrative agency holds a hearing and makes a final determination within one hundred eighty (180) days, an appeal from its action may be taken in the manner prescribed by law.

(d) In any administrative, licensing, or other such proceeding, and in any action for judicial review thereof which is made available by law, the attorney general of the state of Indiana, or any state, city, town, county, or local agency or officer vested with the authority to seek judicial relief, any citizen of the state of Indiana, or any corporation, partnership, or association maintaining an office in the state of Indiana shall be permitted to intervene as a party upon the filing of a verified pleading asserting that the proceeding or action for judicial review involves conduct, programs, or products which may have the effect of significantly impairing, polluting, or destroying the environment of the state.

(e) In any such administrative, licensing, or other such procedure, the agency shall consider the alleged significant impairment, pollution, or destruction of the environment of the state, and no conduct, program, or product shall be authorized, approved, or permitted to continue which does, or is reasonably likely to, have such effect so long as there is a feasible and prudent alternative consistent with the reasonable requirements of the public health, safety, and welfare.

(f) In any action for judicial review of any proceedings as described in subsection (c), the court shall, in addition to any other duties imposed upon it by law, grant review of claims

that the conduct, program, or product under review has, or is reasonably likely to impair, significantly pollute, or destroy the environment of the state. *(Formerly: Acts 1971, P.L.182, SEC.2). As amended by P.L.143-1985, SEC.70.*

13-6-1-2 Respondent's burden

Sec. 2. (a) In any action maintained under section 1 of this chapter, whenever the petitioner shall have made a prima facie showing that the conduct of the respondent has, or is reasonably likely to impair, pollute, or destroy the environment of the state, the respondent shall have the burden of establishing:

(1) where there is an applicable rule adopted by an agency of the state setting standards for pollution, impairment or destruction, or for antipollution devices, compliance with such rule which shall constitute a prima facie defense to petitioner's claim; or

(2) where there is no applicable rule, that there is no feasible and prudent alternative and that the conduct, program, or product at issue is consistent with and reasonably required for the promotion of the public health, safety, and welfare in light of the state's paramount concern for the protection of its environment from pollution, impairment, or destruction.

(b) Upon making such proof, said respondent shall have rebutted the prima facie showing, and the petitioner shall have the burden of going forward with the evidence. *(Formerly: Acts 1971, P.L.182, SEC.2). As amended by P.L.17-1985, SEC.15.*

13-6-1-3 Venue

Sec. 3. Such action shall be brought in a circuit or superior court in the county in which the significant pollution, impairment or destruction is alleged to have occurred. *(Formerly: Acts 1971, P.L.182, SEC.2).*

13-6-1-4 Master or referee; appointment

Sec. 4. The court may appoint a master or referee, who shall be a disinterested person and technically qualified, to take testimony and make a report to the court in any such action. The costs thereof may be apportioned to the parties if the interests of justice require. *(Formerly: Acts 1971, P.L.182, SEC.2).*

13-6-1-5 Temporary and permanent equitable relief

Sec. 5. The court may grant temporary and permanent equitable relief, or may impose such conditions upon the respondent as are required to protect the environment of the state from pollution, impairment and destruction. *(Formerly: Acts 1971, P.L.182, SEC.2).*

13-6-1-6 Failure to intervene; effect

Sec. 6. In any action where a petitioner or intervenor seeking judicial adjudication as provided by this chapter has failed to intervene in any administrative, licensing or other such proceeding, the court may remit such petitioner, or intervenor to such proceeding for amplification of the record therein, and may order the granting of intervention and the granting of review therein as provided in section 1 of this chapter: Provided, That where intervention was available in such administrative, licensing or other such proceedings, and where the petitioner or intervenor seeking judicial adjudication hereunder willfully and inexcusably refused intervention therein, the court may dismiss the action with prejudice to the petitioner or intervenor. *(Formerly: Acts 1971, P.L.182, SEC.2).*

Chapter 2. Reimbursement for Hazardous Materials Emergency Action

All legal rights of the affected party state established under this compact cease upon the effective date of revocation but any legal obligations of that party state arising prior to revocation continue until they are fulfilled. The chairperson of the Commission shall transmit written notice of a revocation of a party state's membership in the compact immediately following the vote of the Commission to the governor of the affected party state, all other governors of the party states and the Congress of the United States.

g. This compact becomes effective July 1, 1983, or at any date subsequent to July 1, 1983, upon enactment by at least three eligible states. However, Article IX, Section (b) shall not take effect until the Congress has by law consented to this compact. The Congress shall have an opportunity to withdraw such consent every five years. Failure of the Congress to affirmatively withdraw its consent has the effect of renewing consent for an additional five year period. The consent given to this compact by the Congress shall extend to any future admittance of new party states under section (b) and (c) of this article and to the power of the region to ban the shipment of waste from the region pursuant to Article III.

h. The withdrawal of a party state from this compact under section (e) of this article or the revocation of a state's membership in this compact under section (f) of this article does not affect the applicability of this compact to the remaining party states.

i. A state which has been designated by the Commission to be a host state has 90 days from receipt by the Governor of written notice of designation to withdraw from the compact without any right to receive refund of any funds already paid pursuant to this compact, and without any further payment. Withdrawal becomes effective immediately upon notice in writing of the withdrawal to the commission and to the governor of each party state. A designated host state which withdraws from the compact after 90 days and prior to fulfilling its obligations shall be assessed a sum the Commission determines to be necessary to cover the costs borne by the Commission and remaining party states as a result of that withdrawal. *As added by P.L.170-1983, SEC.1.*

13-5-9-9 Penalties

Sec. 9.

ARTICLE IX. PENALTIES

a. Each party state shall prescribe and enforce penalties against any person who is not an official of another state for violation of any provision of this compact.

b. Unless otherwise authorized by the Commission pursuant to Article III(h) after January 1, 1986 it is a violation of this compact:

1. For any person to deposit at a regional facility waste not generated within the region;

2. For any regional facility to accept waste not generated within the region;

3. For any person to export from the region waste which is generated within the region; or

4. For any person to dispose of waste at a facility other than a regional facility.

c. Each party state acknowledges that the receipt by a host state of waste packaged or transported in violation of applicable laws, rules and regulations may result in the imposition of sanctions by the host state which may include suspension or revocation of the violator's right of access to the facility in the host state.

d. Each party state has the right to seek legal recourse against any party state which acts in violation of this compact. *As added by P.L.170-1983, SEC.1.*

13-5-9-10 Severability and construction

Sec. 10.

ARTICLE X. SEVERABILITY AND CONSTRUCTION

The provisions of this compact shall be severable and if any phrase, clause, sentence or provision of this compact is declared by a court of competent jurisdiction to be contrary to the Constitution of any participating state or of the United States or the applicability thereof to any government, agency, person or circumstance is held invalid, the validity of the remainder of this compact and the applicability thereof to any government, agency, person or circumstance shall not be affected thereby. If any provision of this compact shall be held contrary to the Constitution of any state participating therein, the compact shall remain in full force and effect as to the state affected as to all severable matters. *As added by P.L.170-1983, SEC.1.*

13-5-9-11 Commission members; appointment; tenure

Sec. 11. (a) The governor shall appoint a person to serve as the commission member representing the state of Indiana. The commission member appointed by the governor shall serve a four (4) year term, at the pleasure of the governor.

(b) If the commission member representing the state of Indiana dies, resigns, or is removed from office before the expiration of his term of office, the governor shall appoint a new commission member to serve the remainder of the unexpired term.

(c) The governor may appoint an alternate to act on behalf of the commission member when the commission member is absent. *As added by P.L.170-1983, SEC.1.*

13-5-9-12 Commission members; per diems and expenses

Sec. 12. (a) A commission member or alternate appointed by the governor under section 11 of this chapter is entitled to the minimum salary per diem as provided in IC 4-10-11-2.1(b) while performing his duties under this chapter. A commission member or alternate is also entitled to reimbursement for traveling expenses and other expenses actually incurred in connection with his duties, as provided in the state travel policies and procedures established by the department of administration and approved by the state budget agency.

(b) Per diems and expenses under this section shall be paid from moneys appropriated to the department of environmental management. *As added by P.L.170-1983, SEC.1. Amended by P.L.143-1985, SEC.68.*

13-5-9-13 Adoption of rules

Sec. 13. The solid waste management board shall, in the manner prescribed by IC 4-22-2, adopt the rules necessary to implement this chapter. *As added by P.L.170-1983, SEC.1. Amended by P.L. 143-1985, SEC.69.*

13-5-9-14 Violations; offense; penalties

Sec. 14. After January 1, 1986, a person who knowingly or intentionally commits any of the violations listed in section 9(b) of this chapter commits a Class D felony. However, notwithstanding IC 35-50-2-7(a), a person who is convicted of a Class D felony under this section may, in addition to the term of imprisonment established under IC 35-50-2-7(a), be fined not more than fifty thousand dollars ($50,000) for each day of violation. *As added by P.L.170-1983, SEC.1.*

ARTICLE 6. ENVIRONMENTAL LEGAL ACTIONS

APPENDIX

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units of a different design or type, or to upgrading, modernizing, or renovating production unit equipment to reduce the need for toxic materials.

(D) Operational improvement, which refers to such techniques as improved housekeeping practices, system adjustments, product and process inspections, and the use of production unit control equipment or methods.

(E) Inprocess recycling, which refers to recycling, reuse, or extended use of toxic materials by using equipment or methods that become an integral part of the production unit of concern, including filtration and other closed looped methods.

(3) Assessment of the technical and economic feasibility of each pollution prevention approach set forth in subdivision (2).

As added by P.L.105-1990, SEC.3.

13-9-5-3 Technical assistance manual; additional requirements

Sec. 3. (a) The manual developed by the institute under this chapter must encourage a business that is preparing a multimedia pollution prevention plan to consider the feasibility of all of the following options:

(1) Input change.

(2) Product reformulation.

(3) Production process change.

(4) Operational improvement.

(5) Inprocess recycling.

(b) The manual developed under this chapter may not include information on:

(1) the use of pollution control approaches that address waste after the waste has been created; or

(2) the mitigation of toxic material hazards by measures other than by reduced use of toxic materials.

(c) The manual developed under this chapter must state that inprocess recycling is not a means of preventing pollution unless the inprocess recycling is a closed and integral part of the production process or operation. *As added by P.L.105-1990, SEC.3.*

Chapter 6. State Report

13-9-6-1 Preparation and submission

Sec. 1. Each year the commissioner shall prepare and submit to the governor and the general assembly a report regarding the pollution prevention information gathered under this article, including a description of the operations and activities of the programs under this article and recommendations the commissioner may have for legislative action. *As added by P.L.105-1990, SEC.3.*

13-9-6-2 Contents

Sec. 2. The report required under this chapter must include at least the following:

(1) A quantitative assessment of statewide pollution prevention progress among all types of industries.

(2) An identification of regulations and government policies that are inhibiting pollution prevention and opportunities in existing regulatory programs to promote and assist in pollution prevention, including reductions in the use of toxins in production and commerce.

(3) An assessment of how programs under this article have promoted and assisted pollution prevention and the costs and benefits to government and industry of those programs.

(4) A statement concerning the identification of opportunities and development of priorities for research and development in pollution prevention techniques, economic analyses, and management techniques useful in supporting pollution prevention. The state report may not include information considered by a business to be a trade secret of that business.

(5) Recommendations concerning incentives and policies needed to encourage investment in research and development in pollution prevention and in making greater use of programs established under this article.

As added by P.L.105-1990, SEC.3.

13-9-6-3 Draft version available for comment by public or liaison advisory panels

Sec. 3. Before the commissioner submits a report to the governor and the general assembly under section 1 of this chapter, the commissioner shall make a draft version of the report available for at least forty-five (45) days for comment by the public and the liaison advisory panels established under IC 13-9-2. The final report shall respond to public comments submitted during the comment period. *As added by P.L.105-1990, SEC.3.*

Chapter 7. Program Implementation

13-9-7-1 Voluntary participation by businesses

Sec. 1. Programs developed under this article are to be implemented based on voluntary participation by businesses. Businesses may not be required to comply with any program developed under this article. *As added by P.L.105-1990, SEC.3.*

13-9-7-2 Documents, manuals, and policies not binding on businesses

Sec. 2. Guidance documents, technical assistance manuals, and policies developed or used in implementing programs under this article are not binding on participating businesses unless rules are adopted by the division, under IC 4-22-2, that incorporate these documents, manuals, or policies into the implementation of a program other than a pollution prevention program, such as a solid waste management or an air pollution control program. *As added by P.L.105-1990, SEC.3.*

13-9-7-3 Pollution prevention techniques encouraged

Sec. 3. Programs implemented by the division shall encourage pollution prevention and not discourage the use of environmentally sound recycling or treatment techniques for pollution that has not been prevented. *As added by P.L.105-1990, SEC.3.*

ARTICLE 9.5. SOLID WASTE MANAGEMENT

Chapter 1. Definitions

13-9.5-1-1 Definitions

Sec. 1. The definitions in this chapter apply throughout this article. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-2 Definitions; applicability

Sec. 2. The definitions in IC 36-1-2 apply throughout this article. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.4.*

13-9.5-1-3 "Board"

Sec. 3. "Board" refers to the board of directors of a solid waste management district established under IC 13-9.5-2. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-4 "Commissioner"

Sec. 4. "Commissioner" refers to the commissioner of the department of environmental management appointed under IC 13-7-2-12. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-5 "Composting"

Sec. 5. "Composting" means an aerobic degradation process by which plant and other organic wastes decompose under controlled conditions to produce a usable product. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-6 "Cost"

Sec. 6. "Cost", as applied to a facility or any part of a facility, includes the following:

(1) The cost of construction, modification, decommissioning, disposal, or acquisition of the facility or any part of the facility.

(2) Financing charges.

(3) Interest before and during construction and for a reasonable period after the construction as determined by the board.

(4) The cost of funding reserves to secure the payment of principal and interest on bonds issued by the district.

(5) The cost of funding an operation and maintenance reserve fund.

(6) The cost of funding a major repair or replacement fund.

(7) Legal and underwriting expenses.

(8) Municipal bond insurance premiums.

(9) The cost of plans, specifications, surveys, and estimates of costs and revenues.

(10) Other expenses necessary or incidental to determining the feasibility or practicability of constructing the facility.

(11) Administrative expense.

(12) Other expenses necessary or incidental to the construction, modification, or acquisition of the facility, the financing of the construction, modification, or acquisition, and the placing of the facility in operation.

As added by P.L.10-1990, SEC.17.

13-9.5-1-7 "County solid waste management district"

Sec. 7. "County solid waste management district" or "county district" refers to a solid waste management district established under IC 13-9.5-2 that consists of only one (1) county. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-8 "Department"

Sec. 8. "Department" refers to the department of environmental management established under IC 13-7-2. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-9 "Developer"

Sec. 9. "Developer" means a person that:

(1) proposes to enter into or has entered into a financing agreement with the district for financing a facility; and

(2) proposes to enter into or has entered into a separate agreement with some other person for the use and operation of the financed facility.

As added by P.L.10-1990, SEC.17.

13-9.5-1-10 "District"

Sec. 10. "District" refers to a county district or a joint district. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-11 "District plan"

Sec. 11. "District plan" refers to a district solid waste management plan adopted under IC 13-9.5-4. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-12 "Environmental policy commission"

Sec. 12. "Environmental policy commission" refers to the environmental policy commission established under IC 2-5-4. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-13 "Facility"

Sec. 13. "Facility" means any facility, plant, works, system, building, structure, improvement, machinery, equipment, fixture, or other real or personal property of any nature that is to be used, occupied, or employed for the collection, storage, separation, processing, recovery, treatment, marketing, transfer, or disposal of solid waste. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-14 "Final disposal facility"

Sec. 14. (a) "Final disposal facility" means:

(1) a landfill;

(2) an incinerator; or

(3) a waste-to-energy facility.

(b) The term does not include a transfer station. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-15 "Financing agreement"

Sec. 15. "Financing agreement" includes an agreement between a district and a developer, between a developer and a user, or among a district, developer, and user concerning:

(1) payments to the district under the agreement; and

(2) any of the following:

(A) The financing of facilities.

(B) The title to facilities.

(C) The possession of facilities.

As added by P.L.10-1990, SEC.17.

13-9.5-1-16 Repealed

(Repealed by P.L.130-1991, SEC.38.)

13-9.5-1-16.5 "Household hazardous waste"

Sec. 16.5. (a) "Household hazardous waste" means solid waste that:

(1) is generated by households; and

(2) consists of or contains materials that are ignitable, corrosive, reactive, or toxic.

(b) For the purposes of this section, a material is:

(1) "ignitable" if the material has the quality of ignitability (as defined in 40 CFR 261.21);

(2) "corrosive" if the material has the quality of corrosivity (as defined in 40 CFR 261.22);

(3) "reactive" if the material has the quality of reactivity (as defined in 40 CFR 261.23); and

(4) "toxic" if the material has the quality of EP toxicity (as defined in 40 CFR 261.24).

As added by P.L.130-1991, SEC.19.

13-9.5-1-17 "Incinerator"

Sec. 17. "Incinerator" has the meaning set forth in IC 13-7-1-13.5. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-18 "Joint solid waste management district"

Sec. 18. "Joint solid waste management district" or "joint district" refers to a solid waste management district established under IC 13-9.5-2 that consists of two (2) or more counties. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-19 "Landfill"

Sec. 19. (a) "Landfill" means a solid waste management disposal facility at which solid waste is deposited on or in the ground as an intended place of final location.

(b) The term does not include the following:

(1) A site that is devoted solely to receiving one (1) or more of the following:

(A) Fill dirt.

(B) Vegetative matter subject to disposal as a result of landscaping, yard maintenance, land clearing, or any combination of activities referred to in this clause.

(2) A facility receiving waste that is regulated under IC 13-7-8.5.

As added by P.L.10-1990, SEC.17.

13-9.5-1-20 "Net revenues"

Sec. 20. "Net revenues" means the amount of revenues received by the district from the operation and ownership of facilities less the reasonable expenses of the operation, repair, and maintenance of the facilities. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-21 "Person"

Sec. 21. "Person" has the meaning set forth in IC 13-7-1-17. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-22 "Processing"

Sec. 22. "Processing" means an operation for the purpose of modifying the characteristics or properties of solid waste to facilitate the transportation of solid waste, the disposal of solid waste, or the recovery of solid waste for reuse or sale. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-23 "Public notice"

Sec. 23. "Public notice" means the following:

(1) For a county or a county district, a notice published by the board in accordance with IC 5-3-1, following procedures applicable to a county.

(2) For a joint district, a notice published by the board in each county in the district in accordance with IC 5-3-1, following procedures applicable to a county.

As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.20.

13-9.5-1-24 "Recycling"

Sec. 24. "Recycling" means a process by which materials that would otherwise become solid waste are collected, separated or processed, and converted into materials or products for reuse or sale. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-25 "Revenues"

Sec. 25. (a) "Revenues" means the amounts received by the district from the operation or ownership of facilities.

(b) The term does not include amounts derived from the levy of taxes or from fees under IC 13-9.5-7. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-26 "Solid waste"

Sec. 26. "Solid waste" has the meaning set forth in IC 13-7-1-22, except that the term does not include the following:

(1) Any waste that is regulated under IC 13-7-8.5.

(2) Any infectious waste (as defined in IC 16-1-9.7-3) that is disposed of at an incinerator permitted under rules adopted by the solid waste management board to dispose of infectious waste.

As added by P.L.10-1990, SEC.17.

13-9.5-1-27 "Solid waste hauler"

Sec. 27. "Solid waste hauler" or "hauler" means a person who operates a vehicle in which solid waste is transported to:

(1) a transfer station for further transport to a final disposal facility; or

(2) a final disposal facility.

As added by P.L.10-1990, SEC.17.

13-9.5-1-28 "Solid waste management"

Sec. 28. "Solid waste management" has the meaning set forth in IC 13-7-1-23. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-29 "Solid waste management board"

Sec. 29. "Solid waste management board" refers to the solid waste management board created under IC 13-1-12. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-30 "Source reduction"

Sec. 30. "Source reduction" means a reduction in the amount of solid waste generated that is achieved through actions affecting the source of the solid waste. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-31 "State plan"

Sec. 31. "State plan" refers to the state solid waste management plan adopted under IC 13-9.5-3. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-32 "Transfer station"

Sec. 32. "Transfer station" means a facility to which solid waste is transferred from a vehicle or a container to another vehicle or container for transportation. The term does not include the following:

(1) A facility where the solid waste has been generated by the facility.

(2) A recycling facility.

As added by P.L.10-1990, SEC.17.

13-9.5-1-33 "User"

Sec. 33. "User" means a person that has entered into a financing agreement with the district, or with a developer, in contemplation of the user's use and operation of the facilities referred to in the agreement. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-34 "Waste-to-energy facility"

Sec. 34. "Waste-to-energy facility" means a facility at which solid waste is converted into energy or another useful product by incineration. *As added by P.L.10-1990, SEC.17.*

13-9.5-1-35 "White goods"

Sec. 35. "White goods" means discarded refrigerators, ranges, water heaters, and other similar domestic and commercial large appliances. *As added by P.L.130-1991, SEC.21.*

Chapter 2. Solid Waste Management Districts

13-9.5-2-1 Ordinance establishing; failure to adopt; agreement

Sec. 1. (a) On or before July 1, 1991, each county must, by ordinance of the county executive:

(1) join with one (1) or more other counties in establishing a joint solid waste management district that includes the entire area of all the acting counties; or

(2) designate itself as a county solid waste management district.

(b) An ordinance adopted under subsection (a)(1) must include the approval of an agreement governing the operation of the joint district.

(c) If a county fails to comply with subsection (a) before July 2, 1991, the commissioner shall designate the county as a solid waste management district. *As added by P.L.10-1990, SEC.17.*

13-9.5-2-2 Inclusion of incorporated and unincorporated area

Sec. 2. All of the incorporated and unincorporated territory of a county must be included in the designated county solid waste management district or the joint solid waste management district to which the county belongs. *As added by P.L.10-1990, SEC.17.*

13-9.5-2-3 Agreement; copy to commissioner

Sec. 3. Within thirty (30) days after adopting an ordinance establishing a joint district and approving an agreement governing the operation of the joint district, a county shall provide the commissioner with a copy of the agreement. *As added by P.L.10-1990, SEC.17.*

13-9.5-2-4 Board of directors; appointment

Sec. 4. After a county has been designated as a county district or has joined with one (1) or more counties in a joint district, a board of directors shall be appointed. *As added by P.L.10-1990, SEC.17.*

13-9.5-2-5 Board of county district; membership

Sec. 5. (a) Except as provided in subsections (b) through (d), the board of a county district consists of the following members:

(1) Two (2) members appointed by the county executive from its membership.

(2) One (1) member appointed by the county fiscal body from the membership of the fiscal body.

(3) One (1) member:

(A) who is the executive of the municipality having the largest population in the county, if that municipality is a city; or

(B) if a town is the municipality having the largest population in the county, who is appointed from the membership of the fiscal body of that town.

(4) One (1) member of the legislative body of the municipality with the largest population in the county appointed by the legislative body of that municipality.

(5) One (1) member:

(A) who is the executive of a city in the county that is not the municipality having the largest population in the county; or

(B) who is a member of the fiscal body of a town that is not the municipality having the largest population in the county;

and who is appointed by the executive of that county to represent the municipalities in the county other than the municipality having the largest population.

(6) One (1) additional member appointed by the county executive from its membership.

(b) If a county having a population of more than four hundred thousand (400,000) but less than seven hundred thousand (700,000) is designated as a county district, the executives of the three (3) cities in the county having the largest populations shall each serve as a member of the board. If a county having a population of more than two hundred thousand (200,000) but less than three hundred thousand (300,000) is designated as a county district, the executives of the two (2) cities in the county having the largest populations shall each serve as a member of the board. If a county having a population of more than two hundred thousand (200,000) but less than three hundred thousand (300,000) is designated as a county district, the board of that county district must include the following:

(1) One (1) member of the city legislative body of the city having the second largest population in the county, appointed by the president of the city legislative body.

(2) One (1) member of the town council of a town located in the county, appointed by the judge of the circuit court in the county.

(c) If a county having a consolidated city is designated a county district, the board of public works established under IC 36-3-5-6 constitutes the board of directors of the county district.

(d) If a county designated as a county district has a population of more than four hundred thousand (400,000) but less than seven hundred thousand (700,000), the board of that district consists of the following members:

(1) One (1) member appointed by the county executive from its membership.

(2) Two (2) members appointed from the county fiscal body appointed from its membership.

(3) The executive of each second or third class city.

(4) One (1) member of the fiscal body of each town appointed by the fiscal body.

(5) One (1) member of the legislative body of the municipality with the largest population in the county appointed by the legislative body of that municipality.

(6) If a local government unit in the county has an operating final disposal facility located within the unit's jurisdiction, one (1)

member of the unit's board of public works appointed by the board of public works.

As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.22; P.L.25-1991, SEC.10; P.L.12-1992, SEC.76.

13-9.5-2-6 Board of joint district; membership (first version)

Note: This version of section amended by P.L.12-1992, SEC.77. See also following version of this section, amended by P.L.33-1992, SEC.5.

Sec. 6. (a) Except as provided in subsections (b) through (d), the board of a joint district consists of the following:

(1) One (1) member of the county executive of each participating county.

(2) One (1) member of the county fiscal body of each participating county.

(3) One (1) member:

(A) who is the executive of the municipality having the largest population in the county, if that municipality is a city; or

(B) if a town is the municipality having the largest population, in the county, who is appointed from the membership of the fiscal body of that town.

(4) One (1) member of the legislative body of the municipality having the largest population in each participating county, appointed by the legislative body of that municipality.

(5) One (1) or more members who are the executives of cities under subsection (b), if applicable.

(6) Additional members appointed by the executive of each participating county from its membership, as permitted under subsection (c).

(7) One (1) additional member appointed by the executive of the participating county having the largest population from its membership if the appointments made under subdivisions (1) through (6) result in an even number of members.

(b) If a county having a population of more than four hundred thousand (400,000) but less than seven hundred thousand (700,000), has joined in a joint district, the executive of the three (3) cities in the county having the largest populations shall each serve as a member of the board. If a county having a population of more than two hundred thousand (200,000) but less than three hundred thousand (300,000) has joined in a joint district, the executive of the two (2) cities in the county having the largest populations shall each serve as a member of the board.

(c) An agreement between two (2) or more counties establishing a joint district may allow the executive of each county to appoint a certain number of additional members from its membership, based upon the proportion of each county's population to the population of the entire district.

(d) An agreement among three (3) or more counties establishing a joint district may provide that the membership of the board and the terms of office of members of the board will be determined by the terms of an agreement entered into by the executive of each county governing the operation of the district. All members of a board appointed under this subsection must be elected officials of a county or a municipality.

(e) The board of a joint district established under subsection (d) after March 1, 1991:

(1) must include representation from the largest municipality in each county included in the joint district as recommended by the executive of the largest municipality and approved by the legislative body of the largest municipality; and

(2) may include representation from other municipalities in each county included in the joint district as recommended by the executive of a municipality and approved by the legislative body of the municipality.

As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.23; P.L.12-1992, SEC.77.

Note: See also following version of this section, amended by P.L.33-1992, SEC.5.

13-9.5-2-6 Board of joint district; membership (second version)

Note: This version of section amended by P.L.33-1992, SEC.5. See also preceding version of this section, amended by P.L.12-1992, SEC.77.

Sec. 6. (a) Except as provided in subsections (b) through (d), the board of a joint district consists of the following:

(1) One (1) member of the county executive of each participating county.

(2) One (1) member of the county fiscal body of each participating county.

(3) One (1) member:

(A) who is the executive of the municipality having the largest population in the county, if that municipality is a city; or

(B) if a town is the municipality having the largest population in the county, who is appointed from the membership of the fiscal body of that town.

(4) One (1) member of the legislative body of the municipality having the largest population in each participating county, appointed by the legislative body of that municipality.

(5) One (1) or more members who are the executives of second class cities under subsection (b), if applicable.

(6) Additional members appointed by the executive of each participating county from its membership, as permitted under subsection (c).

(7) One (1) additional member appointed by the executive of the participating county having the largest population from its membership if the appointments made under subdivisions (1) through (6) result in an even number of members.

(b) If a county having at least two (2) second class cities has joined in a joint district, the executive of each second class city shall serve as a member of the board.

(c) An agreement between two (2) or more counties establishing a joint district may allow the executive of each county to appoint a certain number of additional members from its membership, based upon the proportion of each county's population to the population of the entire district.

(d) An agreement among three (3) or more counties establishing a joint district may provide that the membership of the board and the terms of office of members of the board will be determined by the terms of an agreement entered into by the executive of each county governing the operation of the district. All members of a board appointed under this subsection must be elected officials of a county or a municipality.

(e) The board of a joint district established under subsection (d) after March 1, 1991:

(1) must include representation from the largest municipality in each county included in the joint district as recommended by the executive of the largest municipality and approved by the legislative body of the largest municipality; and

(2) may include representation from other municipalities in each county included in the joint district as recommended by the executive of a municipality and approved by the legislative body of the municipality.

(f) The board of directors of a joint district may allow a member who is appointed from:

(1) the county executive;

(2) a county fiscal body; or

(3) a municipal legislative body;

to have the body on which the member serves designate an alternate member from that body to participate and exercise the right to vote with the board if the member is unable to attend a meeting. *As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.23; P.L.33-1992, SEC.5.*

Note: See also preceding version of this section, amended by P.L.12-1992, SEC.77.

13-9.5-2-7 Board of county district; alternates; executive committee; powers

Sec. 7. (a) In a joint district, the board appointed under section 6 of this chapter may elect from the board's membership an executive committee having an odd number of members.

(b) An executive committee elected under subsection (a) for a joint district has only the powers invested in the committee by resolution of the board. An executive committee may exercise any powers of the board under IC 13-9.5 that are delegated to the executive committee by resolution of the board.

(c) The board of directors of the joint district may appoint one (1) or more alternates from among the membership of the board of directors to:

(1) participate; and

(2) exercise the power to vote;

with the executive committee if a member of the executive committee is absent.

(d) A meeting of an executive committee may serve as the regularly scheduled monthly meeting of a board as required under IC 13-9.5-4-2. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.6.*

13-9.5-2-8 Board of directors; term of office

Sec. 8. (a) This section does not apply to the members of a board of public works that constitutes the board of a county district under section 5(c) of this chapter.

(b) The term of office of a member of the board of directors of a district who is appointed from the membership of an executive, legislative, or fiscal body under this chapter is coextensive with the member's term of office on that body. The term of office of other appointed members of the board is two (2) years.

(c) All board members serve at the pleasure of the appointing authority. *As added by P.L.10-1990, SEC.17.*

13-9.5-2-9 Board of directors; selection of chairperson, vice chairperson, and controller

Sec. 9. (a) This section does not apply to a board of public works that constitutes the board of a county district under section 5(c) of this chapter.

(b) The board shall select:

(1) a chairperson and vice chairperson from the board's membership; and

(2) a controller who is not a member of the board.

(c) If a controller selected by a board under this section is the fiscal officer of a county or municipality, the duties of the controller under a statute or an ordinance are in addition to the duties the controller has while serving as the fiscal officer of the county or municipality. *As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.24; P.L.33-1992, SEC.7.*

13-9.5-2-9.3 Powers and duties of controller

Sec. 9.3. (a) A controller selected under section 9 of this chapter shall do the following:

(1) Be the official custodian of all district funds.

(2) [illegible]sponsible to the board for the fiscal management of the district.

(3) Be responsible for the proper safeguarding and accounting of the district's funds.

(4) Issue warrants approved by the board after a properly itemized and verified claim has been presented to the board on a claim docket.

(5) Make financial reports of district funds and present the reports to the board for the board's approval.

(6) Prepare the district's annual budget.

(7) Perform any other duties:

(A) prescribed by the board; and

(B) consistent with this chapter.

(b) A controller selected under section 9 of this chapter:

(1) does not exercise any sovereign authority of the state; and

(2) does not hold a lucrative office for purposes of Article 2, Section 9, of the Constitution of the State of Indiana.

As added by P.L.33-1992, SEC.8.

13-9.5-2-10 Solid waste management advisory committee; appointment; term; powers; reports

Sec. 10. (a) The board of directors of each district shall appoint and convene a solid waste management advisory committee of citizens not later than thirty (30) days after the board has been established. The committee shall include representatives of the solid waste management industry operating in the district and representatives of the environmental community and other citizens who are knowledgeable about and interested in environmental issues and who are not employed directly or indirectly by the solid waste management industry. At least fifty percent (50%) of the members of the committee must be made up of the representatives of the environmental community and other citizens. All members of the committee must be residents of the district. In the resolution establishing an advisory committee, the board shall specify the terms of the members and the purposes of the committee. Each advisory committee shall do the following:

(1) Study the subjects and problems specified by the board and recommend to the board additional problems in need of study and discussion.

(2) If invited by the board to do so, participate, with[illegible] to vote, in the deliberati[illegible]

[illegible] only to the b[illegible] must:

(1) accompany a final district plan when the plan is submitted to the commissioner under IC 13-9.5-4; and

(2) be made available to members of the public.

(c) A committee may choose to study and report on matters that are not specified by the board if the committee determines a study is warranted. *As added by P.L.10-1990, SEC.17. Amended by P.L.25-1991, SEC.11.*

13-9.5-2-11 Powers of districts

Note: This version of section effective until 2-28-92. See also following version of this section, effective 2-28-92.

Sec. 11. (a) The powers of a district include the following:

(1) The power to develop and implement a district solid waste management plan under IC 13-9.5-4.

(2) The power to impose district fees on the final disposal of solid waste within the district under IC 1[illegible]5-7.

(3) The power to receive and disburse funds.

(4) The power to sue and be sued.

(5) The power to borrow money from the district planning revolving loan fund under IC 13-9.5-10.

(6) The power to plan, design, construct, finance, manage, own, lease, operate, and maintain facilities for solid waste management.

(7) The power to enter with any person into a contract or agreement that is necessary or incidental to the management of solid waste. Contracts or agreements that may be entered into under this subdivision include those for:

(A) the design, construction, operation, financing, ownership, or maintenance of facilities by the district or any other person;

(B) the managing or disposal of solid waste; or

(C) the sale or other disposition of materials or products generated by a facility.

Notwithstanding any other statute, the maximum term of a contract or agreement described in this subdivision may not exceed forty (40) years.

(8) The power to enter into agreements for the leasing of facilities in accordance with IC 36-1-10 or IC 36-9-30.

(9) The power to purchase, lease, or otherwise acquire real or personal property for the management or disposal of solid waste.

(10) The power to sell or lease any facility or part of a facility to any person.

(11) The power to make and contract for plans, surveys, studies, and investigations necessary for the management or disposal of solid waste.

(12) The power to enter upon property to make surveys, soundings, borings, and examinations.

(13) The power to accept gifts, grants, or loans of money, other property, or services from any source, public or private, and to comply with the terms of the gift, grant, or loan.

(14) The power to levy a tax within the district to pay costs of operation in connection with solid waste management, subject to regular budget and tax levy procedures.

(15) The power to borrow in anticipation of taxes.

(16) The power to hire the personnel necessary for the management or disposal of solid waste in accordance with an approved budget and to contract for professional services.

(17) The power to otherwise do all things necessary for the reduction, management, and disposal of solid waste and the recovery of waste products from the solid waste stream.

(18) The power to adopt resolutions that have the force of law.

(19) The power to do the following:

(A) Implement a household hazardous waste collection and disposal project.

(B) Apply for a household hazardous waste collection and disposal project grant under IC 13-7-33 and carry out all commitments contained in a grant application.

(b) The powers of a district do not include the following:

(1) The power of eminent domain.

(2) The power to exclusively control the collection or disposal of solid waste within the district.

(c) Notwithstanding subsection (b)(2), if one (1) or more of the governmental entities in a district, at the time of the formation of the district, is a party to a contract providing that the persons contracted with have the exclusive right to collect or dispose of solid waste within the jurisdiction of the governmental entity, the district may enter into an extension of that contract. *As added by P.L.10-1990, SEC.17. Amended by P.L.131-1991, SEC.4; P.L.1-1992, SEC.83.*

Note: See also following version of this section, effective 2-28-92.

13-9.5-2-11 Powers of districts (later effective date)

Note: This version of section effective 2-28-92. See also preceding version of this section, effective until 2-28-92.

Sec. 11. (a) The powers of a district include the following:

(1) The power to develop and implement a district solid waste management plan under IC 13-9.5-4.

(2) The power to impose district fees on the final disposal of solid waste within the district under IC 13-9.5-7.

(3) The power to receive and disburse funds.

(4) The power to sue and be sued.

(5) The power to borrow money from the district planning revolving loan fund under IC 13-9.5-10.

(6) The power to plan, design, construct, finance, manage, own, lease, operate, and maintain facilities for solid waste management.

(7) The power to enter with any person into a contract or agreement that is necessary or incidental to the management of solid waste. Contracts or agreements that may be entered into under this subdivision include those for:

(A) the design, construction, operation, financing, ownership, or maintenance of facilities by the district or any other person;

(B) the managing or disposal of solid waste; or

(C) the sale or other disposition of materials or products generated by a facility.

Notwithstanding any other statute, the maximum term of a contract or agreement described in this subdivision may not exceed forty (40) years.

(8) The power to enter into agreements for the leasing of facilities in accordance with IC 36-1-10 or IC 36-9-30.

(9) The power to purchase, lease, or otherwise acquire real or personal property for the management or disposal of solid waste.

(10) The power to sell or lease any facility or part of a facility to any person.

(11) The power to make and contract for plans, surveys, studies, and investigations necessary for the management or disposal of solid waste.

(12) The power to enter upon property to make surveys, soundings, borings, and examinations.

(13) The power to accept gifts, grants, or loans of money, other property, or services from any source, public or private, and to comply with the terms of the gift, grant, or loan.

(14) The power to levy a tax within the district to pay costs of operation in connection with solid waste management, subject to regular budget and tax levy procedures.

(15) The power to borrow in anticipation of taxes.

(16) The power to hire the personnel necessary for the management or disposal of solid waste in accordance with an approved budget and to contract for professional services.

(17) The power to otherwise do all things necessary for the reduction, management, and disposal of solid waste and the recovery of waste products from the solid waste stream.

(18) The power to adopt resolutions that have the force of law.

(19) The power to do the following:

(A) Implement a household hazardous waste collection and disposal project.

(B) Apply for a household hazardous waste collection and disposal project grant under IC 13-7-33 and carry out all commitments contained in a grant application.

(20) The power to enter into an interlocal cooperation agreement under IC 36-1-7 to obtain:

(A) fiscal;

(B) administrative;

(C) managerial; or

(D) operational;

services from a county or municipality.

(21) The power to compensate advisory committee members for attending meetings at a rate determined by the board.

(22) The power to reimburse board and advisory committee members for travel and related expenses at a rate determined by the board.

(23) In a joint district, the power to pay a fee from district funds to the counties in the district in which a final disposal facility is located.

(24) The power to make grants or loans of:

(A) money;

(B) property; or

(C) services;

to public or private recycling programs.

(25) In a district financed entirely by revenues, other than property tax levies, the power to adopt an annual budget without obtaining the approval of a state agency.

(b) The powers of a district do not include the following:

(1) The power of eminent domain.

(2) The power to exclusively control the collection or disposal of solid waste within the district.

(c) Notwithstanding subsection (b)(2), if one (1) or more of the governmental entities in a district, at the time of the formation of the district, is a party to a contract providing that the persons contracted with have the exclusive right to collect or dispose of solid waste within the jurisdiction of the governmental entity, the district may enter into an extension of that contract. *As added by P.L.10-1990, SEC.17. Amended by P.L.131-1991, SEC.4; P.L.1-1992, SEC.83; P.L.33-1992, SEC.9.*

Note: See also preceding version of this section, effective until 2-28-92.

13-9.5-2-11.3 Continuing education; expenses

Sec. 11.3. (a) If a board determines that it is desirable or necessary for employees or members of the board or advisory committee to attend a conference, seminar, or training session that concerns solid waste management or related issues, the board may pay:

(1) applicable registration fees; and

(2) all actual expenses;

of the employees or members who attend the conference, seminar, or training session.

(b) A board may appropriate funds necessary to provide membership for the district in state and national:

(1) civic;

(2) educational;

(3) professional; or

(4) governmental;

organizations that are concerned with the betterment and improvement of solid waste management planning and practices. *As added by P.L.33-1992, SEC.10.*

13-9.5-2-11.7 Grants and loans to districts

Sec. 11.7. The executive of a county or municipality located in a district may, with the approval of the fiscal body of the county or municipality:

(1) grant or loan public funds to the district; and

(2) establish procedures:

(A) for awarding grants; and

(B) for the repayment of loans.

As added by P.L.33-1992, SEC.11.

13-9.5-2-12 Delegation of board's authority; resolution

Sec. 12. (a) The board of a district may delegate any of the board's authority to any board or legislative body of a municipality by resolution. However:

(1) an exercise by a municipality of the taxing power of the district must be ratified by the board of the district; and

(2) if the board of a municipality has been delegated authority under this subsection, the legislative body of the municipality must approve an action of the board of the municipality that involves:

(A) an exercise of the taxing power of the district;

(B) the issuance of bonds under this article; or

(C) the setting of fees, rates, and charges under this article.

(b) The board may delegate authority to the board's officers to carry out the directions of the board.

(c) A resolution delegating powers of the board under this section must contain reasonable [illegible] and parameters within which the delegated powers may be exercised. *As added by P.L.10-1990, SEC.17.*

13-9.5-2-13 Exemptions

Sec. 13. Notwithstanding IC 13-9.5-2, IC 13-9.5-4, and IC 13-9.5-7, unless the legislative body of a county having a consolidated city elects by ordinance to participate in the rules, ordinances, and governmental structures enacted or created under this article, the management of solid waste activities and the collection of fees on the disposal of solid waste in a final disposal facility located in that county are exempt until December 2, 2008, from regulation or control under this article. *As added by P.L.10-1990, SEC.17.*

Chapter 3. State Solid Waste Management Plan

13-9.5-3-1 Submission of draft plan

Sec. 1. Th[illegible]ment shall submit to the environmental policy commission a draft version of a state solid waste management plan. The environmental policy commission shall:

(1) make revisions that are necessary to meet the requirements of section 3 of this chapter; and

(2) make other revisions that are not inconsistent with this chapter.

As added by P.L.10-1990, SEC.17.

13-9.5-3-2 Final plan; adoption

Sec. 2. The commissioner shall adopt the state plan in final form and provide for the plan's implementation by rules adopted under IC 4-22-2. *As added by P.L.10-1990, SEC.17.*

13-9.5-3-3 Contents

Sec. 3. The state plan must provide for solid waste management in Indiana for the period of twenty (20) years following the adoption of the state plan. The state plan must include the following, in order of priority:

(1) The establishment of voluntary statewide goals for source reduction.

(2) The establishment of criteria for alternatives to final disposal, including recycling, composting, and the availability of markets.

(3) The establishment of general criteria for the siting, construction, operation, closing, and monitoring of final disposal facilities.

(4) Criteria and other elements to be considered in the adoption of district solid waste management plans.

As added by P.L.10-1990, SEC.17.

13-9.5-3-4 Reviews; revisions

Sec. 4. After the state plan is adopted, the environmental policy commission shall review the plan every five (5) years, utilizing the procedures set forth in section 1 of this chapter. Revisions of the state plan must be developed with the advice of the solid waste planning advisory council established by IC 13-9.5-3.5 and implemented utilizing the procedures set forth in section 2 of this chapter. *As added by P.L.10-1990, SEC.17. Amended by P.L.1-1991, SEC.111; P.L.130-1991, SEC.25.*

Chapter 3.5. Solid Waste Planning Advisory Council

13-9.5-3.5-1 "Council" defined

Sec. 1. As used in this chapter, "council" refers to the solid waste planning advisory council established by this chapter. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-2 Establishment of council; powers of council

Sec. 2. (a) The solid waste planning advisory council is established.

(b) The council shall advise the department and the environmental policy commission in the implementation and revision of the state solid waste management plan required by IC 13-9.5-3. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-3 Membership of council

Sec. 3. The council consists of thirteen (13) members designated and appointed as follows:

(1) The commissioner of the department or the commissioner's designee.

(2) The lieutenant governor or the lieutenant governor's designee.

(3) Two (2) members of the senate appointed by the president pro tempore of the senate.

(4) Two (2) members of the house of representatives appointed by the speaker of the house of representatives.

(5) Seven (7) members appointed by the governor, each of whom must represent one (1) of the following interests:

(A) Cities and towns.

(B) Counties.

(C) Industrial generators of solid waste.

(D) Utilities.

(E) The private recycling industry.

(F) The private solid waste management industry.

(G) Environmentalists.

As added by P.L.130-1991, SEC.26.

13-9.5-3.5-4 Political party restrictions on members

Sec. 4. (a) The two (2) members of the senate appointed to the council under section 3(3) of this chapter may not be members of the same political party.

(b) The two (2) members of the house of representatives appointed to the council under section 3(4) of this chapter may not be members of the same political party.

(c) Not more than four (4) members of the council appointed by the governor under section 3(5) of this chapter may be members of the same political party. A member appointed by the governor may not represent more than one (1) interest set forth in section 3(5) of this chapter. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-5 Terms of members

Sec. 5. (a) Except as provided in subsection (c), the term of a member appointed to the council under section 3(3) or 3(4) of this chapter expires upon the expiration of the term that the member is serving in the house of representatives or senate when the member was appointed to the council

(b) Except as provided in subsection (c), the term of a member appointed to the council by the governor under section 3(5) of this chapter is four (4) years.

(c) The term of a member appointed to the council under section 3(3) through 3(5) of this chapter continues until the member's successor is appointed and qualified. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-6 Filling of vacancies

Sec. 6. A vacancy on the council in a position set forth in section 3(3) through 3(5) of this chapter shall be filled through appointment by the appointing authority. An appointment under this subsection is for the remainder of the unexpired term. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-7 Removal of members

Sec. 7. A member of the council appointed under section 3(3) through 3(5) of this chapter may be removed for cause by the appointing authority. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-8 Compensation and expenses of members

Sec. 8. (a) The ex officio members of the council designated in section 3(1) through 3(2) of this chapter serve on the council without additional compensation.

(b) Each member of the general assembly who is appointed to the council under section 3(3) or 3(4) of this chapter is entitled to receive the same per diem, mileage, and travel allowances paid to members of the general assembly serving on interim study committees established by the legislative council.

(c) Each member of the council who:

(1) is appointed under section 3(5) of this chapter; and

(2) is not a state employee;

is entitled to the minimum salary per diem provided by IC 4-10-11-2.1(b). Such a member is also entitled to reimbursement for traveling expenses and other expenses actually incurred in connection with the member's duties, as provided in the state travel policies and procedures established by the department of administration and approved by the budget agency. *As added by P.L.130-1991, SEC.26.*

13-9.5-3.5-9 Chairman

Sec. 9. The governor shall appoint a chairman from among the members of the council. *As added by P.L.130-1991, SEC.26.*

Chapter 4. District Solid Waste Management Plan

13-9.5-4-1 Adoption

Sec. 1. Each district shall adopt and submit to the commissioner for approval a district solid waste management plan that meets:

(1) the requirements of this chapter; and

(2) the criteria and other elements set forth in the state plan.

As added by P.L.10-1990, SEC.17.

13-9.5-4-2 Public meetings

Sec. 2. (a) A district must conduct at least one (1) regularly scheduled public meeting each month before the creation, amendment, or alteration of the district solid waste management plan. Notice of each public meeting shall be given by the board in accordance with IC 5-14-1.5. In addition, a copy of the schedule of regularly scheduled monthly meetings shall annually be submitted for publication to a newspaper of general circulation in each county of the district. The notice must be at least two (2) columns wide by five (5) inches long and may not be placed in the part of the newspaper where legal notices and classified advertisements appear. Public comments shall be taken at each board meeting.

(b) After considering public comment received during all public meetings held under subsection (a), the board shall hold a public hearing on the proposed plan before adopting a district plan in final form. The proposed plan must be made available to the public at least thirty (30) days before the date the public hearing is held. Public notice of the hearing held under this subsection shall be given by the board.

(c) The department shall furnish a model format to be used in the preparation of district plans under this chapter.

(d) A district plan may be adopted before January 1, 1991, using a format different from the format furnished under subsection (c), but the commissioner may request that such a plan be revised to conform to the model format furnished under subsection (c).

(e) An advisory committee established under IC 13-9.5-2-10 must conduct at least one (1) regularly scheduled public meeting each month before reporting to the board on any matter. After a district plan has been adopted for a district by a board, the advisory committee appointed by the board shall meet:

(1) at least four (4) times each year; and

(2) at the request of the board.

Public comments shall be taken at each advisory committee meeting.

(f) A board must make all working documents available for review by the public for a period of time that allows sufficient time for adequate review before a public meeting of the board. A board shall make updated copies of working documents available to the public on a regular basis. *As added by P.L.10-1990, SEC.17. Amended by P.L.25-1991, SEC.12; P.L.33-1992, SEC.12.*

13-9.5-4-3 Approval or disapproval

Sec. 3. (a) Based upon the contents of the state plan and on rules adopted by the solid waste management board, the commissioner shall approve or disapprove each district plan submitted for review under this chapter within one hundred twenty (120) days after the plan is submitted to the commissioner.

(b) If the commissioner fails to act within one hundred twenty (120) days after a district plan is submitted, the district plan is considered approved.

(c) If the commissioner disapproves a district plan submitted by the board, the commissioner shall promptly notify the board of the disapproval of the district plan and provide written comments on changes that would make the district plan acceptable. The district shall revise the district plan and resubmit the plan to the commissioner within ninety (90) days after the disapproval of the original district plan. Before adoption of the revised district plan, the board shall hold a public hearing utilizing the procedures in section 2(b) of this chapter. The commissioner shall approve or disapprove a revised district plan within one hundred twenty (120) days after the revised plan is submitted to the commissioner. If the commissioner fails to act within one hundred twenty (120) days after a revised plan is submitted, the revised plan is considered approved. *As added by P.L.10-1990, SEC.17.*

13-9.5-4-4 Department to provide information to counties

Sec. 4. The department shall provide information to assist counties to:

(1) establish districts; and

(2) develop district plans under this chapter.

As added by P.L.10-1990, SEC.17.

13-9.5-4-5 Demographic studies

Sec. 5. A district plan must include the following:

(1) The results of a demographic study of the district predicting the population of the district five (5) years, ten (10) years, and twenty (20) years after the year the district plan is adopted.

(2) A description of the origin, content, and weight or volume of the solid waste to be generated in the district at the time of the development of the district plan, and a projection of the origin, content, and weight or volume of the solid waste to be generated in the district five (5) years, ten (10) years, and twenty (20) years after the year the district plan is adopted.

(3) An inventory and description of the facilities [illegible] within the district and of the solid [illegible] management activities taking place within the dist[illegible]

(4) A statement identifying and assessing solid waste problems that exist in the district at the time of the development of the district plan and solid waste problems that may exist in the district in the future.

(5) A projection of the need for, and a description of, facilities in the district five (5) years, ten (10) years, and twenty (20) years after the year the district plan is adopted.

As added by P.L.10-1990, SEC.17.

13-9.5-4-6 Policy; establishment

Sec. 6. A district plan must establish a solid waste management policy for the district that reflects the needs of the district and provides an integrated approach to solid waste management that includes the following:

(1) Source reduction.

(2) Alternatives to complete or partial dependence on final disposal facilities, including recycling and composting.

(3) Final disposal facilities.

As added by P.L.10-1990, SEC.17.

13-9.5-4-7 Contents

Sec. 7. A district plan must do the following:

(1) Set forth goals and objectives for the district.

(2) Identify alternative means of achieving these goals and objectives based upon the problems and needs of the district.

(3) Set forth a description of the operational costs and capital costs of implementing the district plan and the proposed means of financing the implementation of the district plan.

(4) Set forth the basis for setting fees, rates, and charges for use of any facility.

(5) Designate a person to supervise the implementation of the district plan and describe the responsibilities and authority of that person.

(6) Describe the surveillance and enforcement procedures to be implemented to ensure compliance with the district plan.

As added by P.L.10-1990, SEC.17.

13-9.5-4-7.5 Management and disposal of certain materials

Sec. 7.5. (a) A district plan must also include provisions for the management and disposal of the following materials for the term of the plan:

(1) Waste tires (as defined in IC 13-7-23-4).

(2) Household hazardous waste.

(3) Used oil (as defined in IC 13-7-1-25.5).

(4) White goods.

(5) Other classifications of waste provided for in the state plan.

(b) A district plan that sets forth provisions for the management and disposal of materials identified in subsection (a) must comply with all laws and rules governing the management and disposal of those materials. *As added by P.L.130-1991, SEC.27.*

13-9.5-4-8 Solid waste from other states; provisions

Sec. 8. A district plan may, to the extent it is constitutionally permissible, include provisions to restrict or prohibit the disposal within the district of solid waste originating from another state if the district reasonably considers the provisions necessary to accomplish the long range planning goals of the district. *As added by P.L.10-1990, SEC.17.*

13-9.5-4-9 Contracts with private persons; facilities in operation at time of adoption of plan; privately owned facilities; operational requirements

Sec. 9. (a) A district plan must consider, in all circumstances, contracts with private persons.

(b) A district plan or amended plan must, where reasonably necessary to effectuate the efficient use of existing permitted final disposal facilities, take account of permitted final disposal facilities in the district that are in operation at the time the district plan is adopted. A district plan or amended plan must incorporate all recycling activities in progress in the district at the time the district plan is adopted or amended.

(c) A district plan may not impose operational requirements on a privately owned or operated facility that differ from operational requirements imposed on a public facility solely because the facility is privately owned or operated. *As added by P.L.10-1990, SEC.17.*

13-9.5-4-10 Failure to adopt or disapproval of plan; adoption of plan by commissioner

Sec. 10. If:

(1) a district fails to submit a district plan to the commissioner under section 1 of this chapter; or

(2) the commissioner disapproves a revised district plan submitted by the district under section 3(c) of this chapter;

the commissioner may adopt a solid waste management plan for the district. *As added by P.L.10-1990, SEC.17.*

13-9.5-4-11 Amendment of plan

Sec. 11. (a) A district shall reconsider and, if appropriate, amend its solid waste management plan at least once every five (5) years using the procedures set forth in sections 1, 2, and 3 of this chapter.

(b) A district may amend its plan at any time within the five (5) year period referred to in subsection (a). An amended plan prepared under this subsection shall be immediately filed with the commissioner and may be implemented within sixty (60) days after filing unless the commissioner notifies the district in writing within thirty (30) days after the filing that the amended plan fails to comply with the state plan. The written notice of the commissioner shall also provide written comments on changes that would make the amended plan acceptable. *As added by P.L.10-1990, SEC.17.*

13-9.5-4-12 Merger of districts before submission of plan

Sec. 12. (a) Before a district submits a district plan to the department under this chapter, a district may merge with one (1) or more other districts after the adoption of identical resolutions by the board of each district to be merged.

(b) Upon adoption of identical resolutions under subsection (a), a board for the resulting merged district shall be established using the procedures set forth in IC 13-9.5-2. *As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.28.*

13-9.5-4-12.5 Merger of districts after submission of plan

Sec. 12.5. (a) After a district submits a district plan to the department under this chapter, a district may merge with one (1) or more other districts after the adoption of identical resolutions by the board of each district to be merged.

(b) Upon adoption of identical resolutions under subsection (a), a board for the resulting merged district shall be established using the procedures set forth in IC 13-9.5-2.

(c) A merged district must adopt a district plan within thirty (30) days after the merger is completed and file the district plan with the commissioner.

(d) A district plan adopted under this section is considered approved unless the commissioner notifies the district within thirty (30) days after the district plan is filed with the commissioner that the district plan fails to comply with the state plan. *As added by P.L.130-1991, SEC.29.*

13-9.5-4-13 Removal of county from joint district

Sec. 13. (a) Before the district plan of a joint district is approved under section 3 of this chapter, a county may by ordinance of its executive remove itself from the joint district and:

(1) designate itself as a county district;

(2) join into a joint district; or

(3) join with one (1) or more other counties in establishing a new joint district.

(b) If a county designates itself as a county district under subsection (a)(1), the board appointed for the new county district under IC 13-9.5-2-4 must file a district plan with the commissioner within ten (10) days after the passage of the ordinance. If the district plan is not filed, the removal of the county from the joint district is not effective.

(c) If a county desires to join into a joint district under subsection (a)(2), the board of the other district must approve the addition of the county to the district, amend its district plan to include the additional county, and file the amended district plan with the commissioner within thirty (30) days after the addition of the county to the district. If the district plan is not filed, the removal of the county under subsection (a) is not effective.

(d) If a county desires to join in establishing a new joint district under subsection (a)(3), the board of the new joint district must, within thirty (30) days after the adoption of an ordinance establishing the joint district and approving an agreement governing the operation of the joint district, file a new district plan with the commissioner. If the district plan is not filed, the removal of the county under subsection (a) is not effective. *As added by P.L.10-1990, SEC.17.*

Chapter 5. State Solid Waste Management Fees

13-9.5-5-1 Amount of fees

Sec. 1. (a) Beginning January 1, 1991, a fee is imposed on ~~the~~ disposal or incineration of solid waste in a final disposal facility in Indiana. Except as provided in section 6 of this chapter, the amount of the fee is as follows:

(1) For solid waste generated in Indiana and delivered to a final disposal facility in a motor vehicle having a registered gross vehicle weight greater than nine thousand (9,000) pounds, fifty cents ($0.50) a ton.

(2) For solid waste generated outside Indiana and delivered to a final disposal facility in a motor vehicle having a registered gross vehicle weight greater than nine thousand (9,000) pounds:

(A) fifty cents ($0.50) a ton; and

(B) if the solid waste management board has adopted rules under subsection (b), an additional amount imposed under the rules.

(3) For solid waste generated in Indiana or outside Indiana and delivered to a final disposal facility in a motor vehicle having a registered gross vehicle weight of not more than nine thousand (9,000) pounds or in a passenger motor vehicle (as defined in IC 9-13-2-123), fifty cents ($0.50) for each load delivered by the motor vehicle.

(b) The solid waste management board shall adopt rules to establish and impose a fee on the disposal or incineration of solid waste that is:

(1) generated outside Indiana; and

(2) disposed of or incinerated in a final disposal facility in Indiana.

The fee shall be set at an amount necessary to offset the costs incurred by the state or a county, municipality, or township that can be attributed to the importation of the solid waste into Indiana and the presence of the solid waste in Indiana.

(c) Revenue from fees collected under subsection (a)(1) and (a)(2)(A) shall be deposited in the state solid waste management fund established under section 2 of this chapter. Revenue from fees collected under subsection (a)(2)(B) shall be deposited in the hazardous substances response trust fund established by IC 13-7-8.7, except that any portion of the revenue that the solid waste management board finds is necessary to offset costs incurred by counties, municipalities, and townships shall be distributed to solid waste management districts (as defined in IC 13-9.5-1-10) pro rata on the basis of the district's population.

(d) If solid waste has been subject to a fee under this section, the total amount of the fee paid shall be credited against any other fee to which the solid waste may later be subject under this section. *As added by P.L.10-1990, SEC.17. Amended by P.L.69-1991, SEC.20; P.L.127-1991, SEC.2; P.L.1-1992, SEC.84.*

13-9.5-5-2 State solid waste management fund; establishment; purpose

Sec. 2. (a) The state solid waste management fund is established to provide funds for programs that provide grants and loans to promote recycling and the use of recycled materials.

(b) The expenses of administering the fund shall be paid from money in the fund.

(c) The sources of money for the fund are the following:

(1) All fees paid under section 1(a)(1) of this chapter.

(2) Accrued interest and other investment earnings of the fund.

(3) Appropriations made by the general assembly.

(4) Gifts and donations from any person to the fund.

(d) The treasurer of state shall invest the money in the fund not currently needed to meet the obligatio[illegible] nd in the same manner as other public funds may be invested.

(e) Money in the fund at the end of a state fiscal year does not revert to the state general fund. *As added by P.L.10-1990, SEC.17.*

13-9.5-5-3 [illegible] olid waste management [illegible] ppropriations; [illegible] val of expenditures

Sec. 3. (a) There is annually appropriated to the state solid waste management fund established under section 2 of this chapter, for the purposes set forth in section 2(a) of this chapter, the amount of money deposited in the fund from the sources set forth in section 2(c) of this chapter.

(b) Expenditur[illegible] from the fund under section 2(a) of th[illegible] chapter must be approved by the governor and the budget agency. *As added by P.L.10-1990, SEC.17.*

13-9.5-5-3.1 Registration of owners and operators of final disposal facilities

Sec. 3.1. An owner or operator of a final disposal facility responsible for collecting the fees imposed under section 1 of this chapter shall register with the department of state revenue. To register with the department of state revenue, the owner or operator must pay a registration fee of twenty-five dollars ($25) and file a verified registration form containing the following:

(1) The registrant's name and address.

(2) The name and address of each final disposal facility owned or operated by the registrant.

(3) Any additional information that the department of state revenue reasonably requires.

As added by P.L.69-1991, SEC.21.

13-9.5-5-3.2 Surety bonds

Sec. 3.2. (a) The department of state revenue may require a registrant under section 3.1 of this chapter to file a surety bond:

(1) in an amount determined by the department of state revenue of:

(A) not less than two thousand dollars ($2,000); and

(B) not more than three (3) months tax liability for the registrant as estimated by the department of state revenue; and

(2) conditioned upon the keeping of records and the making of full and complete reports and payments as required by this chapter.

(b) If the registrant files a bond, the bond must:

(1) be with a surety company or financial institution approved by the department of state revenue; and

(2) name the registrant as the principal and the state as the obligee.

As added by P.L.69-1991, SEC.22.

13-9.5-5-3.3 Financial statements

Sec. 3.3. (a) The department of state revenue may require a registrant under section 3.1 of this chapter to furnish a current financial statement with the registration form.

(b) After registration, the department of state revenue may require a registrant to periodically furnish a current financial statement. If the registrant's financial condition warrants an increase in the surety bond, the department of state revenue may require the registrant to furnish an increased bond.

(c) The department of state revenue may require an audited financial statement under this section. *As added by P.L.69-1991, SEC.23.*

13-9.5-5-3.4 Registration cards

Sec. 3.4. The department of state revenue shall issue a registration card to each registrant under section 3.1 of this chapter who complies with this chapter. The registration card shall be prominently displayed at each place in Indiana where the registrant is engaged in business as an owner or operator of a final disposal facility. *As added by P.L.69-1991, SEC.24.*

13-9.5-5-3.5 Release of surety; cancellation of registration for failure to submit new bond

Sec. 3.5. (a) Sixty (60) days after making a written request for release to the department of state revenue, the surety of a bond furnished by a registrant under section 3.2 of this chapter is released from any liability to the state accruing on the bond after the sixty (60) day period. The release does not affect any liability accruing before the expiration of the sixty (60) day period.

(b) The department of state revenue shall promptly notify the registrant furnishing the bond that a release has been requested. The registrant must obtain a new bond that meets the requirements of section 3.2 of this chapter and file with the department of state revenue a new bond within the sixty (60) day period.

(c) The department of state revenue shall cancel the registration for failure to submit a new bond within the sixty (60) day period. *As added by P.L.69-1991, SEC.25.*

13-9.5-5-3.6 Cancellation of registration; hearing; notice

Sec. 3.6. (a) The department of state revenue may, after a hearing, cancel a registration issued to an owner or operator of a final disposal facility, if the owner or operator:

(1) files a false monthly report of the information required by this chapter;

(2) fails or refuses to file a monthly report required by this chapter;

(3) fails or refuses to pay the full amount of the fee imposed by this chapter on or before the due date established by section 4 of this chapter;

(4) fails or refuses to comply with IC 6-8.1-5-4;

(5) knowingly removes or alters a sign posted by this department under section 9 of this chapter;

(6) fails or refuses to have on file a valid bond, as required by section 3.2 or 3.5 of this chapter; or

(7) fails to honor a subpoena issued under IC 6-8.1-3-12.

(b) The department of state revenue shall notify the owner or operator at least fifteen (15) days before the date set for the hearing of the proposed cancellation. The notice must be sent by registered mail to the last known address of the owner or operator. The owner or operator may appear at the time and place given in the notice to show cause why the registration should not be canceled. *As added by P.L.69-1991, SEC.26.*

13-9.5-5-3.7 Written request for cancellation of registration

Sec. 3.7. A person registered under this chapter may make a written request to the department of state revenue to cancel the person's registration. The department of state revenue may cancel the registration sixty (60) days from the date of the written request if before cancellation the person has:

(1) paid all fees, penalties, and interest accruing under this chapter; and

(2) surrendered to the department of state revenue the registration certificate issued under this chapter and any additional copies of the registration.

As added by P.L.69-1991, SEC.27.

13-9.5-5-4 Collection; deposit

Sec. 4. (a) Beginning January 1, 1991, the owner or operator of a final disposal facility is responsible for collecting the fees imposed under section 1 of this chapter from persons delivering solid waste to that facility. Each owner or operator may deduct from the fees an amount equal to one percent (1%) of the fees collected and may retain this amount as compensation for collecting and remitting the fees if the fees collected and the reports required under subsection (c) of this section are timely remitted and filed. If the fees collected are remitted or the required report is filed after the due date, the owner or operator shall remit all fees collected to the department of state revenue.

(b) The owner or operator shall remit the remainder of the fees that the owner or operator collects during a month to the department of state revenue within ten (10) days after the last day of the month in which the fees are collected.

(c) The owner or operator of a final disposal facility shall file monthly reports with the department concerning the fees collected under this section. The department shall adopt a form for these reports. An owner or operator shall use the form in reporting to the department.

(d) Each month the department of state revenue shall deposit the revenue from the fee imposed under section 1(a)(1) of this chapter into the state solid waste management fund established under section 2 of this chapter and the revenue from the fee imposed under section 1(a)(2) of this chapter into the hazardous substance response trust fund established by IC 13-7-8.7. *As added by P.L.10-1990, SEC.17. Amended by P.L.69-1991, SEC.28.*

13-9.5-5-5 Restrictions

Sec. 5. A fee may not be imposed by the state under section 1 of this chapter on the disposal of solid waste by a person who:

(1) generated the solid waste; and

(2) disposed of the solid waste at a site that is:

(A) owned by the person; and

(B) limited, for purposes of the disposal of solid waste, to use by that person for the disposal of solid waste generated by that person.

As added by P.L.10-1990, SEC.17.

13-9.5-5-6 Agreement with other state

Sec. 6. If:

(1) the:

(A) county executive of the county; or

(B) board of directors of the solid waste management district;

in which a final disposal facility is located has entered into an agreement concerning solid waste management with a governmental unit that is, or that is located within, a county that is contiguous to Indiana but within another state; and

(2) the agreement provides for solid waste generated in that governmental unit to be disposed of in the final disposal facility;

the fee imposed under this chapter upon the disposal in the final disposal facility of solid waste generated in that governmental unit is the fee set forth in section 1(a)(1) of this chapter, not the fee set forth in section 1(a)(2) of this chapter. *As added by P.L.10-1990, SEC.17.*

13-9.5-5-7 Weight of solid waste; conversion factors

Sec. 7. (a) For purposes of the collection of the fees imposed under section 1 of this chapter, the owner or operator of a final disposal facility that:

(1) receives, on the average, less than two hundred (200) tons of solid waste each day; and

(2) does not have a scale suitable for weighing the solid waste received at the final disposal facility;

may determine the weight of the solid waste received by conversion from the volume of the solid waste.

(b) The owner or operator shall apply the following conversion factors:

(1) Three and three-tenths (3.3) cubic yards of compacted solid waste equals one (1) ton of solid waste.

(2) Six (6) cubic yards of uncompacted solid waste equals one (1) ton of solid waste.

As added by P.L.10-1990, SEC.17.

13-9.5-5-8 Proceeds not considered to be revenues

Sec. 8. Fees prescribed by this chapter are not revenues (as defined in IC 36-9-31-2) of a facility (as defined in IC 36-9-31-2) or revenues under IC 8-1.5, IC 13-9.5-9, or IC 36-9-30. *As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.30.*

13-9.5-5-9 Posting of sign prohibiting further transactions involving solid waste disposal

Sec. 9. (a) If any of the following conditions occur, the department of state revenue may post a sign at a solid waste disposal site that prohibits further transactions involving solid waste disposal at the site:

(1) An owner or operator of a final disposal facility becomes delinquent in payment of any amount due under this chapter.

(2) There is evidence that the revenue of an owner or operator of a final disposal facility is in jeopardy.

(3) An owner or operator of a final disposal facility is operating without the registration required by this chapter.

(4) An owner or operator of a final disposal facility is operating without the bond required by this chapter.

(5) An owner or operator of a final disposal facility continues to operate the final disposal facility after the registration of the owner or operator has been canceled under this chapter.

(b) The department of state revenue may require that the sign posted under this section must remain posted until the owner or operator of the final disposal facility:

(1) files all reports and pays in full the fees and penalties imposed by this chapter;

(2) pays in full the interest and penalties imposed under IC 6-6.1-10-1 and IC 6-8.1-10-2;

(3) obtains the registration required by this chapter; and

(4) provides the bond required by this chapter.

As added by P.L.69-1991, SEC.29.

13-9.5-5-10 Remedies cumulative

Sec. 10. The remedies provided by this chapter are cumulative, and action taken by the state may not be construed as an election to pursue a remedy to the exclusion of other remedies. *As added by P.L.69-1991, SEC.30. Amended by P.L.1-1992, SEC.85.*

13-9.5-5-11 Failure to pay fees

Sec. 11. A person who knowingly or intentionally fails to pay the fee to the department of state revenue under section 4 of this chapter commits a Class D felony. *As added by P.L.69-1991, SEC.31.*

13-9.5-5-12 Tampering with signs; failure to report tampering with signs

Sec. 12. (a) A person, without authorization, who:

(1) removes;

(2) alters;

(3) d[illegible] or

(4) covers;

a sign posted by the department of state revenue under section 9 of this chapter commits a Class B misdemeanor. However, the offense is a Class D felony if the offense is committed with the intent to evade the fee imposed by this chapter or to defraud the state.

(b) An owner or operator of a final disposal facility shall notify the department of state revenue within two (2) days after discovering that a sign posted by the department has been removed, altered, defaced, or covered.

(c) An owner or operator of a final disposal facility who fails to notify the department under subsection (b) commits a Class B misdemeanor. *As added by P.L.69-1991, SEC.32.*

Chapter 6. County Solid Waste Planning Fees

13-9.5-6-1 Amount of fees

Sec. 1. (a) After March 22, 1990, the county executive of a county in which a final disposal facility is located may impose fees on the disposal or incineration of solid waste at that facility.

(b) The amount of fees imposed under this section shall be established after a public hearing of the county executive. Public notice of the hearing shall be given by the county executive.

(c) A county executive that also owns or operates a final disposal facility may establish differential fees for the disposal at that facility of solid waste generated outside the county.

(d) Except as provided in section 5 of this chapter, fees imposed under this chapter shall be imposed uniformly on public facilities and on privately owned or operated facilities throughout the county. *As added by P.L.10-1990, SEC.17.*

13-9.5-6-2 Deposit into county solid waste planning fund; use

Sec. 2. (a) Fees remitted under this chapter shall be deposited in a fund known as the "__________county solid waste planning fund".

(b) Money in the fund may be used only for the following purposes:

(1) To pay expenses of administering the fund.

(2) To pay costs associated with the determination of the county to organize as either a county district or a joint district.

(3) To pay costs associated with the development of a district plan.

(c) The county auditor shall administer the fund in the same manner as all other county funds. *As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.31.*

13-9.5-6-3 Proceeds not considered to be revenues

Sec. 3. Fees imposed by this chapter are not revenues (as defined in IC 36-9-31-2) of a facility (as defined in IC 36-9-31-2) or revenues under IC 8-1.5, IC 13-9.5-9, or IC 36-9-30. *As added by P.L.10-1990, SEC.17. Amended by P.L.1-1992, SEC.86.*

13-9.5-6-4 Collection

Sec. 4. (a) If a fee is imposed under section 1 of this chapter, the owner or operator of a final disposal facility located in the county is responsible for collecting fees from persons delivering solid waste to the facility. Each owner or operator may deduct an amount equal to one percent (1%) of the fees collected and may retain this amount as compensation for collecting and remitting the fees.

(b) The owner or operator shall remit the remainder of the fees the owner or operator collects during a month to the county auditor within ten (10) days after the last day of the month in which the fee is collected. *As added by P.L.10-1990, SEC.17. Amended by P.L.1-1991, SEC.112.*

13-9.5-6-5 Restrictions

Sec. 5. A fee may not be imposed by a county under this chapter on the disposal of solid waste by a person that:

(1) generated the solid waste; and

(2) disposes of the solid waste at a site that is:

(A) owned by that person; and

(B) limited, for the purposes of the disposal of solid waste, to use by that person for the disposal of solid waste generated by that person.

As added by P.L.10-1990, SEC.17.

13-9.5-6-6 Weighing of solid waste; conversion factors

Sec. 6. (a) If the fees imposed under section 1 of this chapter are based and charged on each ton of solid waste, an owner or operator of a final disposal facility that does not have a scale suitable for weighing solid waste received at the final disposal facility may determine the weight of the solid waste by conversion from the volume of the solid waste.

(b) An owner or operator described in subsection (a) shall apply the following conversion factors:

(1) Three and three-tenths (3.3) cubic yards of compacted solid waste equals one (1) ton of solid waste.

(2) Six (6) cubic yards of uncompacted solid waste equals one (1) ton of solid waste.

As added by P.L.10-1990, SEC.17.

13-9.5-6-7 Waste received before January 1, 1990

Sec. 7. Fees imposed under section 1 of this chapter may not be imposed on solid waste that is received at a final disposal facility under a contract entered into before January 1, 1990, unless the contract has a pass-through provision by which the transporter of the solid waste may recover the fees from the transporter's client. *As added by P.L.10-1990, SEC.17.*

13-9.5-6-8 Effective date

Sec. 8. The disposal or incineration of solid waste at a final disposal facility is not subject to a fee under this chapter after the earlier of:

(1) the date on which a county is either designated a county district or joins into a joint district; or

(2) December 31, 1992.

As added by P.L.10-1990, SEC.17.

13-9.5-6-8.5 Money remaining in fund to become property of district

Sec. 8.5. Money remaining in the county solid waste planning fund on the date on which the county is:

(1) designated a county district; or

(2) joins in a joint district;

becomes the property of the district. *As added by P.L.130-1991, SEC.32.*

13-9.5-6-9 Expiration date

Sec. 9. This chapter expires January 1, 1993. *As added by P.L.10-1990, SEC.17.*

Chapter 7. Final Disposal Fees

13-9.5-7-1 Imposition; amount

Sec. 1. (a) A board may impose fees on the disposal of solid waste in a final disposal facility located within the district after the district is established under IC 13-9.5-2.

(b) The amount of fees imposed under this section shall be set by the board after a public hearing. Public notice of the hearing shall be given by the board.

(c) If solid waste has once been subject to a district fee under this section, the total amount of that fee that was paid shall be credited against a district fee to which the solid waste may later be subject under this section.

(d) Except as provided in section 4 of this chapter, fees imposed under this chapter shall be imposed uniformly on public facilities and on privately owned or operated facilities throughout the district.

(e) A resolution adopted by a board that establishes fees under this chapter may contain a provision that authorizes the board to impose a penalty of not more than five hundred dollars ($500) per day because of:

(1) nonpayment of fees; or

(2) noncompliance with a condition in the resolution.

As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.13.

13-9.5-7-2 Deposit into district solid waste management fund; use of money; surety bond

Sec. 2. (a) A board that has imposed fees under section 1 of this chapter shall establish and continuously maintain a separate fund under this section to be known as the "_____ district solid waste management fund".

(b) All fees remitted to the district under section 1 of this chapter shall be deposited in the fund.

(c) Money in the fund may be used only for the following purposes:

(1) To pay expenses of administering the fund.

(2) To pay costs associated with the development and implementation of the district plan.

(d) A fund established under this section shall be administered by the controller of the district. Money in the fund that is not currently needed for the purposes set forth in subsection (c) may be invested in the same manner as other county funds may be invested. Interest that accrues from these investments shall be deposited in the fund. Money in the fund at the end of a district's fiscal year does not revert to:

(1) a county general fund; or

(2) any other fund.

(e) The controller of a district shall file an individual surety bond or revise an existing bond in a sufficient amount determined under IC 5-4-1-18 to reflect the liability associated with the handling of the district's funds. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.14.*

13-9.5-7-3 Collection; deduction

Sec. 3. (a) If a fee is imposed under section 1 of this chapter by a board, the owner or operator of a final disposal facility located within the district is responsible for collecting fees from persons delivering solid waste to that facility. Each owner or operator may deduct from the fees an amount equal to one percent (1%) of the fees collected and may retain this amount as compensation for collecting and remitting the fees.

(b) The owner or operator shall remit the remainder of the fees the owner or operator collects during a month to the controller within ten (10) days after the last day of the month in which the fees are collected.

(c) Each owner or operator of a final disposal facility shall, at the time the collected fees are remitted, furnish to the controller a fee collection report. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.15.*

13-9.5-7-4 Restrictions

Sec. 4. A fee may not be imposed by a board under this chapter on the disposal of solid waste by a person that:

(1) generated the solid waste; and

(2) disposes of the solid waste at a site that is:

(A) owned by that person; and

(B) limited, for purposes of the disposal of solid waste, to use by that person for the disposal of solid waste generated by that person.

As added by P.L.10-1990, SEC.17.

13-9.5-7-5 Weighing of solid waste; conversion factors

Sec. 5. (a) If fees imposed under section 1 of this chapter are based and charged on each ton of solid waste, the owner or operator of a final disposal facility that:

(1) annually receives, on the average, less than two hundred (200) tons of solid waste each day; and

(2) does not have a scale suitable for weighing the solid waste received at the final disposal facility;

may determine the weight of the solid waste received by conversion from the volume of the solid waste.

(b) An owner or operator described in subsection (a) shall apply the following conversion factors:

(1) Three and three-tenths (3.3) cubic yards of compacted solid waste equals one (1) ton of solid waste.

(2) Six (6) cubic yards of uncompacted solid waste equals one (1) ton of solid waste.

As added by P.L.10-1990, SEC.17.

13-9.5-7-6 Repealed

(Repealed by P.L.89-1992, SEC.1.)

13-9.5-7-7 Proceeds not considered to be revenues

Sec. 7. Fees prescribed by this chapter are not revenues (as defined in IC 36-9-31-2) of a facility (as defined in IC 36-9-31-2) or revenues under IC 8-1.5, IC 13-9.5-9, or IC 36-9-30. *As added by P.L.10-1990, SEC.17. Amended by P.L.1-1992, SEC.87.*

Chapter 8. Contracts and Agreements

13-9.5-8-1 Contracts and agreements

Sec. 1. (a) Notwithstanding any other statute concerning the length, duration, and terms of contracts and agreements, a board may enter into a contract or agreement with a person, upon terms and conditions as agreed upon, for the design, construction, operation, financing, ownership, or maintenance of a facility for solid w[illegible] [illegible]dance with the requireme[illegible] [illegible] this chapter. Before or after the expiration or termination of the term or duration of any contract or agreement entered into under this chapter, the board, in accordance with the requirements and conditions of this chapter, may from time to time enter into amended, extended, supplemental, new, or further contracts or agreements with the same person or any other person for any purpose referred to in this chapter.

(b) A contract, including all amendments, extensions [illegible] supplements, may not exceed a ter[illegible] [illegible] years. *As added by P.L[illegible]*

13-9.5-8-2 Public bidding

Sec. 2. Notwithstanding any other statute, a contract entered into between the board and any person under this chapter may be awarded by the board by:

(1) public bidding in compliance with IC 36-1-12; or

(2) compliance with section 3 of this chapter.

As added by P.L.10-1990, SEC.17.

13-9.5-8-3 Requests for proposals

Sec. 3. The board may issue a request for qualifications and a request for proposals as prescribed by section 4 of this chapter in accordance with the following provisions:

(1) The board may, by resolution, adopt a requirement that a person that desires to submit a proposal in response to a request for proposals must prequalify as a proposer by submitting information, in response to a request for qualifications, relating to the experience of the proposer, the basis on which the proposer purports to be qualified to carry out all work required by a proposed contract, and the financial condition of the proposer. Minimum requirements may be set by the board as to these qualifications in a request for qualifications.

(2) Before the issuance of a request for proposals under this section, the board shall adopt a proposed request for proposals by resolution and shall publish a public notice that may contain a request for qualifications if a prequalification process has been adopted under subdivision (1), including the criteria on which proposers may be selected. The public notice must:

(A) include the intent to issue a request for proposals;

(B) designate times and places where the proposed request for proposals may be viewed by the general public; and

(C) state the time of commencement of the thirty (30) day period established in this subdivision, which constitutes the event referred to in IC 5-3-1-2.

The board shall allow not more than a thirty (30) day period for the submission of qualifications, if required, and comments on the proposed request for proposals, following which the board shall select a proposer or proposers and adopt a request for proposals. Comments may be addressed to the scope or contents of the proposed request for proposals. The board shall notify the proposer or proposers of their selection and inform each proposer of the date and place proposals are to be submitted and deliver to each proposer a copy of the request for proposal.

(3) The board may prescribe the form and content of proposals, and the proposer must submit sufficiently detailed information to permit a fair and equitable evaluation by the board of the proposal. In addition, the board in the request for proposals may set the maximum allowable cost limits that the board determines to be appropriate.

(4) Proposals may not be received before thirty (30) days following notification to the proposers of their selection.

(5) Proposals received under this section shall be evaluated by the board as to net cost or net revenues and, in the manner consistent with provisions set forth in the requests for proposals, may be evaluated on the basis of additional factors such as the technical evaluation of facility design, net energy efficiency, environmental protection, overall system reliability, and financial condition of the proposer.

(6) The board may negotiate with the proposer or proposers and may make a preliminary contract award to any responsible proposer. The board shall give public notice of a public hearing, which must designate the time and place of a public hearing at which the board will hear comments upon the preliminary contract to be awarded. Following the public hearing, the board shall make a final contract award to any responsible proposer selected under this section based on a determination that the selected proposal is the most responsive to the needs of the district. The final contract award must be in the form of a resolution and must include particularized findings relative to factors evaluated under this section, indicating that the district's needs are met by the final contract award and that the action is in the public interest.

As added by P.L.10-1990, SEC.17.

13-9.5-8-4 Requests for proposals; requirements

Sec. 4. Requests for proposals must include the following:

(1) A clear identification and specification of all elements of cost that will become charges to the district, in whatever form, in return for the fulfillment by the proposer of all tasks and responsibilities established by the request for proposals for the full lifetime of a proposed contract, including such matters as the following:

(A) Proposals for project staffing.

(B) Implementation of all work tasks.

(C) Carrying out of all responsibility required by the proposed contract.

(D) The cost of planning, design, construction, operation, management, or maintenance of any facility.

(E) The cost of solid waste management.

(2) A clear identification and specification of any revenues that would accrue to the district from the sale of any byproducts or from any other source.

(3) Other information that the board determines to have a material bearing on the board's ability to evaluate a proposal in accordance with this section.

As added by P.L.10-1990, SEC.17.

13-9.5-8-5 Action to contest validity of contract

Sec. 5. An action to contest the validity of the contract awarded or the procedure by which the contract was awarded must be brought within thirty (30) days following the final contract award. After that date, the contract is incontestable for any cause. *As added by P.L.10-1990, SEC.17.*

Chapter 9. Financing Solid Waste Management Facilities

13-9.5-9-1 Special taxing district; creation

Sec. 1. (a) A special taxing district is created in each solid waste management district established under IC 13-9.5-2 for the purpose of providing persons within the district with solid waste management service.

(b) The special taxing district is coterminous with the territory of the district. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-2 Solid waste management fees; imposition; schedules; notice and hearing; action to contest; use

Sec. 2. (a) The board:

(1) may; and

(2) if necessary to pay principal or interest on any bonds issued under this chapter, shall;

establish solid waste management fees in addition to fees imposed under IC 13-9.5-7 that apply to all persons owning real property benefited by waste collection, a facility for waste disposal, or a facility for waste processing. The board may change and readjust fees from time to time.

(b) The board may fix the solid waste management fees on the basis of the following:

(1) A flat charge for each residence or building in use in the waste management district.

(2) On weight or volume of the refuse received.

(3) On the average number of containers or bags of refuse received.

(4) On the relative difficulty associated with the collection or management of the solid waste received.

(5) On any other criteria that the board determines to be logically related to the service.

(6) On any combination of these criteria.

(c) The collection of the fees authorized by this section may be effectuated through a periodic billing system.

(d) The board may exercise reasonable discretion in adopting differing schedules of fees based upon variations in the following:

(1) The cost of furnishing the services included within this chapter to various classes of owners of property.

(2) The distance of the property benefited from the facility.

(3) Any other variations the board determines to be logically related to the cost of the service.

(e) Fees shall be established only after public notice and a public hearing before the board at which all persons using facilities or owning property benefited by solid waste management and other interested persons have an opportunity to be heard concerning the proposed fees. After adoption of the resolution fixing fees and before the resolution takes effect, public notice of the hearing, setting forth the schedule of fees, shall be given. The hearing may be adjourned from time to time. After the hearing the resolution establishing fees, either as originally passed or as amended, shall be passed and put into effect. A copy of the schedule of fees established shall be kept on file in the office of the board or the controller, secretary, or other recordkeeping officer of the district and shall be kept open to inspection by all interested persons. The fees established shall be extended to cover any additional territory later served that falls within the same class without the necessity of a hearing or notice. A change or readjustment of fees may be made in the same manner as the fees were originally established.

(f) An action to contest the validity of the fees adopted or the procedure by which they were adopted must be brought within thirty (30) days following the adoption of the fees under subsection (e).

(g) Fees imposed under this chapter may be used, together with any other revenues, to pay any of the following:

(1) The cost of facilities for solid waste management.

(2) The operation and maintenance of facilities.

(3) The charges that may be pledged to the payment of principal of and interest on waste management district or revenue bonds.

(h) If a fee established is not paid within the time fixed by the board, the amount, together with a penalty of ten percent (10%) and a reasonable attorney's fee, may be recovered in a civil action in the name of the district. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.16.*

13-9.5-9-3 Waste management district bonds; board resolution; written remonstrances; proceeds from sale of bonds; real property tax levy

Sec. 3. (a) The board may issue waste management district bonds under this section for the payment of the cost of the facility. Before authorizing the waste management district bonds, the board may either accept public bids for the facility or adopt a resolution approving a request for proposals under IC 13-9.5-8.

(b) When plans and specifications have been prepared according to the public bidding requirements of IC 36-1-12 or a resolution approving a request for proposals has been

adopted by the board, the board may adopt a resolution declaring that, upon investigation, the board has found it necessary for the public health and welfare, and of public utility and benefit, to construct, modify, or acquire, and maintain if constructed, the facility, and to acquire the property described for that purpose. The resolution shall be kept open to inspection by all persons interested in or affected by the acquisition of the property or the construction of the facility. Upon adoption of the resolution, the board shall give public notice of the adoption and the resolution's purpose. The notice must name a date not later than ten (10) days after the date of the last publication of the notice on which the board will receive or hear remonstrances from persons interested in or affected by the facility and will determine the public utility and benefit of the facility.

(c) At the time fixed for the hearing, or at any time before that, any person owning real or personal property within the district may file a written remonstrance with the board. At the hearing, which may be adjourned from time to time, the board shall hear all persons interested in the proceedings and all remonstrances filed. After considering the remonstrances, the board shall take final action determining the public utility and benefit of the proposed proceedings and confirm, modify and confirm, or rescind the resolution. The final action shall be duly recorded. This action is final and conclusive upon all persons, except that any person who has remonstrated in writing and who is aggrieved by the decision of the board may take an appeal as provided in subsection (d).

(d) A person who has filed a written remonstrance with the board as provided in subsection (c), if the board takes final action confirming the resolution in an original or modified form, is entitled to appeal to the circuit or superior court of the county in which the person resides. Within ten (10) days after the final action of the board, the remonstrator must file in the office of the clerk of the court a copy of the re[illegible] the board and the remonstrance [illegible] with a surety bond conditioned to p[illegible] of the appeal should the appeal be determined against the remonstrator. The only ground of remonstrance of which the court has jurisdiction on appeal is the question of whether it will be of public utility and benefit to construct, modify, or acquire the proposed facility. The burden of proof is upon the remonstrator. The cause shall be summarily tried by the court without a jury. All remonstrances upon which an appeal are taken shall be consolidated and heard as one (1) cause of action by the court, and the cause shall be heard and determined by the court within thirty (30) days after the time of filing the appeal. Upon the date fixed for hearing, the court [illegible] the remonstran[illegible] final action of the boa[illegible] the resolution or sustain the remonstrance.

(e) On adopting a resolution ordering the issuance of waste management district bonds, the board shall certify a copy of the resolution and a copy of the approval to the controller of the district, who shall prepare the bonds.

(f) The waste management district bonds are special obligations of the district and are not, in any respect [illegible]rporate obligation or indebtedness of t[illegible] comprise the district. The waste management district bonds issued under this section, and interest on the bonds, are payable out of a special tax levied upon all of the property of the district and any other revenues made available for that purpose under this chapter. The waste management district bonds must recite these terms on the face of the bonds together with the purpose for which the bonds are issued.

(g) All proceeds from the sale of waste management district bonds shall be kept as a separate and specific fund, to pay the cost of the facility, and no part of the proceeds may be used for any other purpose, except as provided in IC 5-1-13 and IC 5-1-14. However, money derived from sources other than the waste management district bond proceeds, such as state or federal grants or other contributions, are not restricted as to application even if the contribution arises for a project financed from waste management district bond proceeds.

(h) For the purpose of raising money to pay waste management district bonds issued under this section, the board shall levy each year a special tax upon all the real property of the district in the amount and the manner necessary to meet and pay the principal of the waste management district bonds as they severally mature, together with all accruing interest on them. The tax is declared to constitute the amount of benefits resulting to all of the property in the district.

(i) The tax levied each year shall be certified to the controller of the district and to the county auditor of each county within the district. The tax levied and certified shall be estimated and entered upon the tax duplicate by the county auditor and shall be collected and enforced by the county treasurer in the same manner as county taxes are estimated, entered, collected, and enforced. As the tax is collected by the county treasurer, the tax shall be transferred to the controller of the district, kept in a separate fund to be known as the waste management district bond fund, and applied to the payment of the principal of and interest on the waste management district bonds as the bonds become due and to no other purpose, except as provided in IC 5-1-13 and IC 5-1-14.

(j) In fixing the amount of the necessary levy the board shall consider the amount of net revenues, if any, to be derived from the collection of fees under this chapter or any other net revenues collected under this chapter. Instead of making the levy or to reduce the amount of the levy, the board shall annually set aside by resolution the amount of the net revenues to be collected before maturity of the principal and interest of the waste management district bonds payable in the following calendar year. If the board adopts this resolution, the board may not use any part of the amount set aside out of the net revenues for any purpose other than the payment of waste management district bonds and the interest on the bonds. A proportionate payment of this amount shall be made monthly to the waste management district bond fund.

(k) The district may not issue waste management district bonds under this section that are payable by special taxation or fees under section 2 of this chapter in a total amount, including outstanding bonds already issued, exceeding six percent (6%) of the net assessed valuation. All waste management district bonds issued in violation of this subsection are void. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.17.*

13-9.5-9-4 Revenue bonds

Sec. 4. (a) A board may finance the cost of facilities by borrowing money and issuing revenue bonds under this section.

(b) The issuance of revenue bonds must be authorized by a resolution of the board.

(c) The revenue bonds are special obligations of the district and are payable solely from and secured by a lien upon the revenues of all or part of the facilities whether or not the facilities are being financed with revenue bonds under this section, as shall be more fully described in the resolution authorizing the issuance of the revenue bonds. The resolution may pledge and assign for the security of the revenue bonds all or part of the revenues or net revenues of the facilities.

(d) The revenue bonds, and interest on them, are special obligations of the district and are not a debt of the board, the district, or the units that comprise the district, nor a charge, a lien, or an encumbrance, legal or equitable, upon the property of the board, the property of the district, or the revenues of the board or district other than the revenues of the facilities that have been pledged to the payment of the revenue bonds. Every revenue bond must recite in

substance that the revenue bond, including interest, is payable solely from the revenues pledged to the bond's payment, and that neither the board nor the district is under any obligation to pay the bond, except from those revenues.

(e) To adequately secure the payment of the revenue bonds and the interest on them, the district and its officers, agents, and employees shall provide for the covenants and do other acts and things that may be necessary, convenient, or desirable to secure the revenue bonds or that may tend to make the revenue bonds more marketable. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-5 Board's powers

Sec. 5. (a) A board may do the following:

(1) Enter into agreements concerning, and acquire by any lawful means, real property or interests in real and personal property needed for the purposes of this section.

(2) Enter into financing agreements to purchase, lease as lessee, construct, remodel, rebuild, enlarge, or substantially improve facilities.

(3) Lease facilities to users or developers with or without an option to purchase.

(4) Sell facilities to users or developers for consideration, which may be paid in installments or otherwise.

(5) Make direct loans to users or developers for the cost of acquisition, construction, or installation of facilities, including real property, machinery, or equipment, in which event the development bonds shall be secured by the pledge of one (1) or more bonds or other secured or unsecured debt obligations of the users or developers.

(6) Enter into agreements with users or developers to allow the users or developers to wholly or partially acquire, construct, or modify facilities to be acquired by the district.

(7) Issue waste management development bonds under this section to accomplish the purposes of this section and to secure payment of the development bonds as provided in this section.

(b) This section does not authorize the district's financing of facilities for a developer unless any agreement that exists between a developer and a user is fully disclosed to, and approved by, the board.

(c) A board may, from time to time, enter into negotiations with one (1) or more persons concerning the terms and conditions of financing facilities. Preliminary expenses in connection with negotiations may be paid from money furnished by the proposed user or developer, from grant money, or from funds of the board.

(d) The board shall hold a public hearing on the proposed financing of the facilities after giving public notice. Upon findings by the board that the proposed financing will be of benefit to the health or welfare of the district and that the proposed financing complies with the purposes and provisions of this chapter, the board shall, by resolution, approve the financing, including the form and terms of the financing agreement, the waste management development bonds, and the trust indenture, if any.

(e) If the board finds that the proposed financing will be of benefit to the health or welfare of the district and that the financing complies with the purposes and provisions of this section, the board may adopt a resolution approving the proposed financing. The resolution may also authorize the issuance of waste management development bonds payable solely from revenues and receipts derived from a financing agreement or from payments made under a guaranty agreement by a developer, user, or any other person. The waste management development bonds are not in any respect a general obligation of the district.

(f) A financing agreement must provide for payments in an amount not less than an amount sufficient to pay the principal of, premium, if any, and interest on the waste management development bonds authorized for the financing of the facilities. The term of a financing agreement may not exceed forty (40) years from the date of any waste management development bonds issued under the agreement. However, a financing agreement does not terminate after forty (40) years if a default under the agreement remains uncured, unless the termination is authorized under the terms of the financing agreement. If the district retains an interest in the facilities, the financing agreement must require the user or developer to pay all costs of maintenance, repair, taxes, assessments, insurance premiums, trustee's fees, and any other expenses relating to the facilities, so that the district will not incur any expenses on account of the facilities that are not covered by the payments provided for in the financing agreement.

(g) The district may advance all expenses, premiums, and commissions that the district considers necessary or advantageous in connection with the issuance.

(h) The district is exempt from all property taxes on facilities. Developers and users are liable for property taxes on facilities as provided by law. This section does not deny a tax exemption a developer or user may have under other laws because of the nature of the facilities or the user.

(i) The user or developer is responsible for obtaining and maintaining all approvals and permits required for the construction of the facilities under this section. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-6 Refunding of outstanding bonds

Sec. 6. If a board finds that a refunding of outstanding bonds would be of benefit to the health and welfare of the district and would comply with the purposes and provisions of this chapter, the board may authorize the issuance of b[illegible] [illegible]r IC 5-1-5 to refund outstanding bo[illegible] [illegible] with this chapter. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-7 Anticipation; use of proceeds

Sec. 7. (a) A district:

(1) pending receipt of any grant; or

(2) in anticipation of the issuance of bonds under this chapter;

may borrow money from any person and evidence the debt by a note or notes executed by the chairperson of the board and the controller of the district and containing the terms and provisions prescribed by the board.

(b) An[illegible]nce of a note or notes or evidence of indebtedness under this section may be sold at a public or private negotiated sale.

(c) A note or notes issued or renewed under this section must mature not more than five (5) years from the date of issuance of the original note and must pledge for the payment of the principal and interest the proceeds of the grant or bonds.

(d) The board shall apply the proceeds of any note or notes issued under this section to the cost of the facility for which the grant is to be made or bonds issued, but no purchaser of any obligations is liable for the proper application of the proceeds.

(e) Notes issued under this section must be approved by a resolution of the board. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.18.*

13-9.5-9-8 Bonds; terms; sale

Sec. 8. (a) All bonds issued under this chapter may:

(1) be issued as serial or term bonds or as a combination of both;

(2) be executed and delivered by the district at any time and from time to time;

(3) bear the date or dates;

(4) bear the maximum interest rates, if fixed rates are used, or specify any manner in which the interest rate will be determined, if variable or adjustable rates are used;

(5) be redeemable before their stated maturities on the terms and conditions and at premiums as necessary or advisable;

(6) be issued in any denomination of not less than five thousand dollars ($5,000);

(7) be in a form, either book entry or registered, or both;

(8) carry registration conversion privileges;

(9) be payable in a medium of payment and at a place or places, which may be at any one (1) or more banks or trust companies within or outside Indiana;

(10) provide for the replacement of mutilated, destroyed, stolen, or lost bonds;

(11) be authenticated in a manner and upon compliance with conditions;

(12) establish reserves from the proceeds of the sale of bonds or from other funds, or both, to secure the payment of the principal and interest on the bonds issued under this chapter;

(13) establish reserves, from the proceeds of the sale of bonds or from other funds, or both, for extensions, enlargements, additions, replacements, renovations, and improvements to or for the facilities, and

(14) contain other terms and covenants;

as provided in the resolution of the board authorizing the bonds.

(b) The bonds issued under this chapter may mature at the time or times not to exceed forty (40) years.

(c) The bonds issued under this chapter may bear either the impressed or facsimile seal of the district and shall be executed by the manual or facsimile signature of the chairperson of the board and atte[illegible] the manual or facsimile signature of the district controller, as long as one (1) of these signatures is manual. However, any signatures may be facsimiles if the bonds are to be manually authenticated by a fiduciary.

(d) The bonds and the interest coupons appertaining to them, if any, issued under this chapter are valid and binding obligations of the district for all purposes in accordance with the terms of this chapter, notwithstanding that before delivery of the bonds and appertaining interest coupons, any of the persons whose signatures appear on the bonds and appertaining interest coupons have ceased to be officers of the district, as if the persons had continued to be officers of the district until after delivery.

(e) The bonds issued under this chapter, other than waste management district bonds issued under section 3 of this chapter, may be sold at publ[illegible]ivate sale for the price or prices that [illegible] provided in the resolution authorizing their issuance. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.19.*

13-9.5-9-9 Bonds secured by trust indenture

Sec. 9. The bonds issued under this chapter may be secured by a trust indenture between the district and a corporate trustee, which may be any national or state bank having its principal office in Indiana and having trust powers. The trust indenture or resolution under which the bonds are issued may do the following:

(1) Mortgage the land, interest in land, or the facilities on account of which the bonds are issued.

(2) Pledge the revenues or any other funds, or any part of them, to be received by the district.

(3) Contain the provisions for protecting and enforcing the rights and remedies of the

bondholders or lenders that may be considered reasonable, including covenants setting forth the duties of the district or board in relation to the construction of the facilities and the custody, safeguarding, application, and investment of all money received or to be received by the district on account of the facilities financed by the issuance of the bonds.

(4) Provide for the establishment of reserve funds from the bond proceeds or from other sources to the extent authorized.

(5) Set forth the rights and remedies of the bondholders and trust and provisions restricting the individual rights or actions of bondholders.

(6) Contain provisions regarding the investment of funds, sales, exchange or disposal of property, and the manner of authorizing and making of payments without regard to any general statute relating to these matters.

(7) Provide for the payment of the proceeds of the sale of bonds to the trustee, officer, bank, or depository that may be determined under the trust indenture, or resolution for their custody, and for the method of their disbursement, with the safeguards and restrictions that are determined.

(8) Provide for the appointment of a receiver by the circuit or superior court of the county under terms and conditions that are considered reasonable.

(9) Contain the other provisions that the district considers reasonable and proper for the security of the bondholders.

As added by P.L.10-1990, SEC.17.

13-9.5-9-10 Security exempt from registration

Sec. 10. A security issued in connection with a financing under this chapter, the interest on which is excludable from gross income tax, is exempt from the registration requirements of IC 23. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-11 Interest on bonds and notes; tax exemption

Sec. 11. All bonds, as well as grant and bond anticipation notes, issued under this chapter and the interest on them are exempt from taxation in accordance with IC 6-8-5. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-12 Revenues exempt from taxation

Sec. 12. All revenues received by the board or district under this chapter are exempt from all taxation. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-13 Methods of financing facilities

Sec. 13. The facilities, or any part of them, to be financed under this chapter may be financed by any combination of one (1) or more of the methods provided for in this chapter. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-14 Action to contest bonds; time requirement

Sec. 14. An action to contest the validity of the bonds or to prevent their issuance must be brought within thirty (30) days following the first publication of public notice of the adoption of the resolution authorizing the bonds. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-15 Chapter as full authority for issuance of bonds

Sec. 15. This chapter constitutes full authority for the issuance of bonds. No procedure, proceedings, publications, notices, consents, approvals, orders, acts, or things by a board, officer, commission, department, agency, or instrumentality of the state is required to issue bonds or to do any act or perform anything under this chapter except as prescribed by this chapter. The powers conferred by this chapter are in addition to, and not in substitution for, and the limitations imposed by this chapter do

not affect the powers conferred by any other statute. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-16 Exemption

Sec. 16. A facility owned, operated, or financed under this chapter, and the sale of byproducts from the facility are exempt from regulation under IC 8-1-2 and IC 8-1.5. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-17 Rights of holders of outstanding bonds

Sec. 17. The general assembly covenants and agrees with the holders of any bonds that as long as any bonds of a district issued under this chapter are outstanding and unpaid, the state:

(1) will not limit or alter the rights of the district to:

(A) acquire, construct, reconstruct, improve, enlarge, extend, own, operate, and maintain any project or interest in any project;

(B) establish, maintain, revise, charge, and collect the fees and taxes referred to in this chapter; and

(C) fulfill the terms of any agreements made with the holders of the bonds; and

(2) will not in any way impair the rights and remedies of the bondholders;

until the bonds, together with interest on the bonds, interest on any unpaid installment of interest, and all costs and expenses in connection with any action or proceedings by or on behalf of the bondholders, are fully paid, met, and discharged. *As added by P.L.10-1990, SEC.17.*

13-9.5-9-18 Chapter supplemental to other statutes

Sec. 18. This chapter is supplemental to all other statutes covering the acquisition, construction, modification, use, and maintenance of facilities for solid waste disposal by a district. *As added by P.L.10-1990, SEC.17.*

Chapter 10 District Planning Revolving Loans

13-9.5-10-1 District planning revolving loan fund; establishment

Sec. 1. (a) The district planning revolving loan fund is established for the purpose of providing loans to solid waste management districts under this chapter for the preparation of the district plans required by IC 13-9.5-4. The fund shall be administered by the department of environmental management.

(b) The fund consists of appropriations from the state general fund or any fund, loan repayment made under this chapter, any gifts or donations to the fund, and any interest accruing to the fund. The expenses of administering the fund shall be paid from money in the fund.

(c) The treasurer of state shall invest the money in the fund not currently needed to meet the obligations of the fund in the same manner as other public funds may be invested.

(d) Money in the fund at the end of a fiscal year does not revert to the state general fund. *As added by P.L.10-1990, SEC.17.*

13-9.5-10-2 Application for loan

Sec. 2. (a) A district may apply for a loan under this chapter by filing an application with the department on or before January 1, 1993.

(b) The contents of the application must include the following:

(1) The name, if any, of the district.

(2) The county or counties that comprise the district.

(3) The name and mailing address of the controller of the district.

(4) The names and addresses of the members of the board of directors of the district.

(5) A description of the methodology to be used by the district in the preparation of its district plan.

(6) The estimated cost for preparation of the district plan.

(7) Alternative funding sources, if any, that the district proposes to use to pay for the district plan.

(8) The location of any final disposal facilities in the district.

(9) Information on any other factors that the department considers relevant and requires in the application.

(c) The department shall prescribe an application form to be used by districts seeking loans under this chapter. *As added by P.L.10-1990, SEC.17. Amended by P.L.33-1992, SEC.20.*

13-9.5-10-3 Maximum amount of loan

Sec. 3. The maximum loan that may be made under this chapter is as follows:

(1) Twenty thousand dollars ($20,000) to a county district.

(2) Twenty thousand dollars ($20,000) multiplied by the number of participating counties in the district to a joint district.

As added by P.L.10-1990, SEC.17.

13-9.5-10-4 Criteria for making loans

Sec. 4. (a) In making loans under this chapter, the department shall consider the following factors:

(1) Whether a final disposal facility is located within a district.

(2) If a final disposal facility is located within the district, whether the district has imposed a final disposal fee under IC 13-9.5-7.

(3) The size of the district.

(4) The population of the district.

(5) Any other factors the department considers relevant.

(b) Priority shall be given to districts that do not contain a final disposal facility. *As added by P.L.10-1990, SEC.17. Amended by P.L.1-1991, SEC.113.*

13-9.5-10-5 Repayment

Sec. 5. A loan made under this chapter may be repaid with revenue from fees imposed under IC 13-9.5-6 or from any revenue or combination of revenue available to the district. A loan may be made to the district by the adoption of a resolution by the district and execution of a note payable to the department without complying with any other statutory procedures. *As added by P.L.10-1990, SEC.17.*

13-9.5-10-6 Rules; rate of interest; terms of repayment

Sec. 6. The department shall adopt rules under IC 4-22-2, including emergency rules under IC 4-22-2-37.1 to administer this chapter. The department shall, after consultation with the state board of finance, establish a rate of interest and terms of repayment for any loan made under this chapter. *As added by P.L.10-1990, SEC.17. Amended by P.L.1-1991, SEC.114.*

13-9.5-10-7 Expiration of chapter

Sec. 7. This chapter expires June 30, 1993. *As added by P.L.10-1990, SEC.17.*

Chapter 11. Solid Waste Management Reporting

13-9.5-11-1 Certification of origin; determination of weight of waste

Sec. 1. (a) After June 30, 1990, a solid waste hauler that takes solid waste to a transfer station or a final disposal facility located in Indiana shall certify to the owner or operator of the transfer station or final disposal facility the county and state of origin of the largest part of the solid waste by weight. If a transfer station or a final disposal facility does not have a scale suitable for weighing the solid waste received at the transfer station or final disposal facility, the following conversion factors shall be used to determine the weight of the solid waste by conversion from the volume of the solid waste:

(1) Three and three-tenths (3.3) cubic yards of compacted solid waste equals one (1) ton of solid waste.

(2) Six (6) cubic yards of uncompacted solid waste equals one (1) ton of solid waste.

(b) The owner or operator of a transfer station or final disposal facility who receives certified statements under subsection (a) shall do the following:

(1) Retain the statements for one (1) year.

(2) File quarterly reports with the department that state the county and state of origin of the largest part of the solid waste by weight received at the facility during the reporting period.

As added by P.L.10-1990, SEC.17. Amended by P.L.130-1991, SEC.33.

13-9.5-11-2 Record of origin

Sec. 2. (a) After June 30, 1990, a solid wa hauler that collects solid waste in Indiana takes the solid waste to a transfer station final disposal facility outside Indiana sh maintain records for at least one (1) year t identify, for each shipment, the county state of origin of the largest part of the s waste by volume.

(b) Each solid waste hauler who is requi to maintain records under subsection (a) sh file quarterly reports with the department th state the location of each out-of-state trans station or final disposal facility and identify t volume of solid waste from each county a state taken to the transfer station or final di posal facility during the reporting period. *A added by P.L.10-1990, SEC.17. Amended P.L.130-1991, SEC.34.*

13-9.5-11-3 Certification of origin

Sec. 3. A hauler required to make a certifica tion or report under section 1 or 2 of this chap ter concerning the origin of the solid waste tha did not collect the solid waste at the point o origin may satisfy the requirements of section 1 and 2 of this chapter concerning a certifica tion or report of origin of the solid waste b presenting a certification from the owner o operator of the facility at which the solid wast was picked up that indicates the county an state of origin of the largest part of the soli waste. The department shall establish proce dures that allow the use of average figures i making the certification. *As added b P.L.10-1990, SEC.17.*

13-9.5-11-4 Applicability of chapter

Sec. 4. The requirements of sections 1 and 2 of this chapter do not apply to haulers and owners or operators engaged in transporting or disposing of solid waste that is:

(1) generated by a person; and

(2) disposed of at a site that is:

(A) owned by that person; and

(B) limited, for the purposes of the disposal of solid waste, to use by that person for the disposal of solid waste generated by that person.

As added by P.L.10-1990, SEC.17.

13-9.5-11-5

Sec. 5. The solid waste management board shall adopt rules under IC 4-22-2 to implement this chapter. *As added by P.L.10-1990, SEC.17.*

TITLE 14

RECREATION AND LAND MANAGEMENT

ARTICLE 1. WATERCRAFT AND RECREATIONAL VEHICLES

Chapter 1. Watercraft Operation

14-1-1-6 Motorboats; muffler or underwater exhaust; exemption of racing boats during competition; muffler cutout or bypass prohibited

Sec. 6. (a) It is unlawful for any person to operate a motorboat on the waters of this state unless said boat motor is equipped with a muffler, an underwater exhaust, or other device which [illegible] suppresses the sound of the exhaust [illegible] to prevent excessive and unusual noise at all speeds. However, this section does not apply to any motorboat competing in and during any motorboat race for which a permit has been issued by the department.

(b) It is unlawful for a person to operate a motorboat on Indiana waters if the boat motor is equipped with:

(1) a muffler cutout;

(2) a bypass; or

(3) any device similar to a muffler cutout or bypass.

(Formerly: Acts 1957, c.221, s.6). As amended by Acts 1977, P.L.151, SEC.1; P.L.132-1991, SEC.1.

14-1-1-23 Speed; night; restrictions applicable to certain boundary lakes

Sec. 23. (a) Subject to subsection (b), a person may not operate a boat during the period between sunset and sunrise at a rate of speed greater than ten (10) miles per hour.

(b) This subsection applies only to lakes of more than four hundred (400) acres but less than one thousand (1,000) acres lying on the boundary of Indiana and another state. Between 6:30 p.m. and 10 a.m., a person may not:

APPENDIX T

Draft Technical Manual

for

Solid Waste Disposal Facility Criteria -

40 CFR Part 258

U.S. Environmental Protection Agency
April, 1992

INTRODUCTION

Purpose Of This Manual

This technical manual presents information and examples of alternative methods and procedures to assist municipal solid waste landfill (MSWLF) owners and operators achieve compliance with the revised MSWLF Criteria, promulgated on October 9, 1991 in Chapter 40, Part 258, of the *Code of Federal Regulations* (CFR). This manual is not a regulatory document, and does not provide mandatory technical guidance, but does provide assistance in coming into compliance with the technical aspects of the revised landfill Criteria. This document is intended for use primarily by landfill owners/operators and their consultants and contractors providing advice on demonstrating compliance with the Part 258 standards.

Implementation Of The Landfill Criteria And Use Of This Manual

The Environmental Protection Agency (EPA) fully intends that States and Indian Tribes will maintain the lead role in implementing and enforcing the revised MSWLF criteria through State/Tribal permit programs. The State/Tribal Implementation Rule (STIR), to be codified in 40 CFR Part 239, will establish procedures for States/Tribes to follow in preparing and submitting applications to EPA for adequacy determinations. The State/Tribal Implementation Rule will provide a framework that will allow States/Tribes flexibility in individual program structure while requiring that States/Tribes have the necessary authority to ensure that MSWLFs comply with 40 CFR Part 258.

States and Tribes may be in various stages of the program approval process. Some may have received full program approval, others may have received "partial" program approval (i.e., only some portions of the State/Tribal program are approved while the remainder of the program is pending approval), while still others may have submitted a schedule for approval. Of course, some States/Tribes may have been deemed inadequate or may not seek approval at all. EPA recommends that owners/operators keep abreast of the approval status of their State programs.

The Part 258 criteria were written to be largely self-implementing for owners/operators located in States/Tribes that have not received full program approval. There is no Federal permitting program to interact with owners/operators self-implementing the Part 258 criteria. In the event than an owner/operator's State/Tribe has not received full program approval, this manual may be helpful to assist owners/operators in this self-implementing mode.

Landfill owners/operators must comply with the revised Criteria on the effective date, which is October 9, 1993, for most of the Part 258 provisions. [The effective date for the financial responsibility requirements is April 9, 1994, and the ground-water monitoring requirements are phased-in over a period of several years, 1994-1996.] Regardless of a State's/Tribe's program approval status, landfill owners/operators must be prepared to come into compliance on this date. It is important to note that any State/Tribal landfill regulations and the Federal Criteria will be effective concurrently. Where State/Tribal programs are more stringent than the Federal Criteria, the owner/operator would need to follow the more stringent requirements. This Manual is based on the Federal Criteria; therefore, the reader should understand that their approved State/Tribal program requirements may differ from those described here.

States/Tribes have considerable motivation to seek program approval because additional flexibility is provided to States/Tribes that are approved. For example, an approved State/Tribe can specify an alternative liner design as long as it meets the performance standard provided in the final MSWLF rule. In unapproved States/Tribes, a landfill owner/operator constructing a new landfill unit or lateral expansion of an existing unit must install a composite liner as specified in the final rule. [A "petition process" does exist for owners/operators in unapproved States/Tribes desiring to use a design other than the composite liner. See Section 4.5 of this Manual for further information.] Because States/Tribes applying for EPA approval must demonstrate that their program ensures compliance with the Part 258 Criteria, this document may be helpful as they revise their landfill programs to reflect the new Criteria. However, States/Tribes are urged to work closely with their Regional EPA Office as they develop program approval applications.

In addition, State regulatory personnel likely will find this document helpful when reviewing permit applications for landfills. This manual presents technical information to be used in designing, operating, and closing landfills, but does not present a mandatory approach for demonstrating compliance with the revised Criteria. This Manual also outlines the types of information necessary to make the demonstrations allowed in the Criteria, including demonstrations for restricted locations and alternative designs in approved States/Tribes.

How To Use This Manual

The organization of this document follows the general order of the Criteria and is subdivided into six Chapters. The first chapter deals with general applicability of the Part 258

Criteria, the second with location restrictions, the third with operating requirements, the fourth with design standards, the fifth with ground-water monitoring and corrective action, and the sixth with closure and post-closure care. Each chapter contains a general introduction to that section of the Criteria.

Within each chapter, the Criteria have been subdivided into smaller segments. The *Statement of Regulation* section provides a verbatim recital of the regulatory language. The second section, the *Applicability* section, provides a general explanation of the regulations and who must comply. Finally, for each segment of the regulation, a *Technical Considerations* section is provided that identifies key technical issues that may need to be addressed to ensure compliance with a particular requirement. Each chapter ends with a section entitled *Further Information* that provides references, addresses, organizations, and other information that may be of use to the reader. A list of acronyms and a glossary is provided for terms that may be unfamiliar to the reader. [This document does not include a section on the financial responsibility requirements; questions regarding these requirements may be addressed to the RCRA/Superfund Hotline (800-424-9346).]

Limitations Of This Manual

The ability of this document to provide current guidance is limited by the technical literature available at the time of preparation. The rate at which technology and product development are advancing is on a notable increase, especially in the areas of geosynthetic materials and design concepts. As experience with new waste management techniques expands in the engineering and science community, an increase in published literature, research, and technical information also will occur. The owners and operators of MSWLFs are encouraged to keep abreast of innovation through technical journals, professional organizations, and technical information developed by the U.S. EPA. Many of the Criteria contained in Part 258 are performance-based. Future innovative technology may provide additional means for owners/operators to meet these performance standards in more cost-effective ways or to meet standards that previously could not be met by a particular facility due to site-specific conditions.

1.0
SUBPART A
GENERAL

1.1 INTRODUCTION

Under the authority of both the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, and Section 405 of the Clean Water Act, the EPA published revised municipal solid waste landfill (MSWLF) criteria in the Federal Register on October 9, 1991. Part 258 was established to provide minimum national criteria for all solid waste landfills that:

- Receive municipal solid waste,
- Accept nonhazardous municipal combustor ash, or
- Co-dispose sewage sludge with municipal solid waste; and
- Are not regulated under Subtitle C of RCRA.

Part 257 remains in effect for all other solid waste facilities and practices.

Subpart A of the regulations defines the purpose, scope, and applicability of Part 258 and provides definitions necessary for proper interpretation of the requirements. In summary, the applicability of the Criteria is dependent on the operational status of the MSWLF unit relative to the date of publication of Part 258 and the effective date of the rule (October 9, 1993). An exemption from design and ground-water monitoring requirements is provided for small MSWLFs if specific operating, environmental, and location conditions are present. Owners or operators of MSWLFs that do not meet the Part 258 Criteria will be considered to be engaging in the practice of "open dumping" in violation of Section 4005 of RCRA. Similarly, owners and operators of MSWLFs that receive sewage sludge and do not comply with these criteria will also be in violation of applicable sections of the Clean Water Act.

1.2 PURPOSE, SCOPE, AND APPLICABILITY
40 CFR §258.1 (a) (b)

1.2.1 Statement of Regulation

(a) The purpose of this part is to establish minimum national criteria under the Resource Conservation and Recovery Act (RCRA or the Act), as amended, for all municipal solid waste landfill (MSWLF) units and under the Clean Water Act, as amended, for municipal solid waste landfills that are used to dispose of sewage sludge. These minimum national criteria ensure the protection of human health and the environment.

(b) These Criteria apply to owners and operators of new MSWLF units, existing MSWLF units, and lateral expansions, except as otherwise

specifically provided in this part; all other solid waste disposal facilities and practices that are not regulated under Subtitle C of RCRA are subject to the criteria contained in Part 257.

1.2.2 Applicability

Owners and operators of MSWLF units that receive municipal solid waste and are not currently regulated under Subtitle C of RCRA must comply with the Criteria. Furthermore, MSWLF units which receive and co-dispose sewage sludge must comply with Part 258 to be in compliance with sections 309 and 405(e) of the Clean Water Act.

1.2.3 Technical Considerations

Criteria that define a solid waste disposal facility are contained within Part 257 of RCRA (Criteria for Classification of Solid Waste Disposal Facilities and Practices). Definitions pertaining to the revised criteria are included in the definition section of Part 257. A MSWLF unit is defined as a discrete area of land or excavation that receives household waste, and is not considered a land application unit, surface impoundment, injection well, or waste pile as those terms are defined under §257.2. An existing unit is a solid waste disposal unit that is receiving solid waste as of October 9, 1993. A lateral expansion is a horizontal expansion of the waste boundaries of an existing MSWLF unit (Figure 1-1). A new unit is a MSWLF unit that has not received waste before the effective date of Part 258.

In addition to household waste, a MSWLF unit may receive solid waste streams from nonmanufacturing commercial facilities, non-hazardous solid waste from industrial facilities including non-hazardous sludges and sewage sludge from waste water treatment plants. The terms commercial solid waste, industrial waste and household waste are explicitly defined in §258.2 (Definitions).

The types of landfills regulated under Part 257 are those facilities that receive:

- Construction and demolition debris;
- Yard waste for compost only;
- Tires only; and
- Sewage sludge monofills.

Sewage sludge co-disposal is regulated by Part 258 standards.

Subtitle D landfills are not intended nor allowed to receive hazardous wastes. Should a MSWLF discover that a shipment contains hazardous waste, while still in the possession of the transporter, it should refuse to accept the waste from the transporter. If a MSWLF discovers that a shipment contains hazardous waste after accepting the waste from the transporter, the MSWLF must return the shipment or manage the wastes in accordance with RCRA Subtitle C requirements (unless the waste is exempt household hazardous waste or waste received from conditionally exempt small quantity generators).

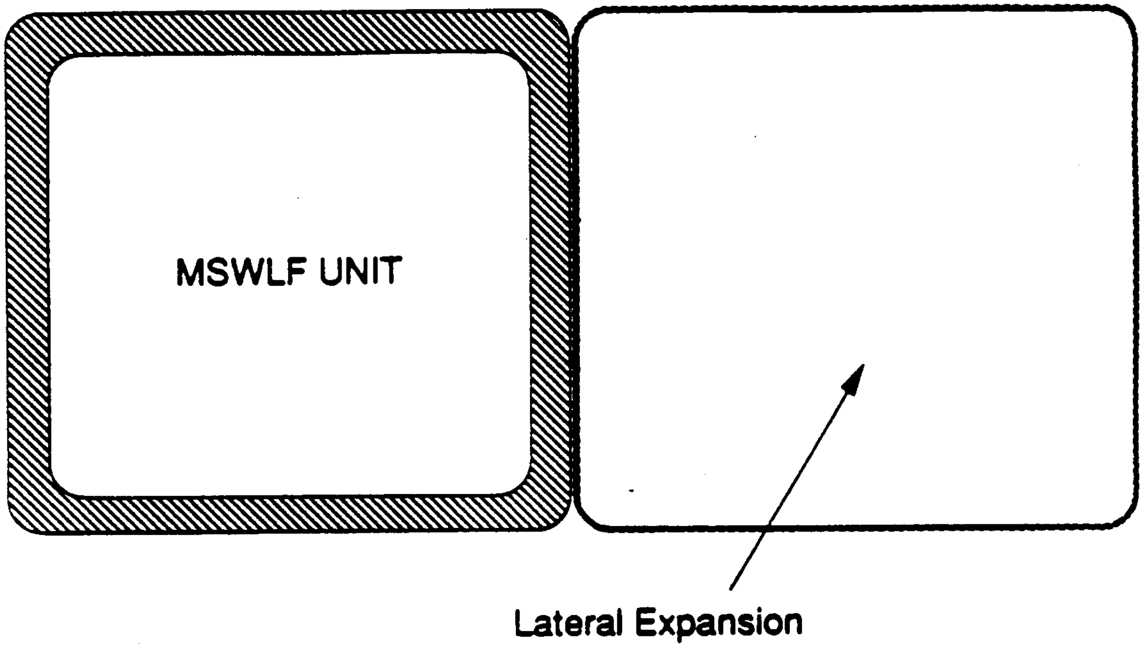


Figure 1.1
Lateral Expansion

Subtitle C of RCRA establishes procedures for making a hazardous waste determination. These procedures are summarized in Section 3.0 and Appendix B of this document.

1.3 PURPOSE, SCOPE, AND APPLICABILITY (cont.) 40 CFR §258.1 (c)-(e)

1.3.1 Statement of Regulation

(c) These Criteria do not apply to municipal solid waste landfill units that do not receive waste after October 9, 1991.

(d) MSWLF units that receive waste after October 9, 1991 but stop receiving waste before October 9, 1993 are exempt from all the requirements of Part 258, except the final cover requirement specified in Section 258.60(a). The final cover must be installed within six months of last receipt of wastes. Owners or operators of MSWLF units described in this paragraph that fail to complete cover installation within this six month period will be subject to all the requirements of Part 258, unless otherwise specified.

(e) All MSWLF units that receive waste on or after October 9, 1991 must comply with all requirements of Part 258 unless otherwise specified.

1.3.2 Applicability

The applicability of Part 258, in its entirety or with exemptions to specific requirements, is based upon the operational status of the MSWLF unit relative to the date of publication, October 9, 1991, or the effective date of the rule, October 9, 1993 (See Figure 1-2). Three possible scenarios exist:

(1) The MSWLF unit received its last load of waste prior to October 9, 1991. These facilities are exempt from all requirements of the Criteria.

(2) The last load of waste was received after October 9, 1991, but before October 9, 1993. The owners and operators must comply only with the final cover requirements of §258.60(a). If the final cover is not installed within six (6) months of the last receipt of wastes, the owners and operators will be required to comply with all requirements of Part 258 unless specified otherwise by the Director of an approved State.

(3) The MSWLF unit continues to receive waste after October 9, 1993. The owners or operators must comply with all requirements of Part 258, except where specified otherwise.

1.3.3 Technical Considerations

For MSWLF units that receive the last load of waste between the effective date and the date of publication of the Criteria, closure must be completed within six months of the last receipt of waste. Closure requirements are specified in Subpart F; however, the closure criteria of §258.60(a) are the only requirements these MSWLF units will be subject to unless they fail to complete closure within the six month period. The alternative cover design is not an option for MSWLFs in unapproved states that stop receiving waste between the publication and effective dates of the final rule and are closed within six months of the final receipt of waste.

The final cover system must consist of an erosion layer underlain by an infiltration layer. The erosion layer must be at least six inches in thickness and capable of sustaining native plant growth. The infiltration layer, which is designed to minimize infiltration into the waste, must have a hydraulic conductivity less than or equal to the permeability of the bottom liner system, the natural subsoils or a permeability no greater than 1 x 10^{-5} cm/sec, whichever is less. Technical considerations for the cover requirements under §258.60(a) are provided in Section 6.0 of this document.

1.4 SMALL LANDFILL EXEMPTIONS 40 CFR §258.1 (f)

1.4.1 Statement of Regulation

(f)(1) Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions that dispose of less than twenty (20) tons of municipal solid waste daily, based on an annual average, are exempt from subparts D and E of this Part, so long as there is no evidence of existing ground-water contamination from the MSWLF unit and the MSWLF unit serves:

(i) A community that experiences an annual interruption of at least three consecutive months of surface transportation that prevents access to a regional waste management facility, or

(ii) A community that has no practicable waste management alternative and the landfill unit is located in an area that annually receives less than or equal to 25 inches of precipitation.

(2) Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions that meet the criteria in (f)(1)(i) or (f)(1)(ii) must place in the operating record information demonstrating this.

(3) If the owner or operator of a new MSWLF unit, existing MSWLF unit, or lateral expansion has knowledge of ground-water contamination resulting from the unit that has asserted the exemption in (f)(1)(i) or (ii), the owner or operator must notify the State Director of such contamination and, thereafter, comply with Subparts D and E of this Part.

1.4.2 Applicability

The exemption to Subpart D (Design) and Subpart E (Ground-Water Monitoring and Corrective Action) is applicable only to owners or operators of landfills that receive, on average, less than 20 tons of solid waste per day. The exemption is allowed only if it can be demonstrated that ground-water contamination has not occurred at the MSWLF unit. In addition, the MSWLF must serve a community that meets one of the following two conditions:

- For at least three consecutive months of the year, municipal solid waste cannot be transported by rail, truck, or ship to a regional waste management facility; or

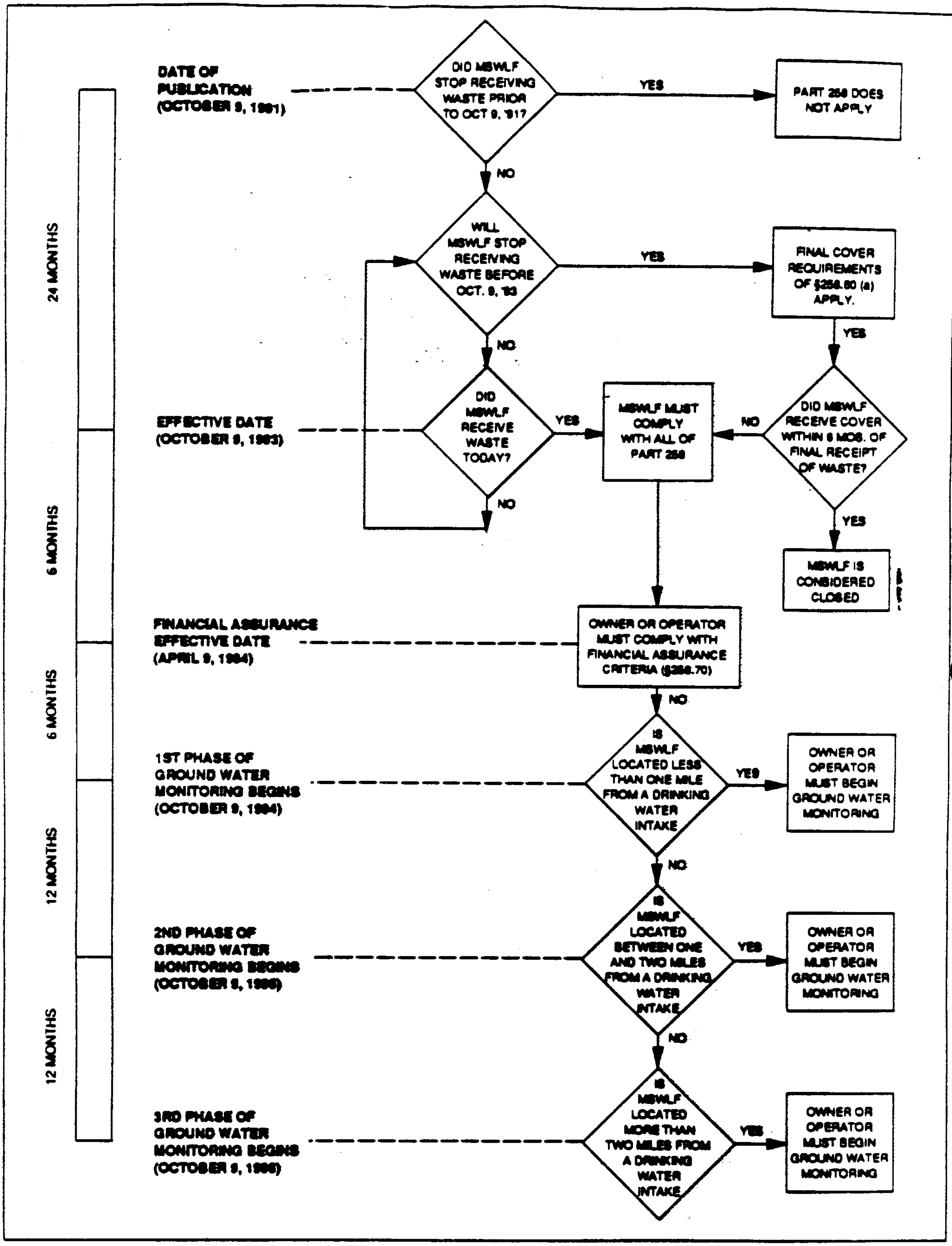


FIGURE 1-2
APPLICABILITY FLOW CHART

- There is no practicable alternative for managing wastes, and the landfill is located in an area that receives less than 25 inches of annual precipitation.

If either of the above two conditions are met, and there is no evidence of existing ground-water contamination, the landfill owner or operator is eligible for the exemption from the design, ground-water monitoring, and corrective action requirements. The owner or operator must place information documenting eligibility for the exemption in the facility's operating record. Once an owner or operator can no longer demonstrate compliance with the conditions of the exemption, the MSWLF facility must comply with Subparts D and E.

1.4.3 Technical Considerations

The weight criterion, 20 tons, does not have to be based on actual measurements but rather should be an annual average. The weighing program can be based on weight or volume estimates. If the daily waste receipt records, which include load weights, are not available for the facility, waste volumes can be estimated. Waste weights may be determined by counting the number of trucks and estimating an average weight for each.

To determine the daily waste received, an average may be used. If the facility is not open on a daily basis the average number should reflect that fact. For example, if a facility is open four days per week (208 days/year) and accepts 25 tons each day, then the average daily amount of waste received can be calculated as follows:

Average Daily Waste Calculation

4 days/week x 52 weeks/year = 208 days/year; and

25 tons/day x 208 days/year = 5200 tons/year; then

5200 tons/year ÷ 365 days/year = 14.25 tons/day.

The facility would meet the criteria for receiving less than 20 tons per day.

Compliance with the 20 tons per day criterion should be based on all waste received, including household waste and agricultural or industrial wastes. As defined in the regulations, household waste includes any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

The exemption from Subparts D and E requires that there be "no evidence of existing ground-water contamination" as a condition for eligibility. Evidence of contamination may include detected, or known, contamination of nearby drinking water wells or physical evidence such as stressed vegetation.

One of two other conditions must be present for the exemption to apply. The first of these conditions is interruption in transportation. For example, some rural villages in Alaska may be restricted from transporting wastes to a regional facility due to extreme winter climatic conditions.

These villages would find it impossible to transport wastes to a regional waste facility for at least three months out of the year due to snow and ice accumulation.

The second condition is comprised of two requirements: (1) the lack of a practical waste management alternative and (2) a location that receives little rainfall. For example, there are small rural communities, especially in the western part of the United States, that are located great distances from the nearest towns making regionalization of waste management very difficult. Additionally, many of these communities are located in arid areas that receive 25 inches or less of precipitation, which reduces the likelihood of ground-water contamination because of reduced leachate generation and contaminant migration. Rainfall information can be obtained from the National Weather Service, the National Oceanographic and Atmospheric Administration (NOAA), and the USGS Water Atlases.

1.5 APPLICABILITY 40 CFR §258.1 (g)-(j)

1.5.1 Statement of Regulation

(g) Municipal solid waste landfill units failing to satisfy these criteria are considered open dumps for purposes of State solid waste management planning under RCRA.

(h) Municipal solid waste landfill units failing to satisfy these criteria constitute open dumps, which are prohibited under Section 4005 of RCRA.

(i) Municipal solid waste landfill units containing sewage sludge and failing to satisfy these Criteria violate sections 309 and 405(e) of the Clean Water Act.

(j) The effective date of this part is October 9, 1993, unless otherwise specified.

1.5.2 Applicability

All MSWLF facilities that receive waste on or after the effective date must comply with all of Part 258 except where otherwise noted. MSWLF facilities that fail to comply with the Part 258 criteria will be in violation of Section 4005 of RCRA and with Sections 309 and 405(e) of the Clean Water Act if the facility receives sewage sludge.

1.5.3 Technical Considerations

Failure to comply with the Part 258 criteria will result in a MSWLF being categorized as an open dump under Section 4005 of RCRA. The practice of operating an open dump is prohibited. In instances where EPA has determined that a State does not have a program adequate to implement and enforce the revised Criteria, EPA can enforce the Part 258 provisions.

Under Section 4005(c) of RCRA, each state is required to adopt and implement a permit program by the effective date of the Criteria. The permit program will be used to assess compliance of MSWLF units with Part 258. The rules are intended to be self implementing so that owners/operators can comply without State and EPA involvement. Specific self-implementing requirements are easy for the owner/operator to interpret and citizens to enforce through citizen suits. For certain provisions, performance standards have been established that the owner/operator must meet. In many cases third parties must certify and document the decisions made or action taken to satisfy the performance criteria. The certification must be placed in the operating record and made available to the State upon request. This responsibility is the obligation of the owners or operators of the MSWLF facility, until such time as the State has implemented an EPA-approved program.

If a MSWLF unit co-disposes sewage sludge with municipal solid waste and fails to comply with Part 258, it will also be in violation of Section 405(e) of the Clean Water Act (CWA), which requires that sewage sludge be disposed of in accordance with regulations established for such disposal. If found to be in violation, owners or operators may be liable for both civil and criminal actions enforced under Section 309 of the Clean Water Act.

1.6 DEFINITIONS
40 CFR §258.2

1.6.1 Statement of Regulation

Unless otherwise noted, all terms contained in this part are defined by their plain meaning. This section contains definitions for terms that appear throughout this Part; additional definitions appear in the specific sections to which they apply.

Active life means the period of operation beginning with the initial receipt of solid waste and ending at completion of closure activities in accordance with §258.60 of this Part.

Active portion means that part of a facility or unit that has received or is receiving wastes and that has not been closed in accordance with §258.60 of this Part.

Aquifer means a geological formation, group of formations, or portion of a formation capable of yielding significant quantities of ground water to wells or springs.

Commercial solid waste means all types of solid waste generated by stores, offices, restaurants, warehouses, and other nonmanufacturing activities, excluding residential and industrial wastes.

Director of an approved State means the chief administrative officer of the State agency responsible for implementing the State municipal solid waste permit program or other system of prior approval that is deemed to be adequate by EPA under regulations published pursuant to section 4005 of RCRA.

Existing MSWLF unit means any municipal solid waste landfill unit that is receiving solid waste as of the effective date of this Part. Waste placement in existing units must be consistent with past operating practices or modified practices to ensure good management.

<u>Facility</u> means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of solid waste.

<u>Ground water</u> means water below the land surface in a zone of saturation.

<u>Household waste</u> means any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas).

<u>Industrial solid waste</u> means solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle C of RCRA. Such waste may include, but is not limited to, waste resulting from the following manufacturing processes: Electric power generation; fertilizer/agricultural chemicals; food and related products/by-products; inorganic chemicals; iron and steel manufacturing; leather and leather products; nonferrous metals manufacturing/foundries; organic chemicals; plastics and resins manufacturing; pulp and paper industry; rubber and miscellaneous plastic products; stone, glass, clay, and concrete products; textile manufacturing; transportation equipment; and water treatment. This term does not include mining waste or oil and gas waste.

<u>Lateral expansion</u> means a horizontal expansion of the waste boundaries of an existing MSWLF unit.

<u>Leachate</u> means a liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste.

<u>Municipal solid waste landfill unit</u> means a discrete area of land or an excavation that receives household waste, and that is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined under §257.2. A MSWLF unit also may receive other types of RCRA Subtitle D wastes, such as commercial solid waste, nonhazardous sludge, and industrial solid waste. Such a landfill may be publicly or privately owned. A MSWLF unit may be a new MSWLF unit, an existing MSWLF unit or a lateral expansion.

<u>New MSWLF unit</u> means any municipal solid waste landfill unit that has not received waste prior to the effective date of this Part.

<u>Open burning</u> means the combustion of solid waste without:

(1) Control of combustion air to maintain adequate temperature for efficient combustion,

(2) Containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion, and

(3) Control of the emission of the combustion products.

<u>Operator</u> means the person(s) responsible for the overall operation of a facility or part of a facility.

<u>Owner</u> means the person(s) who owns a facility or part of a facility.

Run-off means any rainwater, leachate, or other liquid that drains over land from any part of a facility.

Run-on means any rainwater, leachate, or other liquid that drains over land onto any part of a facility.

Saturated zone means that part of the earth's crust in which all voids are filled with water.

Sludge means any solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility exclusive of the treated effluent from a wastewater treatment plant.

Solid waste means any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. 1342, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).

State means any of the several States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Marianas Islands.

State Director means the chief administrative officer of the State agency responsible for implementing the State municipal solid waste permit program or other system of prior approval.

Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

Waste management unit boundary means a vertical surface located at the hydraulically downgradient limit of the unit. This vertical surface extends down into the uppermost aquifer.

1.6.2 Applicability

The definitions are applicable to all new, existing, and lateral expansions of existing MSWLF facilities regulated under 40 CFR §258. Additional definitions are provided within the body of the regulation language and will apply to those particular subsections. Definitions in Subpart A apply to all sections of Part 258.

1.6.3 Technical Considerations

Selected definitions will be discussed in the following brief narratives.

Approved State: Section 4005(c) of RCRA requires that each state adopt and implement a state permit program. EPA is required to determine whether the state has developed an adequate program; a separate rulemaking will be developed for this purpose. Once the state program has been approved, the state will have the primary responsibility for implementation and enforcement of the Criteria. EPA will have the authority to enforce the Criteria in states where EPA has denied program approval.

Aquifer: An aquifer is a formation or group of formations capable of yielding a significant amount of ground-water to wells or springs. To be an aquifer a formation must contain inter-connected pores or open spaces (interstices) that are filled with water and are large enough to transmit water to wells at a useful rate. An unconfined aquifer is one where the water table is exposed to the atmosphere through openings in the overlying geologic formations. A confined aquifer is isolated from the atmosphere at the discharge point by impermeable geological units. A confined aquifer has relatively impermeable beds above and below.

Existing unit: Any MSWLF that is receiving solid waste as of the effective date of the Criteria must continue to operate the facility in a manner that is consistent with both past operating practices and modified practices that continue or improve good waste management. Changes in operating practices intended to circumvent the purpose, intent or applicability of any portions Part 258 will not be considered in conformance with the Criteria. In other words, facilities spreading a thin layer of waste over essentially unused new units will not be exempt from the requirements for new units. The portion of a facility that is considered to be an existing unit will include the waste management unit(s) receiving waste prior to the effective date of Part 258. Existing units may expand vertically to address short-term capacity needs.

Lateral expansion: Any horizontal expansion of the waste boundary of a unit is a lateral expansion. This term is dependent on the definition of existing unit. Expansions to the existing unit have to be consistent with past operating procedures or operating practices to ensure good management. The variability of different state requirements necessitated defining the terms as such. A landfill permitted as an area comprised of several units, including areas not receiving wastes, is not an existing unit for this part. Lateral expansion of smaller units in a large permitted area would not be protective of human health and the environment. Spreading wastes over a large area to increase the size of the existing unit, prior to the effective date is also not consistent with good management practices. All new land surfaces used for MSWLFs after 1993 are subject to Part 258.

Municipal Solid Waste Landfill Unit: Municipal solid waste landfill units are units that receive household waste such as that from single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds and day-use recreation areas. Other Subtitle D wastes, such as commercial solid waste, nonhazardous sludge, and industrial solid waste, may be disposed of in a municipal solid waste landfill.

New Municipal Solid Waste Landfill Unit: A new MSWLF is any unit that has not received waste prior to October 9, 1993. Lateral expansions are considered new

MSWLF units for the purpose of location restrictions and design standards. New MSWLFs are subject to all requirements of Part 258.

1.7 CONSIDERATION OF OTHER FEDERAL LAWS 40 CFR §258.3

1.7.1 Statement of Regulation

The owner or operator of a municipal solid waste landfill unit must comply with any other applicable Federal rules, laws, regulations, or other requirements.

1.7.2 Applicability

Owners and operators of MSWLFs must comply with Federal regulations, laws, rules or requirements, that are in effect at the time of publication of Part 258 or that may become effective at a later date.

1.7.3 Technical Considerations

Specific sections of Part 258 make reference to the major Federal regulations that also may be applicable to MSWLF units regulated under Part 258. These regulations include the Clean Water Act (e.g., requirements pertaining to wetlands, [illegible] discharges), the Clean Air Act, other Parts of RCRA (e.g., Subtitle C if the MSWLF inadvertently receives regulated hazardous waste), and the Endangered Species Act.

It is the responsibility of the owner or operator of the MSWLF unit to determine what special conditions present at the facility may require consideration of other federal acts, rules, requirements or regulations. Careful review of the Part 258 criteria will help to identify most of the other federal laws that may be applicable to a particular MSWLF facility.

§§258.4-258.9 [Reserved].

2.0
SUBPART B
LOCATION CRITERIA

2.1 INTRODUCTION

Part 258 includes location restrictions to address the potential effects that a municipal solid waste landfill (MSWLF) may have on the surrounding environment, as well as the effects natural and man-made conditions may have on the performance of the landfill. These criteria pertain to new and existing MSWLFs and lateral expansions of existing MSWLFs. The location criteria of Subpart B cover the following topics:

- Airport safety;
- Floodplains;
- Wetlands;
- Fault areas;
- Seismic impact zones; and
- Unstable areas.

Floodplain, fault area, seismic impact zone, and unstable area restrictions address conditions that may have adverse effects on landfill performance that could lead to releases to the environment or disruptions of natural functions (e.g., floodplain flow restrictions). Airport safety, floodplain, and wetlands restrictions are intended to keep MSWLF units from areas where the public and sensitive natural environments may be adversely affected.

Owners or operators must demonstrations that the location criteria have been met when Part 258 takes effect. Components of such demonstrations are identified in this section. The owner or operator of the landfill unit must also comply with all other applicable federal and state regulations, such as state wellhead protection programs, that are not specifically identified in the Criteria. Table 2-0 provides a quick reference to the location standards required by the criteria. Some relevant regulations are identified in this guidance document in addition to applicable Criteria listed in 40 CFR Part 258.

2.2 AIRPORT SAFETY
40 CFR §258.10

2.2.1 Statement of Regulation

(a) Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions that are located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used by only piston-type aircraft must demonstrate that the units are designed and operated so that the MSWLF unit does not pose a bird hazard to aircraft.

Table 2-0. Location Restrictions

Restricted Location	Applies to Existing?	Applies to New and Lateral Expansions?	Make Demonstration to Director? OR Put Demonstration in Operating Record?	Must Existing Units Close if Cannot Make Demon-stration?
Airport	Yes	Yes	Operating record	Yes
Floodplains	Yes	Yes	Operating record	Yes
Wetlands	No	Yes	Director	NA
Fault Areas	No	Yes	Director	NA
Seismic Impact Zone	No	Yes	Director	NA
Unstable Areas	Yes	Yes	Operating record	Yes

(b) Owners or operators proposing to site new MSWLF units and lateral expansions within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the Federal Aviation Administration (FAA).

(c) The owner or operator must place the demonstration in paragraph (a) in the operating record and notify the State Director that it has been placed in the operating record.

(d) For purposes of this section:

(1) Airport means public-use airport open to the public without prior permission and without restrictions within the physical capacities of available facilities.

(2) Bird hazard means an increase in the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

2.2.2 Applicability

This requirement applies to owners and operators of MSWLFs located within 10,000 feet of any airport runway used by turbojet aircraft or within 5,000 feet of any airport runway used by only piston-type aircraft as long as the airport is open to the public without prior permission for use and use of available facilities is not restricted. If the above conditions are present, the owner or operator must demonstrate that the MSWLF does not pose a bird hazard to aircraft and notify the State Director that the demonstration has been placed in the operating record. If the demonstration is not made, existing facilities must be closed in accordance with §258.16.

The regulation, based on Federal Aviation Administration (FAA) Order 5200.5 (Appendix A), does not prohibit the disposal of solid waste within the specified distances unless the owner or operator is unable to make the required demonstration showing that the landfill is designed and operated so as not to pose bird hazards to aircraft. The regulation defines a "danger zone" within which particular care must be taken to ensure that no bird hazard arises.

Owners or operators proposing to site new units or lateral units within five miles of any airport runway end must notify both the affected airport and the FAA. This requirement is based on the FAA's position that MSWLFs located within a five mile radius of any airport runway end and which attract or sustain hazardous bird movements across aircraft flight paths and runways, will be considered inconsistent with safe flight operations and notification to the appropriate regional FAA office will allow FAA review of the proposal.

2.2.3 Technical Considerations

A demonstration that a MSWLF does not pose a bird hazard to aircraft within specified distances of an airport runway should address at least three elements of the regulation:

- Is the facility within the regulated distance;

- Is the runway part of a public-use airport; and
- Does or will the existence of the landfill increase the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

A negative response to any one of these elements constitutes an adequate demonstration.

The first element can be addressed using existing maps showing the relationship of existing runways at the airport to the existing or proposed new unit or lateral expansion. Topographic maps (USGS 15-minute series) or state, regional, or local government agency maps providing similar or better accuracy would allow direct scaling, or measurement, of the closest distance from the end of a runway to the nearest MSWLF unit. The measurement should not be made between property or other boundaries except the end of the runway and the nearest unit perimeter.

The second element should be readily determined by contacting the airport administration or the regional FAA office. This rule does not apply to private airfields.

The MSWLF unit design features and operational practices can have a significant effect on the likelihood of increased bird/aircraft collisions. Birds may be attracted to MSWLFs to satisfy a need for water, food, nesting, or roosting. Scavenger birds such as starlings, crows, and gulls are most commonly associated with operating landfills and these birds are more commonly involved with aircraft collisions. Waste management techniques to reduce the supply of food to these birds include:

- Frequent covering of wastes that provide a source of food;
- Shredding, milling, or baling the food-containing waste; and
- Eliminating wastes from the landfill that represent a food source for birds (by alternative waste management techniques such as source separation and composting or waste minimization).

Frequent covering of wastes that represent a food source for the birds effectively reduces the availability of the food supply. Depending on site conditions such as volume and types of wastes, waste delivery schedules, and size of the working face, cover may need to be applied several times a day to keep the inactive portion of the working face small relative to the area accessible to birds. By maintaining a small working face, spreading and compaction equipment are also concentrated in a small area which further disrupts scavenging by the birds.

Milling or shredding of municipal solid waste tends to break up food waste into smaller particle sizes and distribute the particles throughout non-food wastes, thereby diluting food wastes to a level that frequently makes the mixture no longer attractive as a food supply for birds. Similarly, baling of municipal solid waste reduces the surface area of waste that may be available to scavenging birds.

Various methods, such as visual deterrents or sound, have beeen used with mixed success in an attempt to discourage birds from food scavenging. Visual deterrents include realistic models (still or animated) of the bird's natural predators (e.g., man, owls, hawks, falcons). Sounds that have had limited success as deterrents include cannon, distress calls of the scavenger birds, and sounds of its natural predators. Use of physical barriers such as fine wires strung across or near the working face have also been successfully used in the short term (see Figure 2-1). Labor intensive efforts have included falconry and firearms. All of these methods have limited long-term effect on controlling bird populations at landfills as the birds adapt to the environment in which they find food.

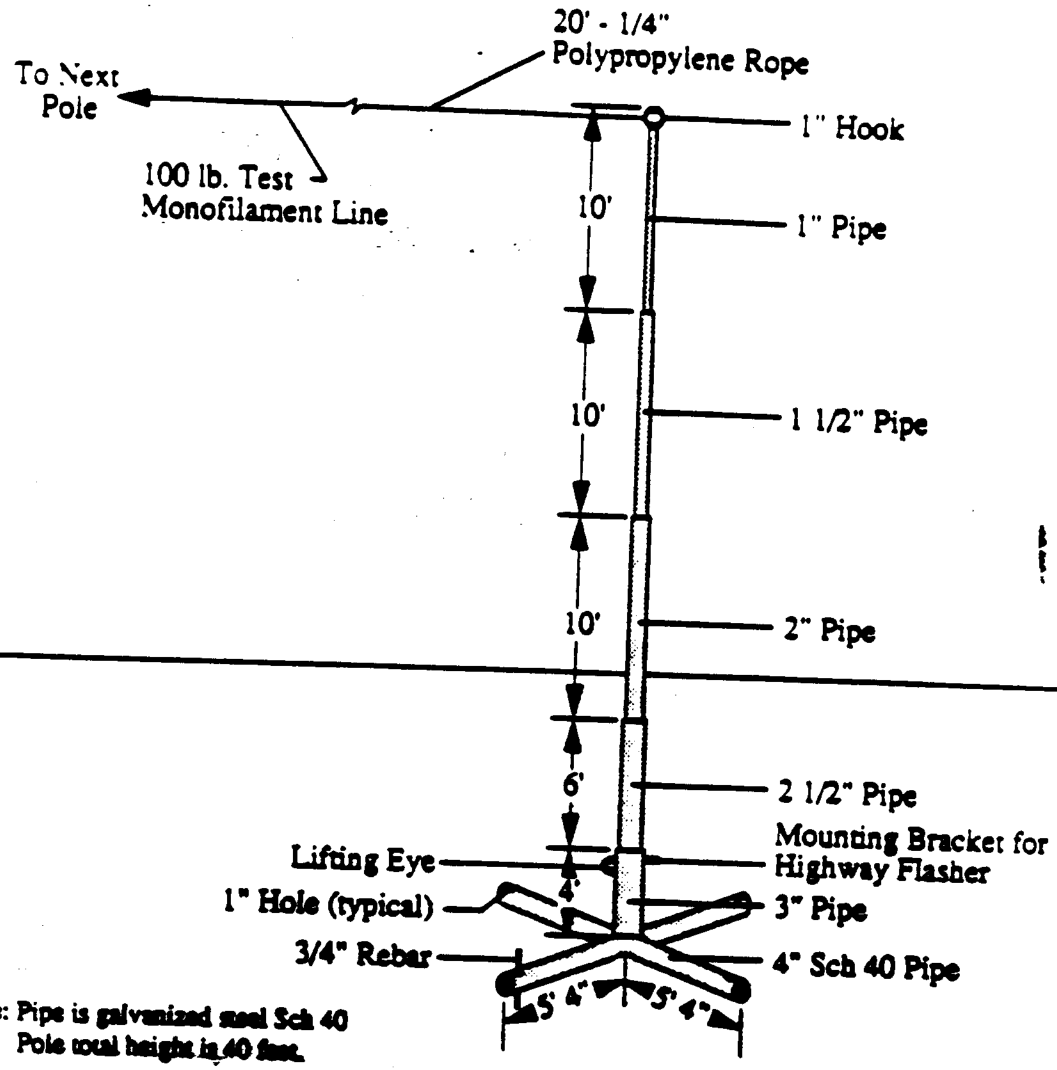
Design and operation can further eliminate the landfill as a source of water by encouraging surface runoff and preventing ponding of water.

Birds also may be attracted to a landfill as a nesting area. Use of the landfill site as a roosting or nesting area is usually limited to ground roosting birds (e.g., gulls). Roosting areas are usually free from predators. Operational landfills that do not operate continuously often provide a unique roosting habitat due to elevated ground temperatures (due to waste decomposition within the landfill) and freedom from disturbance. Nesting can be prevented, however, by an understanding of nesting patterns and requirements of undesirable birds.

In addition to design features and operational procedures to control bird populations, the demonstration should also address the likelihood that the MSWLF unit will increase bird/aircraft collisions and result in damage to the aircraft or injury to its occupants. One approach to adressing this portion of the airport safety criteria is to evaluate the attraction of birds to the MSWLF unit and determine whether this increased population would be expected to result in a discernable increase in bird/aircraft collisions. The evaluation of bird attraction can be based on field observations at existing facilities where similar design features and operational procedures are used.

All observations, measurements, data, calculations and analyses, and evaluations should be documented and included in the demonstration. The demonstration must be placed in the operating record and the State Director must be notified that it has been placed in the operating record. (See Section 3.11)

If an owner or operator of an existing MSWLF unit cannot successfully demonstrate compliance with §258.10(a), then the unit must be closed in accordance with §258.60 and post-closure activities must be conducted in accordance with §258.61 (see §258.16). Closure must occur within 5 years of the effective date of these criteria. The Director of an approved State can extend the period up to 2 years if it is demonstrated that no available alternative disposal capacity exists and the unit poses no immediate threat to human health and the environment (see Section 2.8 of this manual).



Note: Pipe is galvanized steel Sch 40
Pole total height is 40 feet.

Source: GCRDA, (198[illegible])

FIGURE 2-1
Construction Details of Bird Control Device Using Monofiliment Line

If an owner or operator is proposing to locate a new unit or lateral expansion of an existing MSWLF within 5 miles of the end of a public-use airport runway, the affected airport and the regional FAA office must be notified to provide an opportunity to review and comment on the site in accordance with FAA guidance. Topographic maps (e.g., USGS 15-minute series) or other similarly accurate maps showing the relationship of the airport runway and the MSWLF unit will provide a suitable basis for determining whether the FAA should be notified.

2.3 FLOODPLAINS
40 CFR §258.11

2.3.1 Statement of Regulation

(a) Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions located in 100-year floodplains must demonstrate that the unit will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health and the environment. The owner or operator must place the demonstration in the operating record and notify the State Director that it has been placed in the operating record.

(b) For purposes of this section:

(1) Floodplain means the lowland and relatively flat areas adjoining inland and coastal waters, including flood-prone areas of offshore islands, that are inundated by the 100-year flood.

(2) 100-year flood means a flood that has a 1-percent or greater chance of recurring in any given year or a flood of a magnitude equalled or exceeded once in 100 years on the average over a significantly long period.

(3) Washout means the carrying away of solid waste by waters of the base flood.

2.3.2 Applicability

The criteria are applicable to all existing and new MSWLFs and lateral expansions located within a 100-year river floodplain. The rule does not prohibit locating a MSWLF in a 100-year floodplain if the owner or operator can demonstrate that the unit will comply with the flow restriction, temporary storage, and washout provisions of the regulation. A MSWLF will affect the flow and temporary storage capacity of the floodplain, which is acceptable, unless the effect is large enough to cause higher flood levels and greater flood damage downstream with potential hazard to human health and safety. If a demonstration that the landfill will not pose unacceptable threats can be made, the demonstration must be placed in the operating record and the State Director must be notified that the demonstration was made and placed in the record. If the demonstration cannot be made for an existing MSWLF unit, then the MSWLF must be closed in 5 years in accordance with §258.60 and the owner or operator must conduct post-closure activities in accordance with §258.61 (see §258.16). The closure deadline may be extended for up to two years by the Director of an approved State if the ownwer or operator can demonstrate that no available alternative disposal capacity exists and there is no immediate threat to human health and the environment (see Section 2.8 of this Manual).

2.3.3 Technical Considerations

Compliance with the floodplain criteria begins with a determination of whether the MSWLF is located in the 100-year floodplain. If the MSWLF is located in the 100-year floodplain, then the owner or operator must demonstrate that the facility will not:

- Restrict the base flood flow;
- Reduce temporary water storage (if the base flood level would not be raised by more than one foot then it would be an indication that these two points are met); and
- Result in washout of solid waste that may pose a hazard to human health and the environment.

Guidance for identifying flood plains and demonstrating facility compliance is provided below.

Flood Plain Identification

River floodplains are readily identifiable as the flat areas adjacent to the river's normal channel. The 100-year floodplain, which represents the sedimentary deposits formed by floods that have a one percent chance of occurrence in a 100-year period, are identified in the flood insurance rate maps (FIRMs) and flood boundary and floodway maps published by the Federal Emergency Management Agency (FEMA). Guidance on using FIRMs is provided in "How to Read a Flood Insurance Rate Map" published by FEMA. FEMA also publishes "The National Flood Insurance Program Community Status Book" that lists communities that are in the Emergency or Regular programs including communities that may not be involved in the National Flood Insurance Program but which have FIRMs or Floodway maps published. Maps (see Figure 2-2) and other FEMA publications may be obtained from the FEMA distribution Center (see Appendix B for address). Areas not covered by the FIRMs or Floodway maps may be included in floodplain maps available through the Army Corps of Engineers, the U.S. Geologic Survey, the U.S. Soil Conservation Service, the Bureau of Land Management, the Tennessee Valley Authority, and State and local agencies. Many of the river channels covered by these maps may have undergone modification for hydropower or flood control projects and the floodplain boundaries represented may not be accurate or representative. Comparison of the floodplain map series to recent air photographs may be necessary to identify current river channel modifications and land use watersheds that could affect floodplain designations.

If floodplain maps are not available, and the facility is located within a floodplain, then a field study to delineate the 100-year floodplain may be required. A floodplain delineation program would be based primarily on meteorological records and physiographic information such as existing and planned watershed land use, topography, soils and geologic mapping, and air photo interpretation of

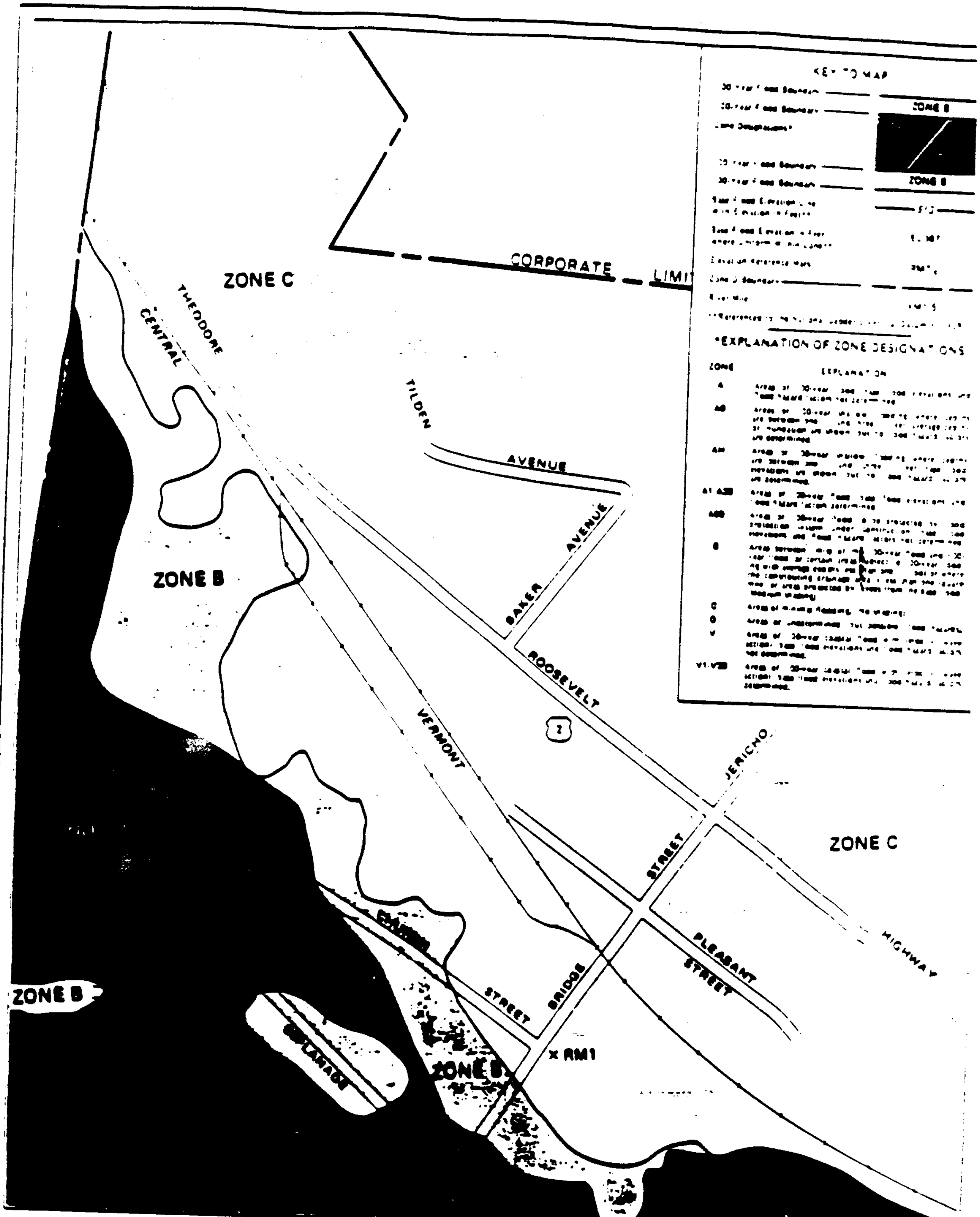


FIGURE 2-2
Example Section of Flood Plain Map

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geomorphologic (land form) features. The United States Water Resource Council (1977), provides information for determining the potential for floods in a given location by stream gauge records. Estimation of the peak discharge by these methods also allows an estimation of the probability of exceeding the 100-year flood. .

Engineering Considerations

If the MSWLF unit is within the 100-year floodplain, it must be located so that the MSWLF does not significantly restrict the base flood flow or significantly reduce temporary storage capacity of the floodplain. Furthermore, the MSWLF must be designed to prevent the washout of solid waste during the expected flood event. The rule requires that floodplain storage capacity and flow restrictions that occur as the result of the MSWLF, do not pose a hazard to human health and the environment.

The demonstration that these considerations are met relies on estimates of the flow velocity and volume of floodplain storage in the vicinity of the MSWLF unit during the base flood. The assessment should consider the floodplain storage capacity and floodwater velocities that would likely exist in absence of the MSWLF. The volume occupied by a MSWLF in a floodplain may theoretically alter (reduce) the storage capacity and restrict flow. Raising the base flood level by more than one foot can be an indicaton that the MSWLF may reduce and restrict storage capacity flow. In some smaller areas a greater than one foot increase in the flood level may be acceptable.

The location of the MSWLF relative to the velocity distribution of floodwaters will greatly influence the susceptibility to washout. This type of assessment will require a conservative estimate of the shear stress on the landfill components caused by the depth, velocity, and duration of impinging river waters. Depending on the amount of inundation, the landfill may act as a channel side slope or bank or it may be isolated as an island within the overbank river channel. In both cases an estimate of the river velocity would be part of a proper assessment.

The assessment of flood water velocity will require that the channel cross section be known above, at, and below the landfill. Friction factors on the overbank are determined from the surface conditions and vegetation present. River hydrologic models may be used to simulate flow levels and estimate velocities through these river cross sections.

The Army Corps of Engineers (COE, 1982) has developed several numerical models to aid in the prediction of flood hydrographs, flow parameters, the effect of obstructions on flow levels, the simulation of flood control structures, and sediment transport. Although not all, or perhaps none, of these methods may be appropriate for a given situation, the models, including the following, do provide well tested analytical approaches:

HEC-1, Flood Hydrograph Package;

HEC-2, Water Surface Profiles;

HEC-5, Simulation of Flood Control and Conservation Systems;

HEC-6, Scour and Deposition in Rivers and Reservoirs.

The HEC-2 model is not appropriate for simulation of sediment-laden braided stream systems or other intermittent/dry stream systems that are subject to flash flood events. Standard runoff and peak flood hydrograph methods would be more appropriate for such conditions to predict the effects of severe flooding.

Cost effective methods to adequately protect the MSWLF unit from flood damage include embankment designs with rip-rap and geotextiles to prevent scour. Guidelines for design with these materials may be found in Maynard (1978) and SCS (1983). Embankment design will require an estimate of river flow velocities, flow profiles (depth), and wave activity. Figure 2-3 provides a design example for an embankment protection from erosion by flood waters and height requirements to control the effects of wave activity. The use of alternate erosion control methods such as gabions (cubic, shaped wire structures filled with stone), paving bricks, and mats may be considered.

2.4 WETLANDS
40 CFR §258.12

2.4.1 Statement of Regulation

(a) New MSWLF units and lateral expansions shall not be located in wetlands, unless the owner or operator can make the following demonstrations to the Director of an approved State.

(1) The presumption that practicable alternative to the proposed landfill is available which does not involve wetlands is clearly rebutted;

(2) The construction and operation of the MSWLF unit will not:

(i) Cause or contribute to violations of any applicable State water quality standard,

(ii) Violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act,

(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973, and

(iv) Violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary;

(3) The MSWLF unit will not cause or contribute to significant degradation of wetlands. The owner/operator must demonstrate the integrity of the MSWLF unit and it's ability to protect ecological resources by addressing the following factors:

(i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the MSWLF unit;

(ii) Erosion, stability, and migration potential of dredged and fill materials used to support the MSWLF unit;

ASSUMPTIONS:

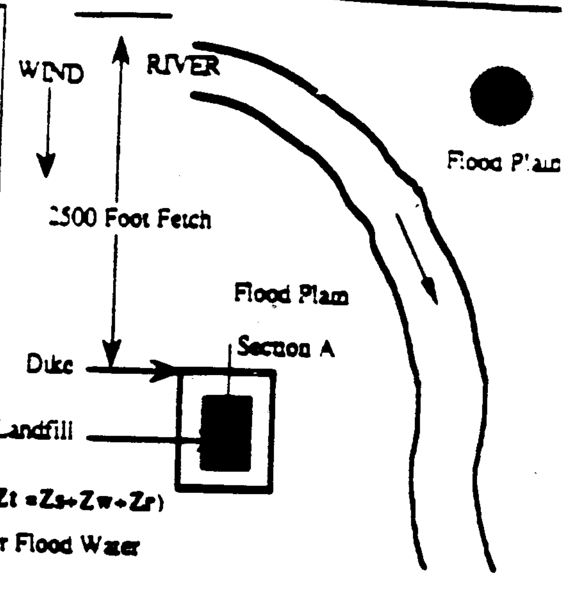
- FETCH = 2500 FT
- WIND SPEED = 50 MPH
- AVE. WATER DEPTH ALONG FETCH = 5 FT
- OVERBANK WATER VELOCITY =0.25 FT/S

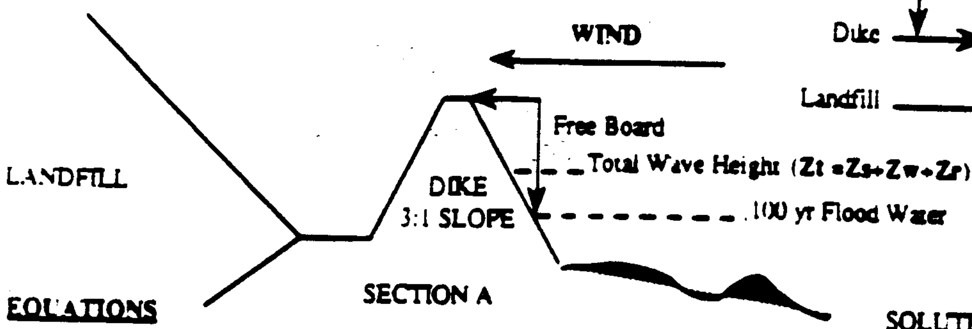
DEFINITIONS

Z_s = Wave Setup (tilting of water surface upward at downwind end)

Z_w = Capillary Waves Height (developed by wind over water surface)

Z_r = Wave Run-up (water run-up along dike from wave impact)





EQUATIONS

$$Z_r = Z_w (Z_r/Z_w)$$

$$\lambda = 5.12\, t_w^{2}$$

$$t_w = 0.46\, V_w^{0.44} F^{0.28}$$

where:
- Z_r = Wave run - up along dike
- Z_r/Z_w = Relative run - up ratio from chart below
- λ = Wavelength
- t_w = Wave period
- V_w = wind speed (mph)
- F= fetch (miles)

$$W = \frac{K \gamma H^{3}}{1000\,(0.016\gamma - 1)^{3}(\cos\alpha - \sin\alpha)^{3}}$$

$$d = \left(\frac{6W}{\pi\gamma}\right)^{1/2}$$

where:
- W= Rip -Rap stone weight (lbs)
- d= Rip - Rap stone diameter
- K = Coefficient (30)
- γ = Stone Density (lb/cf)
- H = height of design wave (ft)
- α = bank slope (degrees)

SOLUTIONS

From the data provided in the assumptions at the beginning of the example:

Z_s = 0.18 ft. Z_w = 1.55 ft. Z_r = 2.40 ft

Z_t Design Height = 4.13 ft

Base 100 yr flood level = 5 ft

for Factor of Safety of 1.5

Dike Height = (1.5) (4.13 + 5) = 1

For the Rip - Rap design given:

K=30, γ=120, H = 1.55 ft, a = 18 °

For the protective stone on Dike

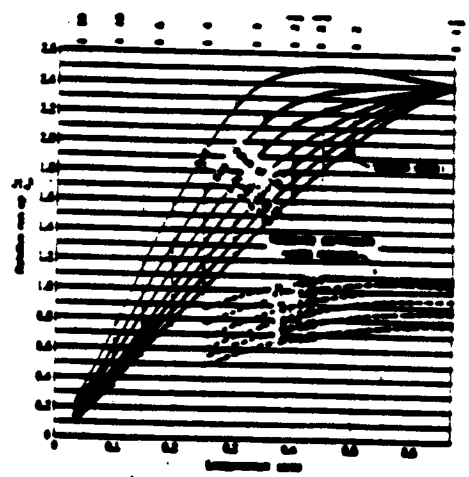
d= 0.5 ft. W = 12lbs/stone

$$Z_w = 0.034\, V_w^{1.06} F^{0.47}$$

where:
- Zw= ave. height of heighest 1/3rd of waves (ft)
- F= fetch (miles)

$$Z_s = \frac{V_w^{2} F}{1400\, d}$$

where:
- Zs= rise above still water level (ft)
- Vw = wind speed (mph)
- F= fetch (miles)
- d= water depth along fetch (ft)



Wave run-up ratios vs. wave steepness and embankment slopes

Reference for Equa... U.S Dept of Interior. Bureau of Land Reclamation (1974)

Reference for Wave Run -up Chart :Linsley and Franzini (1972)

EXAMPLE FLOODPLAIN PROTECTION DIKE DESIGN FIGURE - 3

(iii) The volume and chemical nature of the waste managed in the MSWLF unit;

(iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of the solid waste;

(v) The potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment; and

(vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected.

(4) To the extent required under Section 404 of the Clean Water Act or applicable State wetland laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by paragraph (a)(1) of this section, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands); and

(5) Sufficient information is available to make a reasonable determination with respect to these demonstrations.

(b) For purposes of this section, "wetlands" means those areas that are defined in 40 CFR §232.2(r).

2.4.2 Applicability

The wetland location restrictions are applicable to all new MSWLF units and lateral expansions and require owners and operators of such units to meet the demonstration requirements prior to construction. The location restrictions allow existing MSWLF units located in wetlands to continue operations as long as compliance with the other requirements of Part 258 can be maintained.

In addition to the regulations listed in 40 CFR §258.12(a)(2), other federal requirements may be applicable in siting a MSWLF in a wetland. These include:

- Sections 401, 402, and 404 of the CWA;
- Rivers and Harbors Act of 1989;
- Executive Order 11990, Protection of Wetlands;
- National Environmental Policy Act;
- Migratory Bird Conservation Act;
- Fish and Wildlife Coordination Act;
- Coastal Zone Management Act;
- Wild and Scenic Rivers Act; and the
- National Historic Preservation Act.

The use of wetlands for construction of a MSWLF facility will require a permit from the Army Corps of Engineers (COE), which oversees jurisdictional wetlands under authority of the EPA. COE permits and involvement will likely be required for wetlands impacts in excess of one acre. State permits may also be required.

Owners or operators must be able to demonstrate that alternative sites are not available and that impact to wetlands is therefore unavoidable when proposing to use a wetland to site a new facility or lateral expansion. If it is demonstrated that impacts to the wetland are unavoidable, then all efforts must be made to minimize the impacts. The impacts must be compensated for by restoring degraded wetlands, enhancing or preserving existing wetlands, or creating new wetlands. The result of these activities should be no net loss of wetlands.

2.4.3 Technical Considerations

Wetland, referred to in §258.12(b), is defined in §232.2(r). However, the agency is considering changes to the wetlands program. A proposal to revise a technical guidance document that implements the current definition was published in the Federal Register on August 14, 1991 (56 FR 40446). A proposal to codify these changes was published in the Federal Register on December 19, 1991 (FR 65964).

The rule identifies several key issues that need to be addressed if an owner or operator proposes to locate a lateral expansion or a new MSWLF in a wetland. These issues include: (1) practicable alternatives, (2) evaluation of wetland acreage and function, (3) mitigation of impact, and (4) offsetting impacts. Although EPA has an objective of no net loss of wetlands in terms of acreage and function, it recognizes that regions of the country exist where proportionally large areas are dominated by wetlands and suitable acreage and type of upland may not be present to allow construction of a new MSWLF unit or lateral expansion without wetland impacts. Wetlands evaluations may become an integral part of both the siting, design, permitting, and environmental monitoring aspects of a landfill (see Figure 2-4).

Practicable Alternatives

EPA believes that locating new MSWLFs or lateral expansions should be done only under very limited conditions. Wetlands comprise large areas of the country particularly in certain regions. The banning of new MSWLFs or lateral expansions could cause serious capacity problems and lead to negative health and environmental impacts. The flexibility of the rule allows communities to demonstrate that there are no alternatives to locating or laterally expanding MSWLFs in wetlands.

Compliance with Other Laws

Locating or laterally expanding MSWLFs in wetlands requires compliance with other environmental regulations. The owner or operator must show that operation or construction of the landfill will not:

- Violate any applicable State water quality standards;
- Cause or contribute to violation of any applicable toxic effluent standard or prohibition;
- Cause or contribute to violation of any requirement for the protection of a marine sanctuary; or
- Jeopardize the continued existence of endangered or threatened species or critical habitats.

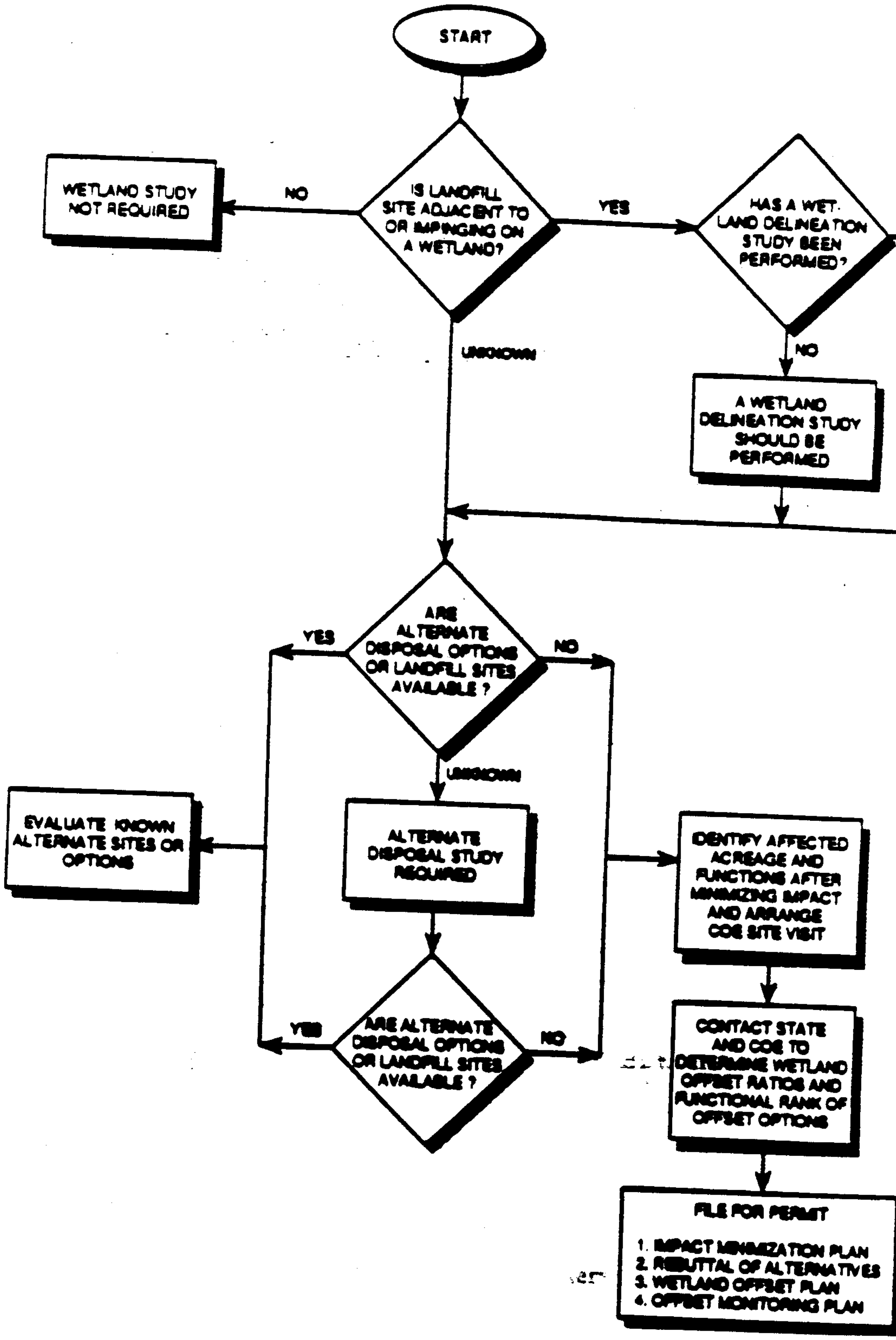


FIGURE 2-4
Wetlands Decision Tree

Wetlands Degradation

The MSWLF cannot cause or contribute to significant degradation of wetlands. The owner/operator must:

- Ensure the integrity of the MSWLF unit;

- Minimize impacts on fish, wildlife and other aquatic resources and their habitat from the release of solid waste; and

- Assure that ecological resources in the wetlands are sufficiently protected.

These factors were partially derived from Section 404(b)(1) of the Clean Water Act. These guidelines address the integrity of the MSWLF ability to protect the ecological resources of the wetland.

Wetlands Mitigation

When a MSWLF is located or created in a wetland, steps must be taken to attempt to achieve no net loss of wetlands as defined by acreage and function. The owner/operator must try to avoid impacts to the wetlands and minimize any impacts as much as possible. Degraded wetlands must be restored, if possible, or additional man-made wetlands must be created.

Demonstrations

Because of the unique nature of wetlands the owner/operator is required to demonstrate that the landfill will not cause or contribute to significant degradation of wetlands. The demonstration must be reviewed and approved by the Director of an approved State and placed in the facilities operating record. This provision effectively bans the siting of new MSWLFS or lateral expansions in unapproved States.

Alternative Sites

Part 258 presumes that practicable alternatives are available to locating landfills in wetlands because landfilling is not a water-dependent activity. In an approved State, the owner or operator can rebut the presumption that a practicable alternative to the proposed landfill or lateral expansion is available. The term "practicable" pertains to the economic and social feasibility of alternatives (e.g., collection of waste at transfer stations and trucking to an existing landfill, other possible landfill sites). The feasibility evaluation may entail financial, economic, administrative, and public acceptability analyses as well as engineering considerations. Furthermore, the evaluations will generally require generation and assessment of land use, geologic, hydrologic, geographic, demographic, zoning, and traffic maps, and other related information.

To rebut the presumption that an alternative practicable site exits generally will require that a site search for an alternative location be conducted. There is no standard methodology for conducting a site search due to the variability of the number and hierarchy of screening criteria that may be applied to a specific case. Typical criteria may include:

- Distance from waste generation sources;
- Minimum landfill size requirements;
- Soil conditions;

- Proximity to ground-water users;
- Proximity to significant aquifers;
- Exclusions from protected natural areas;
- Difficult to remediate features; and
- Setbacks from roadways and residences.

Wetland Evaluations

The term wetland includes swamps, marshes, bogs, and any areas that are inundated or saturated by ground-water and surface water at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions. Wetlands, therefore, may be identified on the basis of soil conditions (saturated vs. unsaturated) the type of vegetation present (hydrophytic), and site hydrology. These factors also determine the functional value of the wetland in terms of its role in supporting fish and wildlife habitats; providing aesthetic, scenic, and recreational value; flood storage; aquatic diversity; and its relationships to surrounding natural areas including nutrient retention and productivity exportation (e.g., releasing nutrients to downstream areas, providing transportable food sources).

In most cases, a wetlands assessment will need to be conducted by a qualified and experienced multi-disciplinary team with a soil scientist and a botanist or biologist. The assessment should identify: (1) the limits of the wetland boundary based on soil and plant types, (2) the type and relative abundance of vegetation including trees, (3) rare, endangered, or otherwise protected plants (if any), and (4) rare and endangered species and their habitats (if any).

Criteria used in wetlands identification have been developed in agreement between the EPA, Fish and Wildlife Service, Soil Conservation Service, and the U.S. Army Corps of Engineers and are presented in the Federal Manual For Identifying and Delineating Jurisdictional Wetlands (COE, 1989). This publication also contains an extensive list of literature available on identification and prevalence of plant species characteristic of wetlands throughout the United States, hydric soil classification, and related wetland topics. Additional published information that may be useful includes USGS topographic maps, National Wetland Inventory (NWI) Maps, Soil Conservation Service (SCS) soil maps, and wetland inventory maps prepared locally.

After completion of a wetland study, the impact on the wetland and its relationship to adjacent wetlands can be more effectively assessed. At some time in the permitting process, state and federal agencies with jurisdiction over wetlands will need to be contacted to schedule a site visit. It is usually advantageous to encourage this collaboration as early as possible in the site evaluation process. Regulations will vary significantly from state to state with regard to the size and type of the wetland which will trigger state agency involvement. In general, the Army Corps of Engineers will require consultation on any proposed impact of any wetland that is over an acre in size; regardless of the actual size of the impact.

Other agencies such as the Fish and Wildlife Service and the Soil Conservation Service may need to be contacted in some states.

The functional value of any given wetland is dependent on soil, plant, and hydrologic characteristics, particularly the diversity, prevalence and extent of wetland plant species. The relationship between the wetland and surrounding areas (e.g., nutrient sinks and sources) and the ability of the wetland to support animal habitat, or particularly rare or endangered species, contributes to the evaluation of functional value. The functional value itself, is a relative value assessed by comparing the wetland under study to other known wetland areas in the immediate area, region, state, or country as a whole. The functional values may be rated as very low, low, moderate, high, and very high relative to other known wetlands for various criteria. The criteria may include plant diversity, prevalence of individual rare or endangered species, wildlife habitat value, recreational value, aesthetic value, and uniqueness. For field methodologies and information on prevalence index determinations, general assessment, and impact evaluation guidance please refer to COE (1989).

Other wetland and related assessment methodologies include the Wetland Evaluation Technique (WET) and the Habitat Evaluation Procedure (HEP). WET allows comparison of the values and functions of wetlands before and after construction of a facility, thereby projecting the impact a facility may have on a wetland. WET was developed by the Federal Highway Administration and revised by COE (Adamus et al., 1987). HEP was developed by the Fish and Wildlife Service to determine the quality and quantity of available habitat for selected species. HEP and WET may be used in conjunction with each other to provide an integrated assessment.

Impact Mitigation

If the new unit or lateral expansion is to be located in a wetland, the owner or operator must demonstrate that the unit will not cause or contribute to significant degradation of the wetland. Erosion potential and stability of wetland soils should be identified as part of the wetlands evaluation and any adverse stability effects caused by the MSWLF should be resolved.

Appropriate steps should be taken to minimize potential effects to the wetland. A number of possible measures exist to mitigate impacts. Appropriate measures are site-specific and should be incorporated into the design and operation of the MSWLF. Placement of ground-water barriers may be required if soil and shallow ground-water conditions would cause dewatering of the wetland due to the existence of underdrain pipe systems at the facility. In many instances, however, wetlands are formed in response to perched, near-surface water tables over geologic material of low hydraulic conductivity and significant drawdown impacts may not occur.

It is possible that the landfill will not directly displace wetlands; however, adverse effects may be caused by leachate or runoff. Engineered containment systems for both leachate and runoff should mitigate the potential for inadvertent discharge to wetlands.

Additional actions and considerations relevant to mitigating impacts from the dredging and placement of fill material in wetlands that may be appropriate for MSWLF facilities are provided in Subpart H (Actions to Minimize Adverse Effects) of 40 CFR §230 (Guidelines for Specification of Disposal Sites for Dredged or Fill Material).

Wetland Offset

All unavoidable impacts must be "offset" or compensated to ensure that the facility has not caused any net loss of wetland acreage of comparable functional value. This compensatory mitigation may take the form of upgrading existing marginal or lower quality wetlands or by creating new wetlands. Wetlands offset studies are site specific.

A cursory assessment of surrounding wetlands may be required to define their functional characteristics and inter-relationships to identify potential sites that may be proposed for upgrade. An upgrade may consist of transplanting appropriate vegetation and importing low-permeability soil materials that would be conducive to forming saturated soil conditions. Excavation to form open water bodies or gradual restoration of salt water marshes by culvert expansions to promote sea water influx are other examples.

Individual states may have offset ratios to determine how much acreage of a given functional value is required to replace the wetlands that were lost or impacted. Preservation of lands, such as through perpetual conservation easements, may be considered as a viable offset option. State offset ratios may require that for wetlands of an equivalent functional value, a larger acreage be created than was displaced.

Due to the experimental nature of creating or enhancing wetlands, a monitoring program to evaluate the progress of the effort should be considered. The purpose of the monitoring program is to verify that the intended function of the wetland becomes self-sustaining as the wetland ages.

2.5 FAULT AREAS 40 CFR §258.13

2.5.1 Statement of Regulation

(a) New MSWLF units and lateral expansions shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates to the Director of an approved State that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the MSWLF unit and will be protective of human health and the environment.

(b) For the purposes of this section:

(1) Fault means a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side.

(2) Displacement means the relative movement of any two sides of a fault measured in any direction.

(3) __Holocene__ means the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch to the present.

2.5.2 Applicability

The regulation bans all new MSWLF units or lateral expansions of existing units within 200 feet (60 meters) of the outermost boundary of a fault that has experienced displacement during the Holocene Epoch. A variance to the 200-foot setback is provided if the owner or operator can demonstrate that a shorter distance will prevent damage to the structural integrity of the MSWLF unit and will be protective of human health and the environment. Existing MSWLF units are neither required to close nor to retrofit if they are located in fault areas.

2.5.3 Technical Considerations

Seismologists generally believe that the structural integrity of an engineered unit cannot be unconditionally guaranteed when they are built within 200 feet of a fault along which movement is highly likely to occur. In general, a 200 foot buffer zone should be sufficient to protect engineered structures from seismic damages.

The U.S. Geological Survey (USGS) map series identifying the location of Holocene faults in the United States (Preliminary Young Fault Maps, MF916) should be used by owners or operators of MSWLFs to determine the location of such fault zones and appropriate setbacks if needed.

Determination that a fault has not had differential movement in Holocene time may be performed by the methods below. Displacement of surficial deposits (glacial) across a fault may be indicative that such displacement has occurred in recent times. In addition, seismic epicenters, recorded in recent times, may be indicative of recent movement or activity along structures in a given area. The NAPP/NHAP high altitude, high resolution areal photographs with stereo coverage are a useful remote sensing aid for delineating fault traces and structural lineaments. This series of areal photography provides coverage over most of the United States and is available through the U.S. Geologic Survey, EROS Data Center (Appendix B).

An owner or operator has an opportunity to demonstrate that an alternate setback of less than 200 feet will prevent damage to the structural integrity of the MSWLF and will be protective of human health and the environment. The demonstration for a new MSWLF or lateral expansion requires review and approval of the Director of an approved State. If the demonstration is approved, it must be placed in the facility's operating record. There are no set procedures for making the demonstration. For areas where movement along a Holocene fault has occurred since 1978 owners/operators would need to conduct a geologic reconnaissance of the site and surrounding areas. Fault traces should be mapped and characterized to determine which faults have had movement during the Holocene epoch. This reconnaissance also may be necessary for a demonstration. Additional requirements may need to be met before a new unit or lateral expansion may be approved. The option to have a setback of less than 200 feet from a Holocene fault is not available in unapproved States.

Site fault characterization is necessary to determine whether or not a site is within 200 feet of a fault which has had movement during the Holocene epoch. An investigation would include obtaining information on any lineaments that suggest the presence of any faults within a 3,000-foot radius of the site and the absence of a fault or faults that have had displacement in the Holocene within 200 feet of the unit. The information could be based on:

- A review of available maps, logs, reports, scientific literature, or insurance claim reports;
- An aerial reconnaissance of an area within a five mile radius of the site, including aerial photo analysis;
- A reconnaissance based on walking portions of the area within 3,000 feet of the unit.

If the information indicates a fault or faults within 3000 feet of the unit, investigations should be conducted to determine the presence or absence of any faults that have had displacement during the Holocene within 200 feet of the site. Suggested investigative tasks are:

- Subsurface exploration, including drilling and trenching to locate fault zones and evidence of faulting;
- Trenching perpendicular to any fault or lineaments within 200 feet of the unit;
- Determination of the age of any displacements; and
- Construction of supporting maps and other analyses.

The report should be prepared by a qualified professional trained in the appropriate field.

2.6 SEISMIC IMPACT ZONES 40 CFR §258.14

2.6.1 Statement of Regulation

(a) New MSWLF units and lateral expansions shall not be located in seismic impact zones, unless the owner or operator demonstrates to the Director of an approved State that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the operating record and notify the State Director that it has been placed in the operating record.

(b) For the purposes of this section:

(1) Seismic impact zone means an area with a ten percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.

(2) Maximum horizontal acceleration in lithified earth material means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a 90 percent or greater probability that the acceleration will not be exceeded in 250 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

(3) Lithified earth material means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.

2.6.2 Applicability

The regulation applies to new MSWLF units and lateral expansions located in a seismic impact zone, which is defined as an area having a 10 percent or greater probability that the maximum expected horizontal acceleration in the lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.

The regulation prohibits siting of new units or lateral expansions in a seismic impact zone unless the owner or operator can demonstrate that the structural components (defined in Section 2.7.2) of the unit are designed to resist the maximum horizontal acceleration in the lithified earth material for the site. Existing units are not required to be retrofitted. Owners or operators of new units or lateral expansions must notify the Director of an approved State and place a demonstration of compliance in the operating record.

2.6.3 Technical Considerations

Owners or operators of MSWLF units, at a minimum, should review the seismic 250-year interval maps in U.S. Geological Survey Open-File Report 82-1033, entitled "Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States," (Algermissen and Perkins, 1982) to determine the maximum horizontal acceleration of the lithified earth material for the site. (see Figure 2-5). For areas not covered by Algermissen and Perkins (1982), USGS State seismicity maps may be used to estimate the maximum horizontal acceleration. The National Earthquake Informations Center, located at the Colorado School of Mines in Golden, Colorado can provide seismicity maps of all 50 states. The center also maintains a database of known earthquakes and fault zones.

If the maximum horizontal acceleration is less than or equal to 0.1g, then the design of the unit will not have to incorporate an evaluation of seismic effects under these rules. For those units located in an area with an estimated maximum horizontal acceleration greater than 0.1g, an evaluation of seismic effects should consider both foundation soil stability and waste stability under seismic loading. Conditions that may be considered for the evaluation, include the construction phase (maximum open excavation depth of new cell adjacent to an existing unit), closure activities (prior to final consolidation of

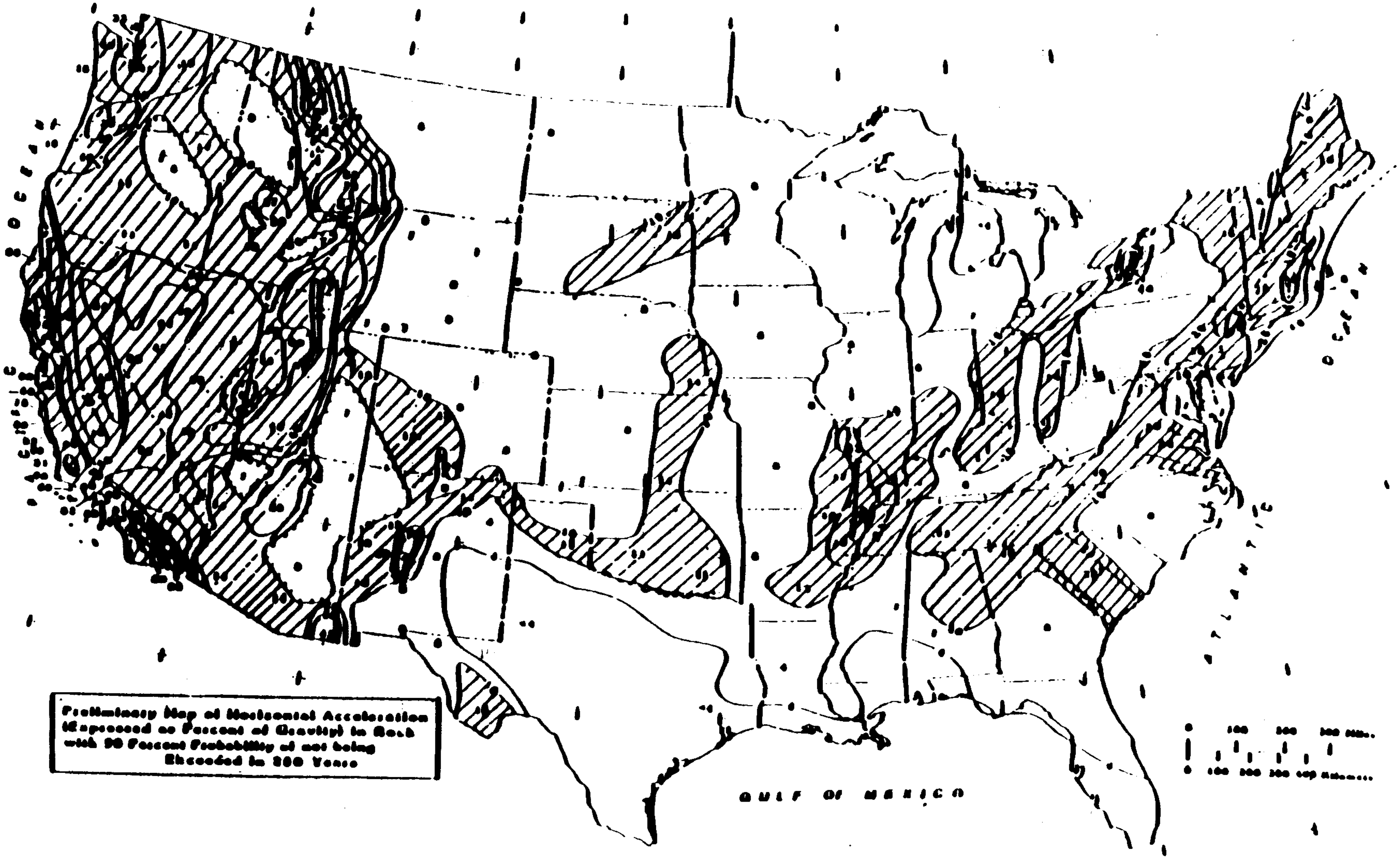


FIGURE 2-5
Seismic Impact Zone Map

LEGEND

Areas where horizontal acceleration of ≥ 0.1g may have 90 percent probability of not being [illegible] both waste and subsoil), and post-closure care (after final consolidation of both waste and foundation soil). For site conditions with low strength foundation soils, or foundation soils that have the potential for liquefaction, the facility should be assessed for seismic activity even if horizontal accelerations are less than 0.1g. Refer to Section 2.7 for detail on unstable areas.

If a MSWLF is located in a seismic impact zone, then a demonstration must be made to the Director of an approved State, that the design of the unit's structural components (e.g., liners, leachate collection, final covers, run-on and runoff systems) will resist the maximum horizontal acceleration in lithified materials at the site. There are no standard procedures for designing landfill components for seismic events. Winterkorn and Fang (1975) and NAVFAC (1983) do, however, present a review of engineering evaluations which consider the influence of local soil conditions on: (1) ground response and shaking intensity; (2) soil settlement; (3) soil liquefaction; and (4) slope instability during earthquakes.

Information on the location of earthquake epicenters and intensities, may be available through State Geologic Surveys or the Earthquake Information Center. For information concerning potential earthquakes in specific areas, the Branch of Geologic Risk Assessment may be of assistance. Other organizations that study the effects of earthquakes on engineered structures include the National Information Service for Earthquake Engineering, the Building Seismic Safety Council, the National Institute of Science and Technology and the American Institute of Architects.

Studies indicate that during earthquakes, superficial (shallow) slides and differential displacement tend to be produced, rather than massive slope failures (NAVFAC, 1983). Stresses created by superficial failures can affect liner and final cover systems, and leachate and gas collection and removal system performance. Tensional stresses within the liner system can result in fracturing of the soil liner and/or tearing of the flexible membrane liner.

When evaluating soil characteristics, it is necessary to know the soil strength as well as the magnitude or intensity of the earthquake in terms of peak acceleration. Other soil characteristics including degree of compaction, sorting, and degree of saturation may need to be considered because of their potential influence on site conditions. For example, deposits of loose granular soils may be compacted by the ground vibrations induced by an earthquake. Such volume reductions could result in large uniform or differential settlements of the ground surface (Winterkorn and Fang, 1975).

Well compacted cohesionless embankments or reasonably flat slopes in insensitive clay, are less likely to fail under moderate seismic shocks (up to 0.15g and 0.20g acceleration). Embankments made up of insensitive cohesive soils founded on cohesive soils or rock may withstand even greater seismic shocks. For earthen embankments in seismic regions, designs with internal drainage and core material most resistant to fracturing should be considered. Slope materials vulnerable to earthquake shocks are as follows (NAVFAC, 1983):

- Very steep slopes of weak, fractured and brittle rocks or unsaturated loess are vulnerable to transient shocks caused by tensional faulting.

- Loess and saturated sand may be liquefied by seismic shocks causing the sudden collapse of structures and flow slides.

- Similar effects are possible in sensitive cohesive soils when natural moisture exceeds the soil's liquid limit.

- Dry cohesionless material on a slope at the angle of repose will respond to seismic shock by shallow sloughing and slight flattening of the slope.

Geotechnical stability investigations frequently incorporate the use of computer methods to reduce the computational time of well-established analytical methods. Several computer software packages are available that approximate the anticipated dynamic forces of the design earthquake by resolving the forces into a static analysis of loading on design cross sections. A conservative approach would incorporate both vertical and horizontal forces caused by bedrock acceleration if it can be shown that the types of material of interest are susceptible to the vertical force component. Examples of computer models, include PC-Slope by Geoslope Programming (1986), and FLUSH by the University of California. FLUSH is a two-dimensional finite element program for seismic and soil-structure interaction. Reference to these programs does not constitute an endorsement for their use as many other well established PC based models are available. The use of any model, however, should be based on a thorough evaluation of the program's limitations, assumptions, and algorithms. Modeling and model validation, should be performed by a qualified geotechnical engineer. For more information concerning slope stability, refer to Section 2.7, Unstable Areas.

Design modifications to accommodate an earthquake may include shallower waste sideslopes, more conservative design of dikes and runoff controls, and additional contingencies for leachate collection should primary systems be disrupted. Strengths of the landfill components should be able to withstand these additional forces with an acceptable factor of safety. The use of professionals experienced in seismic analysis is strongly recommended for design of facilities located in areas of high seismic risk.

2.7 UNSTABLE AREAS
40 CFR §258.15

2.7.1 Statement of Regulation

(a) Owners or operators of new MSWLF units, existing MSWLF units, and lateral expansions located in an unstable area must demonstrate that engineering measures have been

incorporated into the MSWLF unit's design to ensure that the integrity of the structural components of the MSWLF unit will not be disrupted. The owner or operator must place the demonstration in the operating record and notify the State Director that it has been placed in the operating record. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface).

(b) For purposes of this section:

(1) Unstable area means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the landfill structural components responsible for preventing releases from a landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and Karst terrains.

(2) Structural components means liners, leachate collection systems, final covers, run-on/run-off systems, and any other component used in the construction and operation of the MSWLF that is necessary for protection of human health and the environment.

(3) Poor foundation conditions means those areas where features exist which indicate that a natural or man-induced event may result in inadequate foundation support for the structural components of an MSWLF unit.

(4) Areas susceptible to mass movement means those areas of influence (i.e., areas characterized as having an active or substantial possibility of mass movement) where the movement of earth material at, beneath, or adjacent to the MSWLF unit, because of natural or man-induced events, results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluction, block sliding, and rock fall.

(5) Karst terrains means areas where karst topography, with its characteristic surface and subterranean features, is developed as the result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terrains include, but are not limited to, sinkholes, sinking streams, caves, large springs, and blind valleys.

2.7.2 Applicability

The regulation applies to new units, existing units, and lateral expansions that are located on sites classified as an unstable area. Unstable areas are areas susceptible to natural or human-induced events or forces that are capable of impairing or destroying the integrity of some or all of the structural components. Structural components consist of liners, leachate collection systems, final cover systems, run-on and runoff control systems, and any other component necessary for protection of human health and the environment.

MSWLFs are permitted to be located in unstable areas, but the owner or operator must demonstrate the structural integrity of the MSWLF. The demonstration must show that engineering measures have been incorporated into the design of the unit to ensure that the integrity of the structural components of the unit will not be disrupted. Existing MSWLF units that do not meet the demonstration must be closed within five years in accordance with §258.60 and owners and operators must undertake post-closure activities in accordance with §258.61. The director of an approved State can grant a 2-year extension to the closure requirement under two conditions: (1) no disposal alternative is available; and (2) no immediate threat is posed to human health and the environment.

2.7.3 Technical Considerations

A detailed geotechnical and geological evaluation should be conducted to assess the subsurface under natural and human-induced conditions. The assessment of whether the subsurface can support the MSWLF unit adequately without damage to the structural components should be conducted by qualified professionals. Unstable areas include:

- Poor foundation conditions exist that may result in inadequate support for structural components of the MSWLF unit such as expansive soils and soils subject to rapid settlement;
- Areas susceptible to mass movement where down slope movement of soil, rock, (alone or mixed with water) and/or debris can occur under the influence of gravity; or
- Karst terraces underlain by soluble bedrock and may contain extensive subterranean drainage systems and relatively large subsurface voids that can lead to sinkhole development.

The design of a new unit or lateral expansion, or the re-evaluation of an existing MSWLF should include an assessment of the stability of the foundation soils, adjacent man-made and natural embankments, and slopes; especially when unstable conditions are suspected. The purpose of the assessment is to avoid or prevent a destabilizing event from impairing the environmental integrity of the landfill component systems. The assessment should consider the following factors (USEPA, 1988):

- The adequacy of the subsurface exploration program;
- Liquefaction potential of the embankment, slopes and the foundation soils;
- The expected behavior of the embankment, slopes and the foundation soils, when subjected to seismic activity (see Section 2.6, Seismic Impact Zones);
- Potential for seepage-induced failure; and
- Differential settlements.

Types of Failures

Failures occur when the driving forces imposed on the soils or engineered structure exceed the resisting forces of the material. The ratio of the resisting force to the driving force is considered the factor of safety (FS). At a FS value less than 1.0, failure will occur by definition. There is a high probability that, due to natural variability and the degree of accuracy in measurements, interpreted soil conditions will not be precisely representative of the actual soil conditions. Failure, therefore, may not occur precisely at the calculated value and factors of safety greater than one are required for design. For plastic soils such as clay, movement or deformation (creep) in the soil may occur at a higher factor of safety prior to catastrophic failure. Principal modes of failure in soil or rock include:

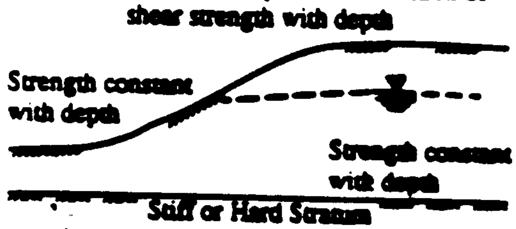
- Rotation on a curved slip surface approximated by a circular arc;
- Translation on a planar surface whose length is large compared to depth below ground;
- Displacement of a wedge-shaped mass along one or more planes of weakness;
- Toppling of rock slopes, with falls, block slides, and lateral spreading;
- Earth and mud flows in loose clayey and silty soils, and
- Debris flows in coarse-grained soils.

Tables 2-1 and 2-2 provide examples of analytical considerations for mode of failure assessments in both natural and man-made slopes. Failures have occurred at operating sites where excavations for expansions adjacent to filled areas reduced the mass of soil at the toe of slope, thereby reducing the overall strength (resisting force) of the foundation soil. Differential settlement beneath a landfill, both in short-term and long-term, should be assessed and compared to the elongation, strength and flexure properties of the liner and leachate collection pipe system. Although excessive differential settlement may not result in catastrophic failure, it may result in liner and piping failure, diminishing the performance of the landfill leachate containment systems.

Differential settlement generally occurs in response to consolidation and dewatering of the foundation soils during and following waste loading. Differential settlement is also discussed in Section 6.2.

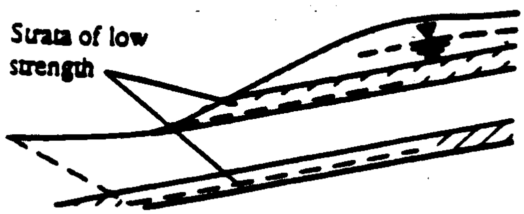
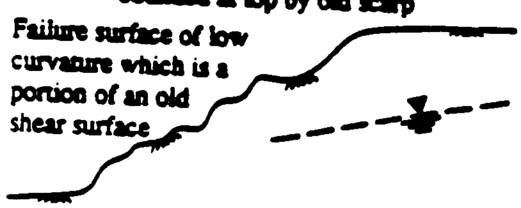
Subsurface Exploration Programs

Foundation soil stability assessments for non-catastrophic failure require field investigations to establish soil strengths and other soil properties. In situ field vane shear tests are commonly conducted in addition to collection of piston samples for laboratory testing of undrained shear strengths (biaxial and triaxial). Field vanes taken with depth (interval dependent on variability of soil strength and type) provide a profile of soil strength. The number of borings required is highly dependent on the variability of the soils, the site size, and landfill dimensions. Borings and field vane testing should consider the anticipated

1. SLOPE IN COURSE-GRAINED SOIL WITH SOME COHESION __Low Groundwater__: Failure of thin wedge, position influenced by tension cracks  __High Groundwater__: Failure at relatively shallow toe circles 	■ With low groundwater, failure occurs on shallow, straight, or slightly curved surface. Presence of a tension crack at the top of the slope influences failure location. With high groundwater, failure occurs on the relatively shallow toe circle whose position is determined primarily by ground elevation. ■ Analyze with effective stresses using strengths C' and Ø' from CD tests. Pore pressure is governed by seepage condition. Internal pore pressures and external water pressures must be included.
2. SLOPE IN COURSE-GRAINED, COHESIONLESS SOIL __Low Groundwater__: Stable slope angle = effective friction angle  __High Groundwater__: Stable slope angle = 1/2 effective friction angle 	■ Stability depends primarily on groundwater conditions. With low groundwater, failures occur as surface sloughing until slope angle flattens to friction angle. With high groundwater, stable slope is approximately 1/2 friction angle. ■ Analyze with effective stresses using strength Ø'. Slight cohesion appearing in test envelope is ignored. Special consideration must be given to possible flow slides in loose, saturated fine sands.
3. SLOPE IN NORMALLY CONSOLIDATED OR SLIGHTLY PRECONSOLIDATED CLAY Location of failure depends on variation of shear strength with depth  	■ Failure occurs on circular arcs whose position is governed by theory. Position of groundwater table does not influence stability unless its fluctuation changes strength of the clay or acts in tension cracks. ■ Analyze with total stresses, zoning cross section for different values of shear strengths. Determine shear strength from unconfined compression test, unconsolidated undrained triaxial test or vane shear.

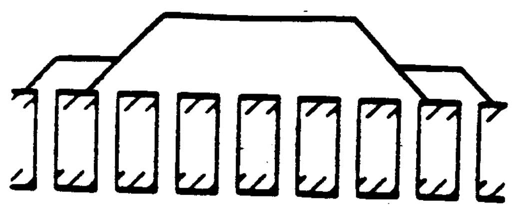
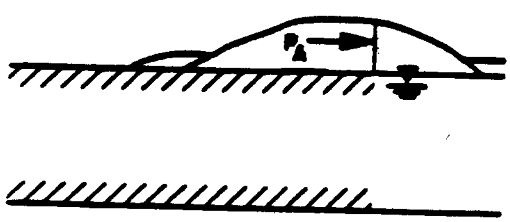
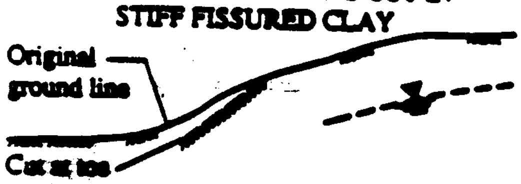
Source: Soil Mechanics, NAVFAC Design Manual 7.01.

TABLE 2-1
Analysis of Stability of Natural Slopes

4. SLOPE IN STRATIFIED SOIL PROFILE Location of failure depends on relative strength and orientation of layers  	■ Location of failure plane is controlled by relative strength and orientation of strata. Failure surface is combination of active and passive wedges with central sliding block chosen to conform to stratification. ■ Analyze with effective stress using C' and Ø' for fine-grained strata and Ø' for cohesionless material.
5. DEPTH CREEP MOVEMENTS IN OLD SLIDE MASS Bowl-shaped area of low slope (9 to 11%) bounded at top by old scarp  	■ Strength of old slide mass decreases with magnitude of movement that has occurred previously. Most dangerous situation is in stiff, over-consolidated clay which is softened, fractured, or slickensided in the failure zone.

Source: Soil Mechanics, NAVFAC Design Manual 7.01.

TABLE 2-1 (continued)
Analysis of Stability of Natural Slopes

1. FAILURE OF FILL ON SOFT COHESIVE FOUNDATION WITH SAND DRAINS  Location of failure depends on geometry and strength of cross section.	■ Usually, minimum stability occurs during placing of fill. If rate of construction is controlled, allow for gain in strength with consolidation from drainage. ■ Analyze with effective stress using C' and Ø' from CU test with pore pressure measurement. Apply estimated pore pressures or piezometric pressures. Analyze with total stress for rapid construction without observation of pore pressures, use shear strength from unconfined compression or unconsolidated undrained triaxial.
2. FAILURE OF STIFF COMPACTED FILL ON SOFT COHESIVE FOUNDATION  Failure surface may be rotation on circular arc or translation with active and passive wedges.	■ Usually, minimum stability obtained at end of construction. Failure may be in the form of rotation or translation, and both should be considered. ■ For rapid construction ignore consolidation from drainage and utilize shear strengths determined from U or UU tests or vane shear in total stress analysis. If failure strain of fill and foundation materials differ greatly, safety factor should exceed one, ignoring shear strength of fill. Analyze long-term stability using C and Ø from CU tests with effective stress analysis, applying pore pressures of groundwater only.
3. FAILURE FOLLOWING CUT IN STIFF FISSURED CLAY  Failure surface depends on pattern of fissures or depth of softening.	■ Release of horizontal stresses by excavation causes expansion of clay and opening of fissures, resulting in loss of cohesive strength. ■ Analyze for short-term stability using C' and Ø' with total stress analysis. Analyze for long-term stability with C_r and $Ø'_r$ based on residual strength measured in consolidated drained tests.

Source: Soil Mechanics, NAVFAC Design Manual 7.01.

TABLE 2-2
Analysis of Stability of Cut and Fill Slopes, Conditions Varying with Time

design to identify segments of the facility where critical cross sections are likely to occur. Critical sections are where factors of safety are anticipated to be lowest.

Other material testing to properly characterize a given soil includes water content, Atterberg limits, grain size distribution, consolidation, effective porosity, and saturated hydraulic conductivity. The site hydrogeologic conditions should be known to determine if soils are in saturated or unsaturated hydraulic conditions.

Catastrophic failure such as sink hole collapse in karst terrain or fault displacement during an earthquake are more difficult to predict. Subsurface karst structures may have surface topographic expressions such as circular depressions over subsiding solution caverns. Subsurface borings may provide the only reliable method of identifying the occurrence, depth and size of solution cavities posing potential for catastrophic collapse.

Methods of Analysis

Depending on the foundation soil of concern, stability analysis should include both short-term and long-term conditions, as well as special conditions that may exist during construction of an expansion (e.g., excavation) which may affect the stability of an existing unit. Factor of safety rationale and selection for different conditions are described by Huang (1983) and Terzaghi and Peck (1967). Table 2-3 lists recommended minimum factor of safety values for slopes. Many states may provide their own minimum factor of safety requirements.

There are numerous methods currently available for performing slope stability analyses. Method selection should be based on the soil properties and the anticipated mode of failure. Rationale for selecting a specific method should be justified.

The majority of the these methods may be categorized as "limit equilibrium" methods where the existing forces are determined and compared. The basic assumption of the limit equilibrium approach is that the failure criterion is satisfied along an assumed failure surface. This surface may be a straight line, circular arc, logarithmic spiral, or other irregular plane. A free body diagram of the forces acting on the slope is constructed using assumed or known values of the forces. The shear resistance of the soil necessary to establish equilibrium is then calculated. This calculated shear resistance is then compared to the estimated or available shear strength of the soil to give an indication of the factor of safety (Winterkorn and Fang, 1975).

Methods that consider only the whole free body as a single unit include the Culmann method and the friction circle method. Another approach is to divide the free body into many vertical slices and to consider the equilibrium of each slice. Several versions of the slice method are available; the best known are the Swedish Circle method and the Bishop method (Winterkorn and Fang, 1975). Further discussions of these and other methods may be found in the Winterkorn and Fang (1975), Lambe and Whitman (1969) and NAVFAC (1986).

TABLE 2-3
Recommended Minimum Values of Factor of Safety for Slope Stability Analyses

Consequences of Slope Failure	Uncertainty of Strength Measurements	
	Small[1]	Large[2]
No imminent danger to human life or major environmental impact if slope fails	1.25 (1.2)*	1.5 (1.3)
Imminent danger to human life or major environmental impact if slope fails	1.5 (1.3)	2.0 or greater (1.7 or greater)

[1] The uncertainty of the strength measurements is smallest when the soil conditions are uniform and high quality strength test data provide a consistent, complete, and logical picture of the strength characteristics.

[2] The uncertainty of the strength measurements is greatest when the soil conditions are complex and when available strength data do not provide a consistent, complete, or logical picture of the strength characteristics.

* Numbers without parentheses apply for static conditions and those within parentheses apply to seismic conditions.

Source: EPA Guide to Technical Resources for the Design of Land Disposal Facilities.

A computer software package, Geotechnical Analysis for Review of Dike Stability (GARDS), has been developed by USEPA's Risk Reduction Engineering Laboratory (RREL) to assist permit writers and designers in evaluating earth dike stability. GARDS details the basic technical concepts and operational procedures for the analysis of site hydraulic conditions, dike slope and foundation stability, dike settlement, and liquefaction potential of dike and foundation soils. The program was designed to meet the expressed need for a geotechnical support tool to facilitate evaluation of existing and proposed earth dike structures at municipal solid waste landfill facilities. The GARDS software package may be obtained from RREL and may be supplemented by the Technical Manual: *Geotechnical Analysis for Review of Dike Stability (GARDS)* (USEPA, 1988).

Design for Slope Stabilization

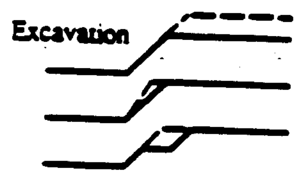
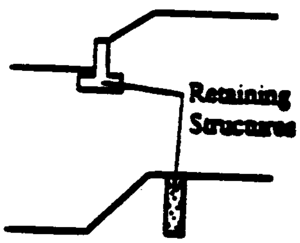
Methods for slope stabilization include regrading the slope profile, seepage and ground-water control and the use of retaining structures. Flattening and/or benching of the slope, or adding material at the slope's toe, may sufficiently enhance stability. Surface control of drainage to decrease infiltration may reduce the potential for mud and debris slides in some areas. Lowering the ground-water table may also have stabilizing effects. Walls or large diameter piling can be used to stabilize slides of relatively small dimension or to retain steep toe slopes so that failure will not extend back into a larger mass (NAVFAC, 1986).

Other potential procedures for stabilizing natural and man-made slopes include use of geotextiles and geogrids to provide additional strength, installation of wick and toe drains to relieve excess pore pressures, grouting, and vacuum and wellpoint pumping to lower ground water. Table 2-4 provides a summary of slope stabilization methods. For more detailed information regarding slope stabilization design, refer to Winterkorn and Fang (1975), NAVFAC (1986), and Sowers (1979). Richardson and Koerner (1987) and Koerner (1986) provide design guidance for geosynthetics in both landfill and general applications.

Monitoring

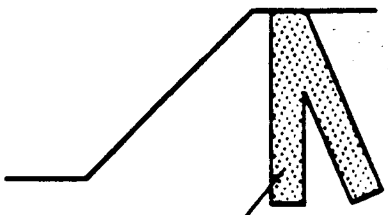
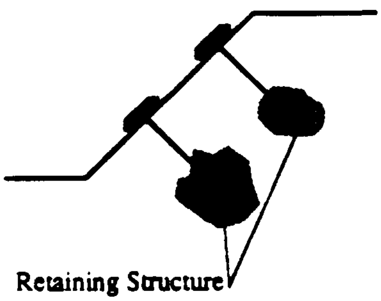
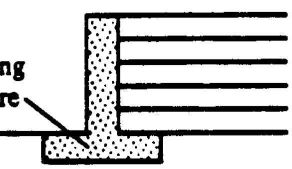
During construction and operation, monitoring of slope stability may be appropriate as additional stresses on natural and engineered soil systems (e.g., slopes, foundations, dikes) are exposed by excavating and filling activities. Post-closure slope monitoring usually is not necessary.

Important monitoring parameters may include settlement, lateral movement and pore water pressure. Monitoring for pore water pressure is usually accomplished with piezometers screened in the particularly sensitive strata. Lateral movements may be detected on the surface by surveying (horizontal and vertical) movements. Subsurface movements may be detected by use of slope inclinometers. Settlement may be monitored by survey of monuments.

Scheme	Applicable Methods	Comments
1. Changing Geometry 	1. Reduce slope height by excavation at top of slope. 2. Flatten the slope angle. 3. Excavate a bench in upper part of slope.	1. Area has to be accessible to construction equipment. Disposal site needed for excavated soil. Drainage sometimes incorporated in this method.
2. Earth Berm Fill 	1. Compacted earth or rock berm placed at and beyond the toe. Drainage may be provided behind berm.	1. Sufficient width and thickness of berm required so failure will not occur below or through berm.
3. Retaining Structures 	1. Retaining wall: crib or cantilever type. 2. Drilled, cast-in-place vertical piles, founded well below bottom of slide plane. Generally 18 to 36 inches in diameter and 4- to 8-foot spacing. Larger diameter piles at closer spacing may be required in some cases to mitigate failures of cuts in highly fissured clays.	1. Usually expensive. Cantilever walls might have to be tied back. 2. Spacing should be such that soil can arch between piles. Grade beam can be used to tie piles together. Very large diameter (6 feet ±) piles have been used for deep slides.

Source: Soil Mechanics, NAVFAC Design Manual 7.01.

TABLE 2-4
Methods of Stabilizing Excavation Slopes

Scheme	Applicable Methods	Comments
 Retaining Structure	3. Drilled, cast-in-place vertical piles tied back with battered piles or a deadman. Piles founded well below slide plane. Generally, 12 to 30 inches in diameter and at 4-to-8-foot spacing.	3. Space close enough so soil will arch between piles. Piles can be tied together with grade beam.
 Retaining Structure	4. Earth and rock anchors and rock bolts.	4. Can be used for high slopes, and in very restricted areas. Conservative design should be used, especially for permanent support. Use may be essential for slopes in rocks where joints dip toward excavation, and such joints daylight in the slope.
Retaining Structure 	5. Reinforced earth.	5. Usually expensive.
4. **Other methods.**	See TABLE 7, NAVFAC DM-7.2, Chapter 1	

Source: Soil Mechanics, NAVFAC Design Manual 7.01.

TABLE 2-4 (continued)
Methods of Stabilizing Excavation Slopes

Engineering Considerations for Karst Terrains

A demonstration that engineering measures have been incorporated into a unit located in a karst terrain may include both initial design and site modifications. The principal concern with karst terrains is progressive and/or catastrophic failure of subsurface conditions due to the presence of sink holes, solution cavities, and subterranean caverns.

The first stage of a demonstration is to characterize the subsurface which may be aided by geophysical techniques including: electromagnetic conductivity, seismic refraction, ground penetrating radar, gravity, and electrical resistivity. Interpretation and applicability of different geophysical techniques should be reviewed by a qualified geophysicist. Often more than one technique should be employed to confirm and correlate findings and anomalies. Subsurface drilling may be appropriate to corroborate results of geophysical investigations.

Additional information on karst conditions can come from remote sensing techniques such as air photograph interpretation. Surface mapping of karst features can help to provide an understanding of structural patterns and relationships in karst terrains. An understanding of local carbonate geology and stratigraphy can aid in the interpretation of both remote sensing and geophysical techniques.

Engineering modification to a karst terrain problem may include both surface water control and conveyance to mitigate the rate of dissolution within known near-surface carbonate structures (limestone). However, it is more likely that structural replacement or filling of karst voids would provide better engineering results. These modifications may include the excavation of loose soils overlying limestone, slurry grouting of cavities with cement or other material, infilling of sink holes and monitoring sinkhole collapse rates, and deep dynamic or vibro-compaction of loose granular overburden soils. Engineering facility components to withstand additional settlement strains may include construction techniques using reinforced concrete mats as part of foundation design. In most instances it will be preferable to avoid construction of MSWLF facility components over known karst conditions that have potential for uncontrollable or catastrophic failure.

2.8 CLOSURE OF EXISTING MUNICIPAL SOLID WASTE LANDFILL UNITS 40 CFR §258.16

2.8.1 Statement of Regulation

(a) Existing MSWLF units that cannot make the demonstration specified in §§285.10(a), pertaining to airports, 258.11(a), pertaining to floodplains, and 258.15(a), pertaining to unstable areas, must close by October 9, 1996, in accordance with §258.60 of this part and conduct post-closure activities in accordance with §258.61 of this part.

(b) The deadline for closure required by paragraph (a) of this section may be extended up to two years if the owner or operator demonstrates to the Director of an approved State that:

(1) There is no available alternative disposal capacity;

(2) There is no immediate threat to human health and the environment.

2.8.2 Applicability

These requirements are applicable to all MSWLF units that receive waste after the effective date of Part 258 and are located within a certain distance of an airport, on a floodplain, or in an unstable area. The owner or operator is required to demonstrate that the facility will not:
(1) pose a bird hazard to aircraft under §258.10(a), (2) cause washout of solid waste, restrict floodplain storage capacity, or increase floodwater flow velocity (thereby increasing flood hazard) in the 100-year floodplain under §258.11(a), and 3) be susceptible to damage that results in failure of landfill structural component systems (e.g., liners, leachate collection, and other engineered systems) from unstable conditions under §258.15(a). If these demonstrations cannot be made, the landfill must close by October 9, 1996.
In approved States the closure deadline may be extended for up to two additional years if it can be shown that alternative disposal capacity is not available elsewhere and that the MSWLF unit does not pose an immediate threat to human health and the environment under the requirements of the airport, floodplain and unstable area location criteria.

2.8.2 Technical Considerations

The engineering considerations that should be addressed for 100-year floodplain encroachment, unstable areas, and landfill operating practices to reduce bird hazards to aircraft are discussed in sections 2.3, 2.7, and 2.2 of this document. Information and evaluations necessary for these demonstrations are also presented in the sections. If applicable demonstrations are not made by the owners or operators, the landfill must be closed according to the requirements of section §258.60 by October 9, 1996.

For MSWLFs located in approved states, this deadline can be extended if there is no immediate threat to human health and the environment and no waste disposal alternative is available. The demonstration of no disposal alternative should consider all waste management facilities, including landfills, incinerators, and recycling facilities. The demonstration for the two year extension should consider the impacts on human health and the environment.

§§258.17-258.19 [Reserved].

2.9 FURTHER INFORMATION

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2.9.2 Organizations

American Institute of Architects
Washington, D.C.
(202) 626-7300

Aviation Safety Institute (ASI)
Box 304
Worthington, OH 43085
(614) 885-4242

Building Seismic Safety Council
201 L Street, Northwest Suite 400
Washington, D.C. 20005
(202) 289-7800

Bureau of Land Management
1849 C St. N.W.
Washington, D.C. 20240
(202) 343-7220 (Locator)
(202) 343-5717 (Information)

Federal Emergency Management Agency
Flood Map Distribution Center
6930 (A-F) San Thomas Road
Baltimore, Maryland 21227-6227

Federal Emergency Management Agency
(800) 638-6620 Continental U.S. only, except Maryland
(800) 492-6605 Maryland only
(800) 638-6831 Continental U.S., Hawaii, Alaska, Puerto Rico,
Guam and the Virgin Islands

Note: The toll free numbers may be used to obtain any of the numerous FEMA publications such as "The National Flood Insurance Program Community Status Book" which is published bimonthly. To obtain Flood Insurance Rate Maps and other flood maps, the FEMA Flood Map Distribution Center should be contacted.

Federal Highway Administration
400 7th St. S.W.
Washington, D.C. 20590
(202) 366-4000 (Locator)
(202) 366-0660 (Information)

National Information Service for Earthquake Engineering (NISSE)
University of California, Berkeley
404A Davis Hall
Berkeley, CA 94720
(415) 642-5113
(415) 643-5246 (FAX)

National Institutes of Science and Technology
(address currently being investigated)

National Oceanic and Atmospheric Administration
Office of Legislative Affairs
1825 Connecticut Avenue Northwest
Room 627
Washington, DC 20235
(202) 208-5717

Tennessee Valley Authority
412 First Street Southeast, 3rd Flr
Washington, DC 20444
(202) 479-4412

U.S. Department of Agriculture
Soil Conservation Service
P.O. Box 2890
Washington, DC 20013-2890
(Physical Location: 14th and Independence Ave. N.W.)
(202) 447-5157

U.S. Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

U.S. Department of the Interior
Fish and Wildlife Service
1849 C Street Northwest
Washington, DC 20240
(202) 208-5634

U.S. Department of Transportation
Federal Aviation Administration
800 Independence Ave., S.W.
Washington, D.C. 20591
(202) 267-3085

U.S. Geological Survey
12201 Sunrise Valley Drive
Reston, Virginia 22092
(800) USA-MAPS

U.S. Geological Survey
Branch of Geological Risk Assessment
Stop 966 Box 25046
Denver, Colorado 80225
(303) 236-1629

U.S. Geological Survey
EROS Data Center
Sioux Falls, South Dakota 57198

U.S. Geological Survey
National Earthquake Information Center
Stop 967 Box 25046
Denver Federal Center
Denver, Colorado 80225
(303) 236-1500

2.9.3 Models

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Note: Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

3.0
SUBPART C
OPERATING CRITERIA

3.1 INTRODUCTION

The Solid Waste Disposal Facility Criteria contain a series of operating requirements pertaining to routine operation, management, and environmental monitoring at a municipal solid waste landfill (MSWLF). The operating requirements pertain to new MSWLFs, existing MSWLFs, and lateral expansions of existing MSWLFs.

The operating requirements have been developed to ensure the safe daily operation and management at MSWLFs. The operating requirements include:

- The exclusion of hazardous waste;
- Daily cover;
- Disease vector control;
- Explosive gases control;
- Air monitoring;
- Facility access;
- Run-on/run-off control systems;
- Surface water requirements;
- Liquid restrictions; and
- Recordkeeping requirements.

The owner or operator of an existing MSWLF, lateral expansion, or new MSWLF must comply with the operating requirements on the effective date of the rule (October 9, 1993).

In specific cases, the operating requirements require compliance with other federal laws (e.g., the Clean Water Act, Clean Air Act). For example, surface water discharges from a MSWLF into the waters of the United States must be in conformance with applicable sections of the Clean Water Act. In addition, burning of MSWLF is regulated under applicable sections of the Clean Air Act.

3.2 PROCEDURES FOR EXCLUDING THE RECEIPT OF HAZARDOUS WASTE 40 CFR §258.20

3.2.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must implement a program at the facility for detecting and preventing the disposal of regulated hazardous wastes as defined in Part 261 of this title and polychlorinated biphenyls (PCB) wastes as defined in Part 761 of this title. This program must include, at a minimum:

(1) Random inspections of incoming loads unless the owner or operator takes other steps to ensure that incoming loads do not contain regulated hazardous wastes or PCB wastes;

(2) Records of any inspections;

(3) Training of facility personnel to recognize regulated hazardous waste and PCB wastes; and

(4) Notification of State Director of authorized States under Subtitle C of RCRA or the EPA Regional Administrator if in an unauthorized State if a regulated hazardous waste or PCB waste is discovered at the facility.

(b) For purposes of this section, <u>regulated hazardous waste</u> means a solid waste that is a hazardous waste, as defined in 40 CFR 261.3, that is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b) or was not generated by a conditionally exempt small quantity generator as defined in §261.5 of this title.

3.2.2 Applicability

This regulation applies to existing MSWLFs, lateral expansions, and new MSWLF facilities that receive wastes on or after the effective date of the Criteria.

The owner or operator must develop a program to detect and prevent disposal of regulated hazardous wastes or PCB wastes at the MSWLF. Hazardous wastes may be gases, liquids, solids, or sludges that are listed or exhibit the characteristics described in 40 CFR Part 261. Hazardous wastes that are excluded from Subtitle C regulation (e.g., household hazardous waste, conditionally exempt small quantity generator waste) are not considered regulated hazardous wastes under these MSWLF criteria; therefore, these wastes do not need to be detected or prevented from disposal at a MSWLF unit.

The hazardous waste exclusion program should be capable of detecting and preventing disposal of PCB wastes. PCB wastes may be liquids or non-liquids (sludges or solids) and are defined at 40 CFR Section 761.60. PCB wastes do not include small capacitors found in fluorescent light ballast, white goods (e.g., washers, dryers, refrigerators) or other consumer electrical products (e.g., radio and television units).

Elements of the hazardous waste exclusion program must include:

- Random inspections of incoming loads or other prevention method;
- Maintaining inspection records;
- Facility personnel training; and
- Notification to appropriate authorities.

The hazardous waste exclusion program is not intended to identify whether regulated hazardous waste or PCB waste was received at the MSWLF prior to the effective date of the Criteria.

3.2.3 Technical Considerations

A solid waste is a regulated hazardous waste if it is: (1) listed in Subpart D of 40 CFR Part 261 (whereby the waste is then termed a "listed" waste), (2) exhibits a hazardous characteristic as defined in Subpart C of 40 CFR Part 261, or (3) is a mixture containing a listed hazardous waste and a non-hazardous solid waste. Appendix B of this document contains the current list of hazardous wastes from Subpart D of 40 CFR Part 261. Characteristics of hazardous wastes a defined in Subpart C of 40 CFR Part 261 include ignitability, corrosivity, reactivity, and toxicity characteristics. The toxicity characteristic leaching procedure, as presented in Appendix II to 40 CFR Part 261, was devised to identify the mobility of metals and some organic compounds present in both the solid and liquid phases of wastes. The characteristics as defined in Subpart C of 40 CFR Part 261 and the toxicity characteristic leaching procedure are discussed briefly in Appendix C.

The MSWLF Criteria exclude conditionally exempt small quantity generator waste (as defined in 40 CFR §261.5) from the definition of "regulated hazardous wastes". These wastes include listed hazardous wastes or wastes that exhibit a characteristic of a hazardous waste, and are generated in quantities no greater than 100 kg/month, or for acute hazardous waste, 1 kg/month. Under 40 CFR §261.5 (f)(3)(iv) and (g)(3)(iv), conditionally exempt small quantity generator hazardous wastes may be disposed at facilities permitted, licensed, or registered by a state to manage municipal or industrial solid waste.

Additional solid wastes are excluded from regulation as a hazardous waste under 40 CFR §261.4(b) and may be accepted for disposal at a MSWLF. Refer to §261.4(b) for a listing of these wastes.

PCBs are regulated under the Toxic Substances Control Act (TSCA), but PCB containing wastes are considered hazardous wastes in some states. PCBs typically are not found in consumer wastes except for fluorescent ballast and small capacitors in white goods and electrical appliances. These sources are not regulated under 40 CFR Part 761 and, therefore, are not part of the detection program required by §258.20. Commercial or industrial sources of PCB wastes that should be addressed by the program include:

- Mineral oil and dielectric fluids containing PCBs;
- Contaminated soil, dredged material, sewage sludge, rags, and other debris from a release of PCBs;
- Transformers and other electrical equipment containing dielectric fluids; and
- Hydraulic machines.

The owner or operator is required to implement a program to detect and exclude regulated hazardous wastes and PCBs from disposal in the landfill. This program must include elements for:

- Random inspections of incoming loads or other prevention methods;
- Maintaining inspection records;
- Facility personnel training; and
- Notification to appropriate authorities if hazardous wastes or PCB wastes are detected.

Each of these program elements is discussed separately below.

Inspections

An inspection is typically a visual observation of the incoming waste loads by an individual who is trained and qualified to identify regulated hazardous or PCB wastes that would not be acceptable for disposal at the MSWLF. An inspection is considered satisfactory if the inspector knows the nature of all materials received in the load and is able to discern whether the materials are potentially regulated hazardous wastes.

While all loads should be screened, it is generally not practical to inspect in detail all incoming loads. Random inspections, therefore can be used to provide a reasonable means to adequately control the receipt of inappropriate wastes. Random inspections are simply inspections made on less than every load.

The frequency of random inspections may be based on the type and quantity of wastes received daily, and the accuracy and confidence desired in conclusions drawn from inspection observations. Since statistical parameters are not provided in the regulation, a reasoned, knowledge-based approach may be taken. A random inspection program may take many forms such as inspecting every incoming load one day out of every month or inspecting one or more loads from transporters of wastes of unidentifiable nature each day. If these inspections indicate that unauthorized wastes are being brought to the MSWLF site, then the random inspection program should be modified to increase the frequency of inspections.

Inspection frequency also can vary depending on the nature of the waste. For example, wastes received predominantly from commercial or industrial sources may require more frequent inspections than wastes predominantly from households. Priority also can be given to inspecting haulers with unknown service areas, to loads brought to the facility in vehicles not typically used for disposal of municipal solid waste, and loads transported by previous would-be offenders. For wastes of unidentifiable nature received from sources other than households (e.g., industrial or commercial establishments), the inspector should question the transporter about the composition of the materials.

Loads should be inspected prior to actual disposal of the waste at the working face of the landfill to provide the facility owner or operator the opportunity to refuse or accept the wastes. Inspections can be conducted on a tipping floor of a transfer station before transfer of the waste to the disposal facility. Inspections may also occur at the tipping floor located near the facility scale house, inside the site entrance, or near, or adjacent to, the working face of the landfill.

Flow charts of a sample methodology to identify, accept or refuse solid waste are provided in Figures 3-1, 3-1B, and 3-1C.

Inspections of materials may be accomplished by discharging the vehicle load in an area designed to contain potentially hazardous wastes that may be received at the facility. The waste should be carefully spread for observation using a front end loader or other piece of

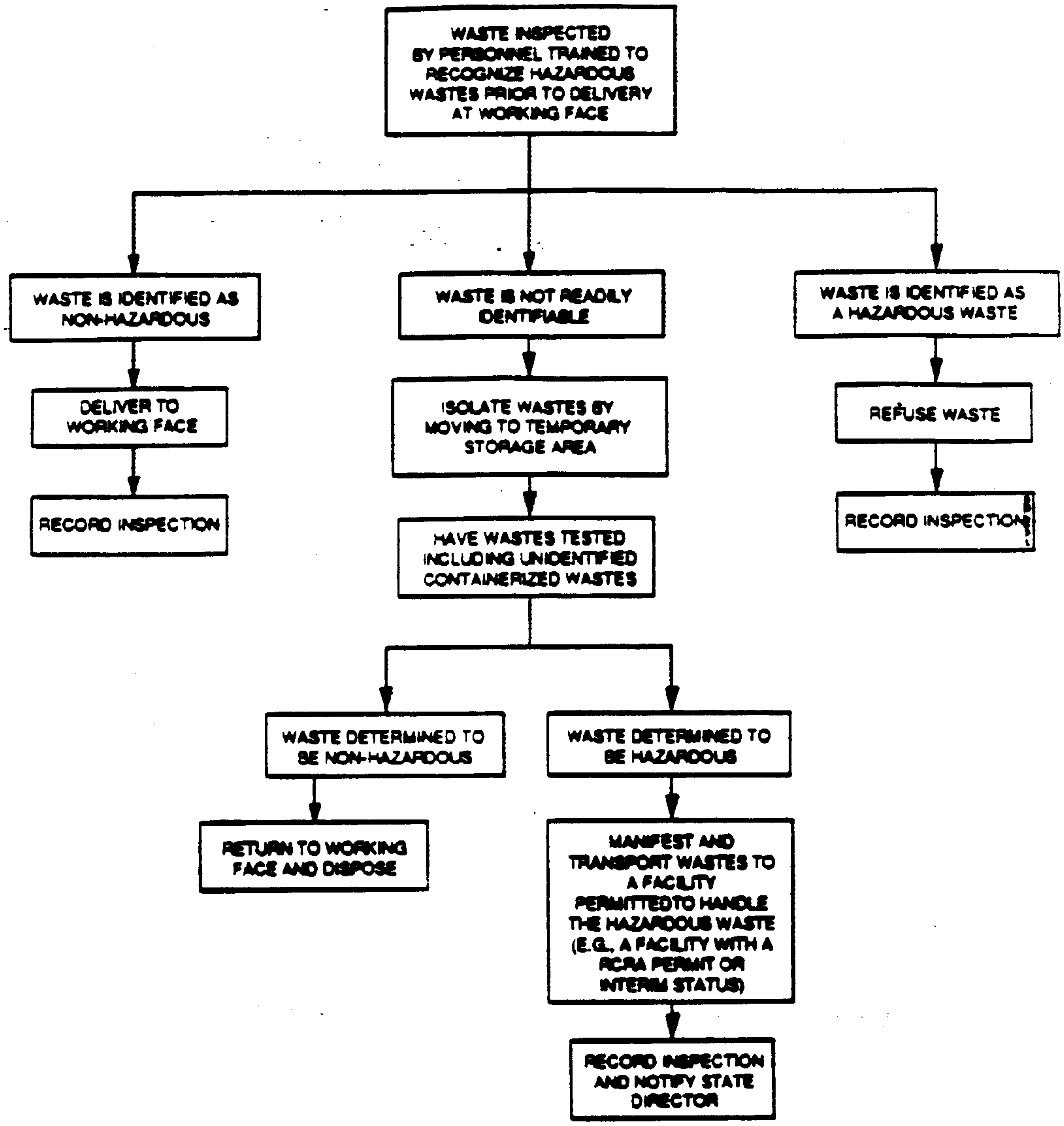


FIGURE 3-1
Hazardous Waste Inspection Decision Tree

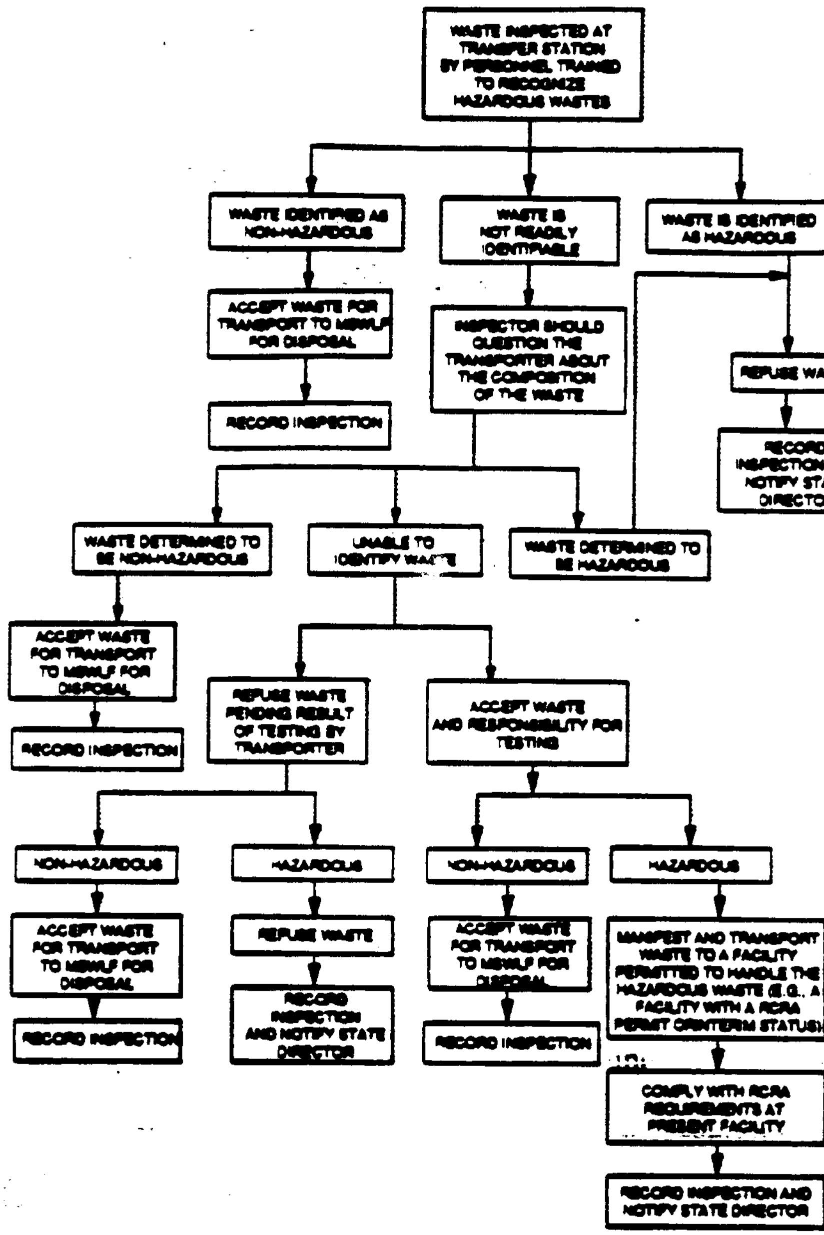


FIGURE 3-1 B
Hazardous Waste Inspection Decision Tree

Inspection at Transfer Station

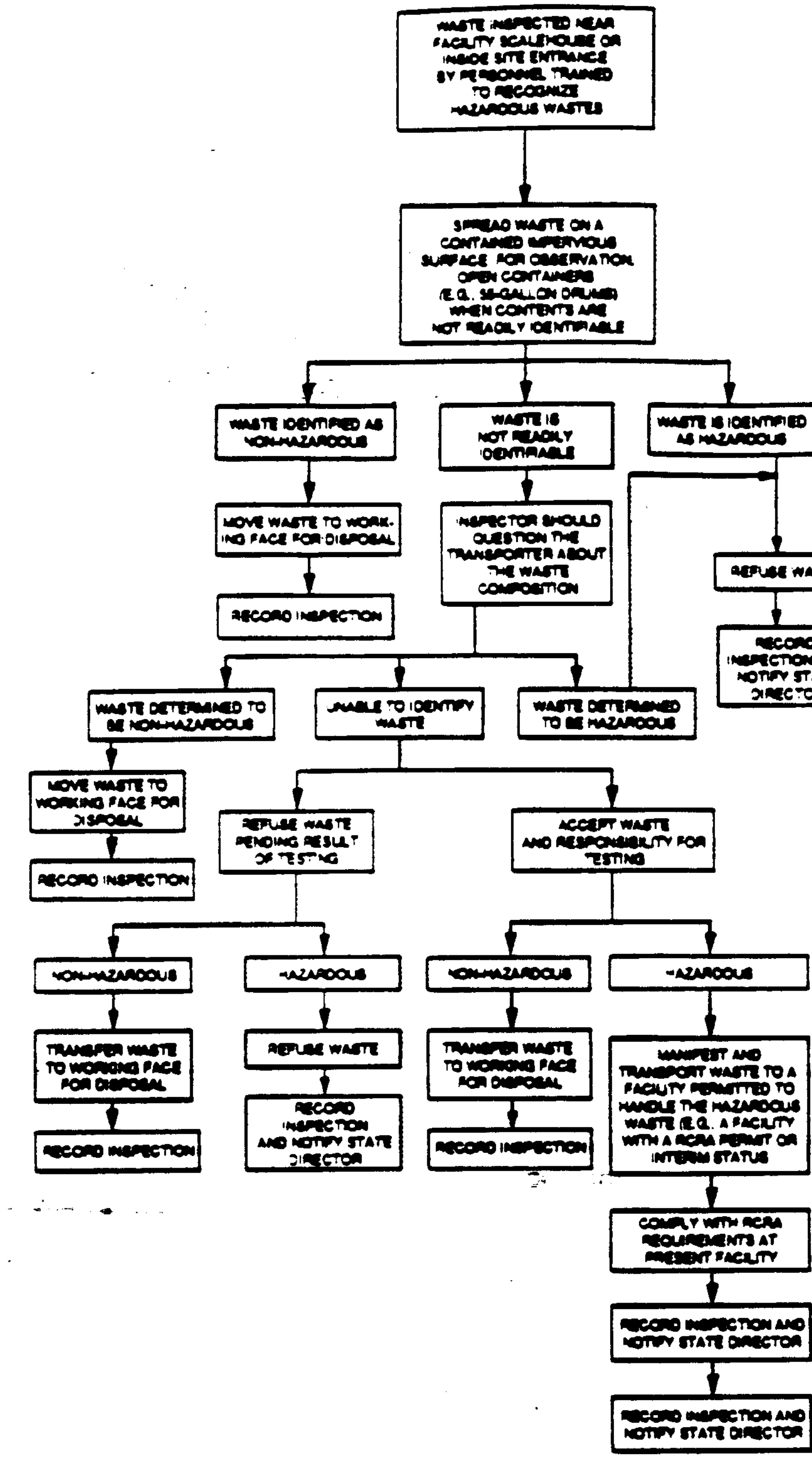


FIGURE 3-1 C
Hazardous Waste Inspection Decision Tree

Inspection Near Facility Scalehouse or Just Inside Site Entrance

equipment. Containers with contents that are not easily identifiable, such as unmarked 55-gallon drums, should be opened only by properly trained personnel. Upon verifying that the solid waste is acceptable, it may then be transferred to the working face for disposal.

Testing typically would include TCLP and other tests for characteristics of hazardous wastes including corrosivity, ignitability, and reactivity. Wastes that are suspected of being hazardous should be handled and stored as a hazardous waste until proven otherwise.

If the wastes temporarily stored at the site are determined to be hazardous, the owner or operator is responsible for the management of the waste. If the wastes are to be transported from the facility, the waste must be: (1) stored at the MSWLF in accordance with requirements of a hazardous waste generator, (2) manifested, (3) transported by a licensed transporter, and (4) disposed of at a permitted Treatment, Storage, or Disposal (TSD) facility. These requirements are discussed more fully later in this section.

Alternative Methods for Detection and Prevention

While the regulations explicitly refer to inspections as an acceptable means of detecting regulated hazardous wastes and PCB wastes, preventing the disposal of these wastes may be accomplished through other methods. These methods may include receipt of only:

- Household wastes; and
- Processed (shredded or baled) wastes that are screened for the presence of the excluded wastes prior to processing.

Recordkeeping

A record should be kept of each inspection that is performed. These records should be included and maintained in the facility operating record. Larger facilities that take large amounts of industrial and commercial wastes may use more detailed procedures than smaller facilities that accept household wastes. Inspection records may include the following information:

- The date and time wastes were received for inspection;
- Source of the wastes;
- Vehicle and driver identification; and
- All observations made by the inspector.

The Director of an approved State can establish alternative recordkeeping locations and requirements.

Training

Owners or operators must train personnel responsible for managing and conducting the detection and prevention program. These personnel include supervisors, designated inspectors, equipment operators, and weigh station attendants who may encounter hazardous wastes. Documentation of training should be placed in the operating record for the facility in accordance with §258.29.

The training program should emphasize methods to identify containers and labels typical of hazardous waste and PCB waste. Training should also address hazardous waste handling procedures, safety precautions, and recordkeeping requirements. Relevant information should be consulted when preparing and developing a training program, including 40 CFR §260 through §270, 29 CFR §1910, and related guidance documents which discuss such topics as: general hazardous waste management; identification of hazardous wastes; transportation of hazardous wastes; standards for hazardous waste treatment, storage and disposal facilities; and hazardous waste worker health and safety training and monitoring requirements.

Notification to Authorities and Proper Management of Wastes

If regulated quantities of hazardous wastes or PCB wastes are found at the landfill, the owner or operator must notify the proper authorities. Proper authorities are either the Director of a State authorized to operate a hazardous waste program under Subtitle C of RCRA or the EPA Regional Administrator in an unauthorized state.

If the owner or operator discovers regulated quantities of hazardous waste or PCB waste while it is still in the possession of the transporter, the owner or operator can refuse to accept the waste at the MSWLF, and the waste will remain the responsibility of the transporter. If, however, the waste is discovered later, the owner or operator must ensure that the waste is managed in accordance with all applicable federal and state regulations.

If the MSWLF is located in an authorized state, the owner or operator should consult state regulations.

Operators of MSWLFs should be prepared to handle hazardous wastes that are inadvertently received at the MSWLF. This may include having containers such as 55-gallon drums available on-site and retaining a list of names and telephone numbers of the nearest haulers licensed to transport hazardous waste.

Hazardous waste may be stored at the MSWLF for 90 days, provided that the procedures required by 40 CFR §262.34, or applicable state requirements, are followed:

- The waste is placed in tanks or containers.
- The date of receipt of the waste is clearly marked and visible on the container;
- The container is clearly marked with the words "Hazardous Waste."
- An employee is designated as the emergency coordinator who is responsible for coordinating all emergency response measures.
- The name and telephone number of the emergency coordinator and the number of the fire department is posted next to the facility phone.

Extensions to store the waste beyond 90 days may be approved pursuant to 40 CFR 262.34.

If the owner or operator transports the wastes off site, the owner or operator must comply with 40 CFR Part 262 or the analogous state requirements. The owner or operator is required to:

- Obtain an EPA identification number (EPA form 8700-12 may be used to apply for an EPA identification number);
- Package the waste in accordance with Department of Transportation (DOT) regulations under 49 CFR Parts 173, 178, and 179. The container must be labeled, marked, and display a placard in accordance with DOT regulations on hazardous waste materials under 49 CFR Part 172; and
- Properly manifest the waste designating a permitted facility to treat, store, or dispose of the hazardous waste.

If the owner or operator decides to treat, store, or dispose of the hazardous waste on site, he or she must comply with the applicable state or federal requirements for hazardous waste treatment, storage, and disposal facilities.

PCB wastes detected at a MSWLF must be stored and disposed of according to 40 CFR Part 761. The owner or operator is required to:

- Obtain an EPA PCB identification number;
- Properly store the PCB waste;
- Mark containers or items with the words "caution contains PCBs."; and
- Manifest the PCB waste for shipment to permitted incinerator, chemical waste landfill, or high efficiency boiler (depending on the nature of the PCB waste) for disposal.

3.3 COVER MATERIAL REQUIREMENTS 40 CFR §258.21

3.3.1 Statement of Regulation

(a) Except as provided in paragraph (b) of this section, the owners or operators of all MSWLF units must cover disposed solid waste with six inches of earthen material at the end of each operating day, or at more frequent intervals if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging.

(b) Alternative materials of an alternative thickness (other than at least six inches of earthen material) may be approved by the Director of an approved State if the owner or operator demonstrates that the alternative material and thickness control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment.

(c) The Director of an approved State may grant a temporary waiver from the requirement of paragraph (a) and (b) of this section if the owner or operator demonstrates that there are extreme seasonal climatic conditions that make meeting such requirements impractical.

3.3.2 Applicability

The regulation applies to existing MSWLFs, new MSWLFs, and lateral expansions. The regulation requires MSWLF owners and operators to cover wastes with a nominal 6-inch layer of earthen material at the end of each operating day. More frequent application of soil may be required if the soil cover does not control:

- Disease vectors (e.g., birds, flies and other insects, rodents);
- Fires;
- Odors;
- Blowing litter; and
- Scavenging.

The Director of an approved State may allow an owner or operator to use alternative cover material of an alternative thickness or grant a temporary waiver of this requirement. An alternative material must not present a threat to human health and the environment, and must continue to control disease vectors, fires, odors, blowing litter, and scavenging. The regulation does not provide for alternative thickness of a soil layer. The only basis for a temporary waiver from the requirement to cover at the end of each operating day would be where extreme seasonal climatic conditions make compliance impractical.

3.3.3 Technical Considerations

Owners and operators of new MSWLFs, existing MSWLFs, and lateral expansions are required to cover solid waste at the end of each operating day with six inches of earthen material. This cover material requirement is not related to the final cover required under §258.60.

The placement of six inches of cover controls disease vectors (birds, insects, or rodents that represent the principal transmission pathway of a human disease) by preventing egress from the waste and by preventing access to breeding environments or food sources. Covering also reduces exposure of combustible materials to ignition sources and may reduce the spread of fire if the disposed waste burns. Odors and blowing litter are reduced by eliminating the direct contact of wind and disposed waste. Similarly, scavenging is reduced by removing the waste from observation. Should these unwanted effects of inadequate cover persist, the owner and operator may increase the amount of soil used or apply it more frequently.

Any soil type can meet the requirements of the regulation when placed in a nominal six-inch layer.

Approved States may grant temporary waivers of the cover requirement to allow demonstrations of alternative designs. The rule does not specify the time frame for the waiver, usually the States decide. A period of six months should be ample time for the owner or operator to make the demonstration. There are no numerical requirements for the alternative cover.

Demonstrations can be conducted in a variety of ways. Some suggested methods for demonstrating alternative covers are:

1) Side by side (six inches of ear ʾen materials and alternative cover) ʾst pads.

2) Full scale demonstration.

3) Short term full scale tests.

Alternatives to soil cover may include:

- Foams;
- Polymer-bonded paper applied in a slurry/spray form;
- Removable and reusable geotextiles;
- Tarps;
- Wood chips;
- Composted sewage sludge; or
- Amended soils.

These alternatives may be used provided that they can control disease vectors, fires, odors, blowing litter, and scavenging without presenting a threat to human health and the environment and increasing complaints from nearby residents.

The temporary climatic waiver of the cover requirement is available only to owners or operators in approved States. The State Director may grant a waiver if the owner or operator demonstrates that meeting the requirements would be impractical due to extreme seasonal climatic conditions. Activities that may be affected by extreme seasonal climatic conditions include:

- Obtaining cover soil from a borrow pit;
- Transporting cover soil to the working face; or
- Spreading and compacting the soil to achieve the required functions.

Extremely cold conditions may prevent the efficient excavation of soil from a borrow pit or the spreading and compaction of the soil on the waste. Extremely wet conditions (e.g., prolonged rainfall, flooding) may prevent transporting cover soil to the working face as well as make it impractical to excavate or spread and compact. The duration of waivers may be as short as one day for unusual rain storms, or as long as several months for extreme seasonal climatic conditions.

3.4 DISEASE VECTOR CONTROL 40 CFR §258.22

3.4.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must prevent or control on-site populations of disease vectors using techniques appropriate for the protection of human health and the environment.

(b) For purposes of this section, disease vectors means any rodents, flies, mosquitoes, or other animals, including insects, capable of transmitting disease to humans.

3.4.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions, and new MSWLFs. The owner or operator is required to prevent or control on-site disease vector populations of rodents, flies, mosquitoes, or other animals, including other insects. The techniques that may be used in fulfilling this requirement must be appropriate for the protection of human health and the environment.

3.4.3 Technical Considerations

Disease vectors such as rodents, birds, flies, and mosquitoes are typically attracted by putrescent waste and standing water, which act as a food source and breeding ground. Putrescent waste is solid waste that contains organic matter (such as food waste) capable of being decomposed by micro-organisms. A MSWLF typically accepts putrescent wastes.

Application of cover at the end of each operating day generally is sufficient to control disease vectors; however, other vector control alternatives may be required. These alternatives could include: reducing the size of the working face; other operational modifications (e.g., increasing cover thickness, changing cover type, density, placement frequency, and grading); repellents, insecticides or rodenticides; composting or processing of organic wastes prior to disposal; and predatory or reproductive control of insect, bird, and animal populations. Additional methods to control birds are discussed in Section 2 (Airport Safety).

Mosquitoes, for example, are attracted to MSWLF facilities by standing water, which can provide a potential breeding ground after only three or more days. Water generally collects in surface depressions, open containers, exposed tires, ponds resulting from soil excavation, leachate storage ponds and siltation basins. Landfill operations that minimize standing water and use an insecticide spraying program, when needed, are ordinarily effective in controlling mosquitoes.

Vectors may reach the landfill not only from areas adjacent to the landfill, but through other modes that are in contact with areas conducive to harborage and breeding of disease vectors. Such areas may include residential and commercial route collection vehicles and transfer stations. These transport modes and areas should also be included in the disease vector control program if disease vectors at the landfill become a problem. Keeping the collection vehicles and transfer stations covered; emptying and cleaning the collection vehicles and transfer stations; using repellents, insecticides, or rodenticides; and reproductive control are all measures available to reduce disease vectors in these areas.

3.5 EXPLOSIVE GASES CONTROL 40 CFR §258.23

3.5.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must ensure that:

(1) The concentration of methane gas generated by the facility does not exceed 25 percent of the lower explosive limit for methane in facility structures (excluding gas control or recovery system components); and

(2) The concentration of methane gas does not exceed the LEL for methane at the facility property boundary.

(b) Owners or operators of all MSWLF units must implement a routine methane monitoring program to ensure that the standards of paragraph (a) of this section are met.

(1) The type and frequency of monitoring must be determined based on the following factors:

(i) Soil conditions;

(ii) The hydrogeologic conditions surrounding the facility;

(iii) The hydraulic conditions surrounding the facility; and

(iv) The location of facility structures and property boundaries.

(2) The minimum frequency of monitoring shall be quarterly.

(c) If methane gas levels exceeding the limits specified in paragraph (a) of this section are detected, the owner or operator must:

(1) Immediately take all necessary steps to ensure protection of human health and notify the State Director;

(2) Within seven days of detection, place in the operating record the methane gas levels detected and a description of the steps taken to protect human health; and

(3) Within 60 days of detection, implement a remediation plan for the methane gas releases, place a copy of the plan in the operating record, and notify the State Director that the plan has been implemented. The plan shall describe the nature and extent of the problem and the proposed remedy.

(4) The Director of an approved State may establish alternative schedules for demonstrating compliance with paragraphs (2) and (3).

(d) For purposes of this section, lower explosive limit (LEL) means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at 25°C and atmospheric pressure.

3.5.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions, and new MSWLFs. The accumulation of methane in MSWLF structures can potentially result in fire and explosions that can endanger employees, users of the disposal site, and occupants of nearby structures, or cause damage to landfill containment structures. These hazards are preventable through monitoring and through corrective action should methane gas levels exceed specified limits in the facility structures (excluding gas control or recovery system components), or at the facility property boundary. MSWLF owners and operators must comply with the following requirements:

- Monitor quarterly;
- Take immediate steps to protect human health in the event of methane gas levels exceeding 25% of the lower explosive limit (LEL), such as evacuating the building;
- Notify the State Director if methane levels exceed 25 % of the LEL in facility structures or exceeds the LEL at the facility property boundary;
- Within 7 days of detection, place in the operating record documentation that methane gas concentrations exceeded the criteria, along with a description of immediate actions taken to protect human health; and
- Within 60 days of detection, implement a remediation plan for the methane gas releases, notify the State Director, and place a copy of the remediation plan in the operating record.

The compliance schedule for monitoring and responding to methane levels that exceed the criteria of this regulation can be changed by the Director of an approved State.

3.5.3 Technical Considerations

To implement an appropriate routine methane monitoring program to demonstrate compliance with allowable methane concentrations, the characteristics of landfill gas (of which methane is one constituent) production, fate, and migration at a site should be understood. Landfill gases are the result of microbial decomposition of solid waste. Gases produced include methane (CH_4), carbon dioxide (CO_2), and lesser amounts of other gases (e.g., hydrogen (H_2), volatile components of waste and its decomposition products (e.g., volatile organic acids and household solvents), and hydrogen sulfide (H_2S). Methane gas, the principal component of natural gas, is generally the primary concern in evaluating landfill gas generation because it is odorless and highly combustible. Typically, hydrogen gas is present at much lower concentrations and its appearance is transient as decomposition progresses from the acid production phase to the methanogenic phase. While hydrogen is explosive and is occasionally detected in landfill gas, it readily reacts to form methane or hydrogen sulfide. Hydrogen sulfide is an asphyxiant and is readily identified by its "rotten egg" smell at a threshold concentration near 5 ppb.

Landfill gas is a mixture of these gases. Gas composition may vary spatially within a landfill as a result of pockets of microbial activity, but due to partial pressure gradients, differences in gas composition are reduced as the gases co-mingle within and outside the landfill. Although methane gas is lighter than air and carbon dioxide is heavier, these gases are concurrently produced at the microbial level and will not separate by their individual density. The gases will remain mixed and will migrate according to the density gradients between the landfill gas and the surrounding gases (i.e., a mixture of methane and carbon dioxide in a landfill or in surrounding soil will not separate by rising and sinking respectively, but will migrate as a mass in accordance with the density of the mixture and other gradients such as temperature and partial pressure).

When undergoing vigorous microbial production, gas pressures on the order of 1 to 3 inches of water relative to atmospheric pressure are common at landfills with much higher pressures occasionally reported. A barometric pressure change of 2 inches of mercury is equivalent to 27.2 inches of water. Relative gauge pressures at a particular landfill or portion of landfill, the ability of site conditions to contain landfill gas, barometric pressure variations, and the microbial gas production rate control pressure-induced landfill gas migration. Negative gas pressures are commonly observed and are believed to occur as a result of the delayed response within a landfill to the appearance of a barometric high. Barometric highs will tend to introduce atmospheric oxygen into surface soils in shallow portions of the landfill which may alter microbial activity, particularly methane production, and gas composition.

Migration of landfill gas is caused by concentration gradients, pressure gradients, and density gradients. The direction in which landfill gas will migrate is controlled by the driving gradients and gas permeability of the porous material through which it is migrating. Generally, landfill gas will migrate through the path of least resistance.

Coarse, porous soils such as sand and gravel will allow greater lateral migration or transport of gases than finer-grained soils. Generally, resistance to landfill gas flow increases slightly as moisture content increases, and an effective barrier to gas flow is created under saturated conditions. Thus, readily drained soil conditions, such as sands and gravels above the water table, may provide a preferred flowpath, but unless finer-grained soils are saturated, landfill gases will not exclusively flow in the sand and gravel deposit. Figure 3-2 illustrates the potential effects of surrounding geology on gas migration.

While providing resistance to landfill gas migration, geomembranes do not eliminate landfill gas migration, but much of the landfill gas in an MSWLF will tend to migrate laterally if the MSWLF has been covered with these materials and if interior side slopes of the landfill do not contain an effective gas barrier such as may exist with a composite infiltration layer. Lateral gas migration is more common in older facilities that lack clay or geomembrane systems. The degree of lateral migration in older facilities may also depend on the type of natural soils surrounding the facility.

Stressed vegetation may be indicative of gas migration. Landfill gas present in the soil atmosphere tends to make the soil anaerobic either by displacing the oxygen in the soil or consuming the oxygen, thereby asphyxiating the roots of plants. Generally, the higher the concentration of combustible gas and/or carbon dioxide and the lower the amount of oxygen, the greater the extent of damage to vegetation (Flowers, et. al, 1977).

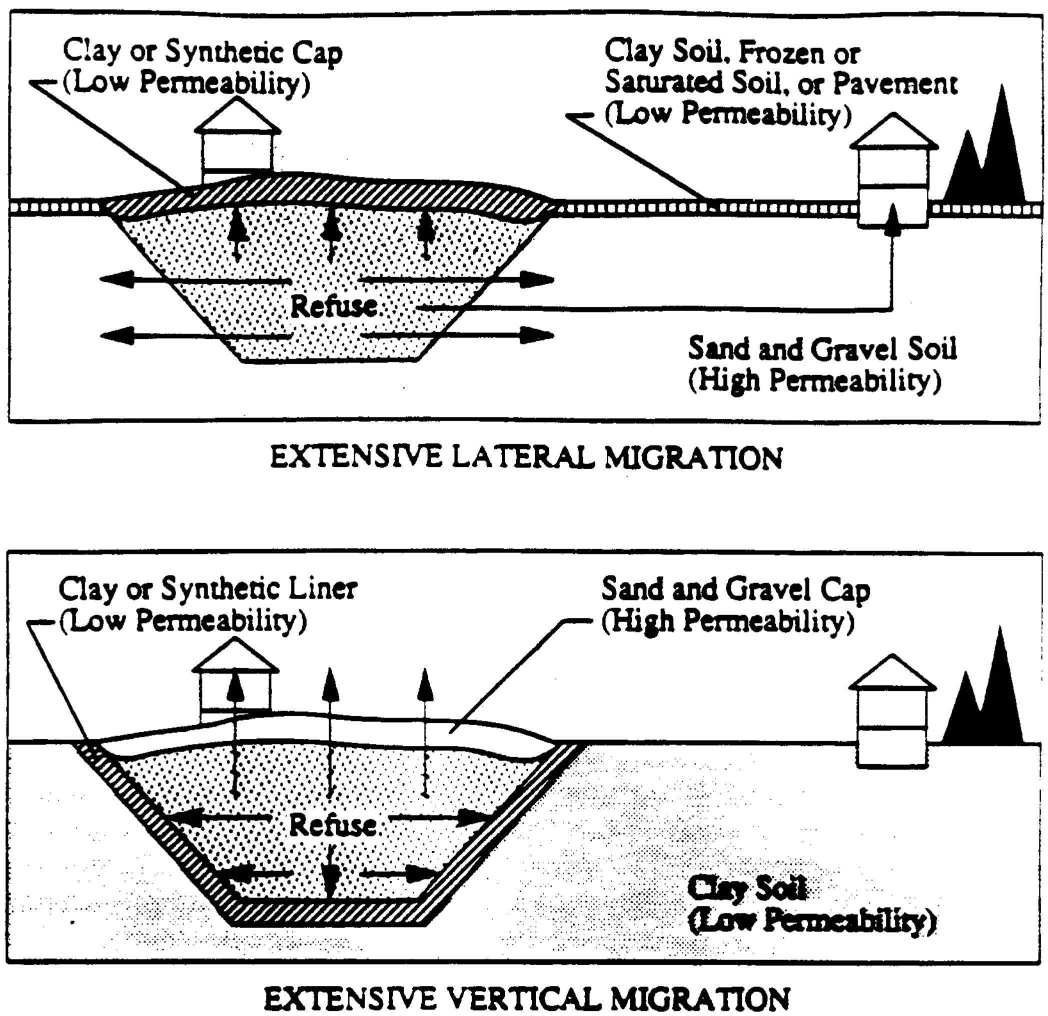
Gas Monitoring

The owner or operator of a MSWLF must implement a routine methane monitoring program to comply with the lower explosive limit (LEL) requirements for methane. Methane is explosive when present in the range of 5 to 15 percent by volume in air. When present in air at concentrations greater than 15 percent, the mixture will not explode. This 15 percent threshold is the Upper Explosive Limit or UEL. The UEL is the maximum concentration of a gas or vapor above which the substance will not burn when exposed to a source of ignition. The explosive hazard range is between the LEL and the UEL. Monitoring may include: (1) sampling gases from probes within the landfill or from within the leachate collection system; (2) sampling gases from monitoring probes installed in soil between the landfill and the property boundary or structures where gas migration may pose a danger; and/or (3) sampling air within facility structures where gas may accumulate and in soil at the property boundary. The third monitoring scheme, facility structures and property boundary, must be used to demonstrate compliance with the criteria. Typical gas monitoring probe installations are depicted in Figure 3-3.

Although not required by the regulations, collection of data such as gas probe pressure, ambient temperature, barometric pressure, and the occurrence of precipitation during sampling provides useful information in assessing monitoring results. For example, falling barometric pressure may cause increased subsurface (gas) pressures and corresponding increased methane content as gas more readily migrates from the landfill. Gas probe pressure can be measured using a portable gauge capable of measuring both vacuum and pressure in the range of zero to five inches of water pressure (or other suitable range for pressure conditions) and should be measured prior to purging the gas probe.

A representative sample of formation (subsurface) gases is obtained by purging the gases in the probe before sample collection. Purging is usually accomplished by use of an aspirator or portable vacuum pump. Although the volume of gas purged prior to sample collection can be estimated from probe construction details, monitoring of the extracted gas composition until relatively constant measurements are obtained is a practical and effective method of obtaining a representative sample. A water trap is recommended to protect instrumentation that is connected directly to the gas probe. After measurements are obtained, the gas probe should be capped to reduce the effects of venting or barometric pressure variations on gas composition in the vicinity of the probe.

The frequency of monitoring should be sufficient to detect landfill gas migration based on subsurface conditions and changing landfill conditions such as partial or complete capping, landfill expansion, gas migration control system operation or failure, construction of new or replacement structures, and changes in landscaping or land use practices. The rate of landfill gas migration as a result of these anticipated changes and site specific



Source: Emcon, 1981.

FIGURE 3-2
Potential Effects of
Surrounding Geology on Gas Migration

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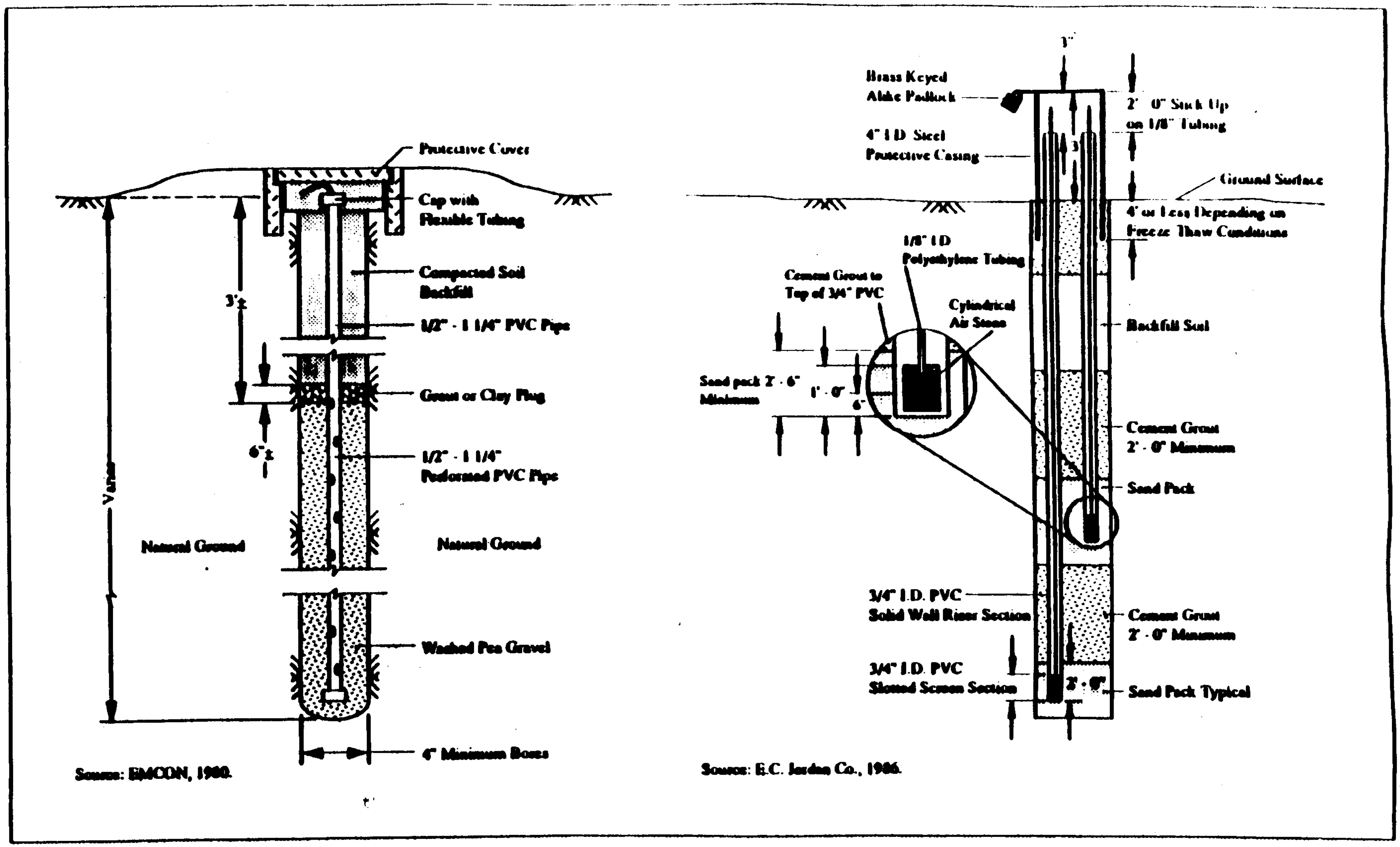


FIGURE 3-3
Typical Gas Monitoring Probes

conditions provides the basis for establishing monitoring frequency. Monitoring should be conducted no less frequently than quarterly.

The number and location of gas probes is also site specific and highly dependent on subsurface conditions, land use, and location and design of facility structures. Monitoring for gas migration should be within the more permeable strata. Multiple or nested probes are useful in defining the vertical configuration of the migration pathway. Structures with basements or crawl spaces are more susceptible to landfill gas infiltration. Elevated structures are typically not at risk.

Measurements are usually made in the field with a portable methane meter, explosimeter, or organic vapor analyzer. Gas samples also may be collected in glass or metal containers for laboratory analysis. Instruments with scales of measure in "percent of LEL" can be calibrated and used to detect the presence of methane. Instruments of the hot-wire Wheatstone bridge type (i.e., catalytic combustion) directly measure combustibility of the gas mixture withdrawn from the probe. The thermal conductivity type meter is susceptible to interference as the relative gas composition, and therefore the thermal conductivity changes. Field instruments should be calibrated prior to measurements and should be rechecked after that day's monitoring activity.

Laboratory measurements, with organic vapor analyzers or gas chromatographs, should be used to confirm the identity and concentrations of gas.

In addition to measuring gas composition, other indications of gas migration may be observed. These include odor (generally described as a "sweet" or rotten egg (H_2S) odor), vegetation damage, septic soil, and audible or visual venting of gases especially in standing water. Exposure to some gases can cause headaches and nausea.

If methane concentrations are in excess of 25 percent of the LEL in facility structures or exceed the LEL at the property boundary the danger of explosion is imminent. Immediate action must be taken to protect human health from potentially explosive conditions. All personnel should be evacuated from the area immediately. Venting the building upon exit (e.g., leaving the door open) is desirable but should not replace evacuation procedures.

Within 60 days of exceeding the methane level, a remediation plan must be prepared and implemented. The remediation plan should describe the nature and extent of the methane problem as well as a proposed remedy.

To comply with this 60-day schedule, an investigation of subsurface conditions may be needed in the vicinity of the monitoring probe where the criterion was exceeded. The objectives of this investigation should be to describe the frequency and lateral and vertical extent of excessive methane migration (that which exceeds the criterion). Such an investigation may also obtain additional characterization of unsaturated soil strata within the area of concern. The investigation should also consider possible causes of the increase in gas concentrations such as landfill operational procedures, gas control system failure or upset, climatic conditions, or closure activity. Based on the extent and nature of the excessive methane migration, a remedial action should be described, if the exceedance is persistent, that can be implemented within the prescribed schedule. The sixty day schedule does not address the protection of human health and the environment. The owner or operator still must take all steps necessary to ensure protection of human health including interim measures.

Landfill Gas Control Systems

Landfill gas may vent naturally or be purposely vented to the atmosphere by vertical and/or lateral migration controls. Systems used to control or prevent gas migration are categorized as either passive or active systems. Passive systems provide preferential flowpaths by means of natural pressure, concentration, and density gradients. Passive systems are primarily effective in controlling convective flow and have limited success controlling diffusive flow. Active systems are effective in controlling both types of flow. Active systems use mechanical equipment to direct or control landfill gas by providing negative or positive pressure gradients. Suitability of the systems are based on the design and age of the landfill, and on the soil, hydrogeologic, and hydraulic conditions of the facility and surrounding environment. Because of these variables, both systems have had varying degrees of success.

Passive systems may be used in conjunction with active systems. An example of this may be the use of a low-permeability passive system for the close. portion of a landfill (for remedial purposes) and the installation of an active system in the active portion of the landfill (for future use).

Selection of construction materials for either type of gas control system should consider the elevated temperature conditions within a landfill compared to the ambient air or soil conditions in which gas control system components are constructed. Since ambient conditions are typically cooler, water containing corrosive and possibly toxic waste constituents may be expected to condense. This condensate should be considered in selecting construction materials. Provisions for managing this condensate should be incorporated to prevent accumulation and possible failure of the collection system. The condensate can be returned to th landfill if the landfill is designed with a composite liner and leachate collection system per §258.40(a)(2). See Chapter 4 for information regarding design. See Section 3.10 of this Chapter for information regarding liquids in landfills.

__Passive Systems__

Passive gas control systems rely on natural pressure and convection mechanisms to vent landfill gas to the atmosphere. Passive systems typically use "high-permeability" or "low-permeability" techniques, either singularly or in combination at a site. High-permeability systems use conduits such as ditches, trenches, vent wells, or perforated vent pipes surrounded by coarse soil to vent landfill gas to the surface and the atmosphere. Low-permeability systems block lateral migration through barriers such as synthetic membranes and high moisture-containing fine-grained soils.

Passive systems may be incorporated into a landfill design or may be used for remedial or corrective purposes at both closed and active landfills. They may be installed within a landfill along the perimeter, or between the landfill and the disposal facility property boundary. A detailed discussion of passive systems for remedial or corrective purposes may be found in USEPA (1985).

A passive system may be incorporated into the final cover system of a landfill closure design and may consist of perforated gas collection pipes, high permeability soils, or high transmissivity geosynthetics located just below the low-permeability gas and hydraulic barrier or infiltration layer in the cover system. These pipes may be connected to vent pipes that vent gas through the cover system or are connected to header pipes located along the perimeter of the landfill. Figure 3-4 illustrates a passive system. The landfill gas collection system may also be connected with the leachate collection system to vent gases in the headspace of leachate collection pipes.

Some problems have been associated with passive systems. For example, snow and dirt may accumulate in vent pipes preventing gas from venting. Vent pipes at the surface are susceptible to clogging by vandalism. Biological clogging of the system is also more common in passive systems.

Active Systems

Active gas control systems use mechanical means to remove landfill gas and consist of either positive pressure (air injection) or negative pressure (extraction) systems. Negative pressure systems extract gas from a landfill by using a blower to pull gas out of the landfill. Positive pressure systems induce a pressure greater than the pressure of the migrating gas and drive the gas out of the soil and/or landfill in a controlled manner.

Negative pressure systems are more commonly used because they are more effective and offer more flexibility in controlling gas migration. The gas may be discharged directly to the atmosphere, recovered for energy conversion, treated, or combusted in a flare system. Typical components of a flare system are shown in Figure 3-5. Negative pressure systems may be used as either perimeter gas control systems or interior gas collection/recovery systems. For more information regarding negative pressure gas control systems, refer to USEPA (1985).

An active gas extraction well is depicted in Figure 3-6. Gas extraction wells may be installed within the landfill waste or in the surrounding soils as depicted in Figure 3-7. One possible configuration of an interior gas collection/recovery system is illustrated in Figure 3-8. The performance of active systems is not as sensitive to freezing or saturation of cover soils as passive systems. Although active gas systems are more effective in withdrawing

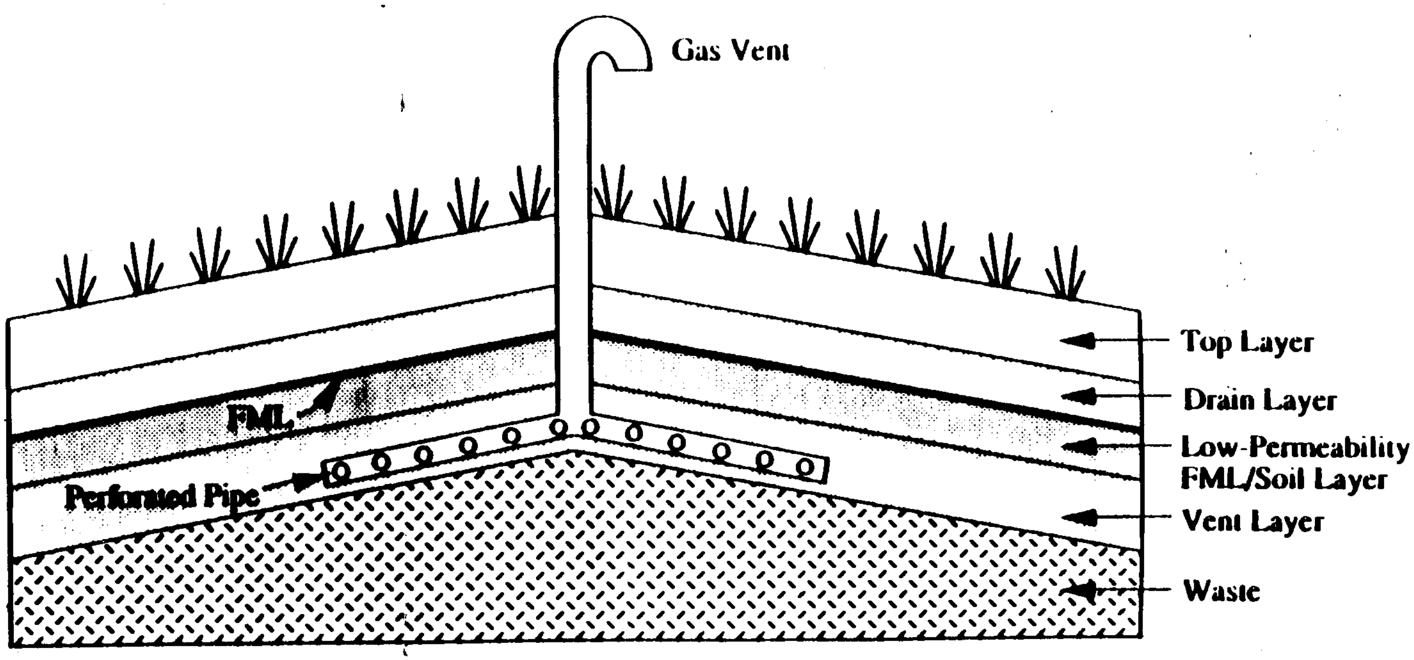
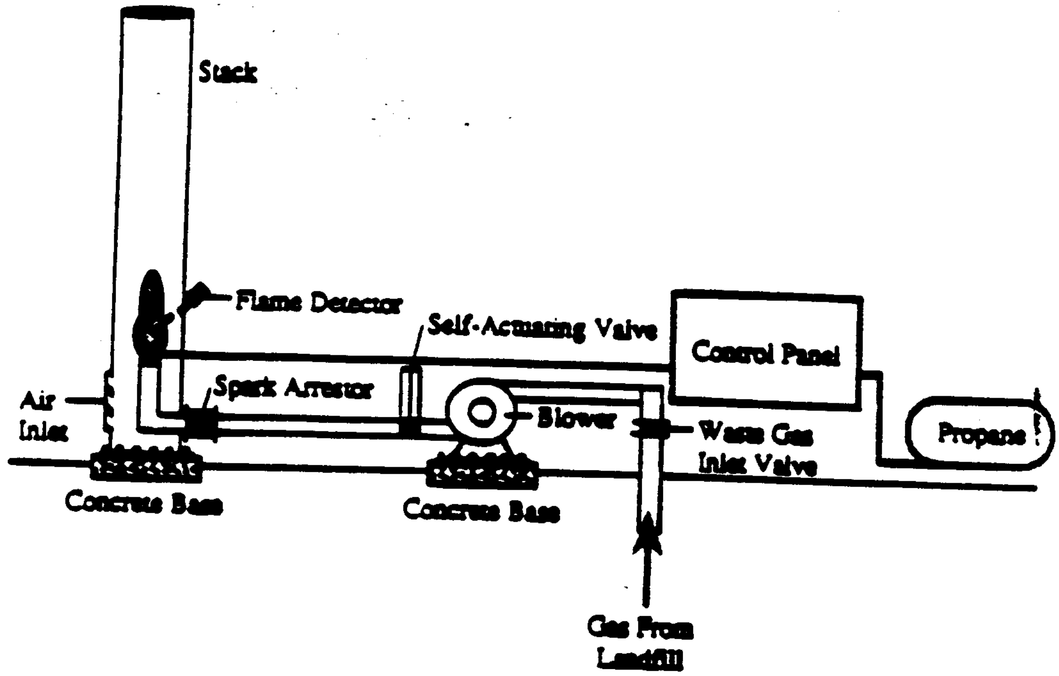


FIGURE 3-4
Passive Gas Control System
(Venting to Atmosphere)

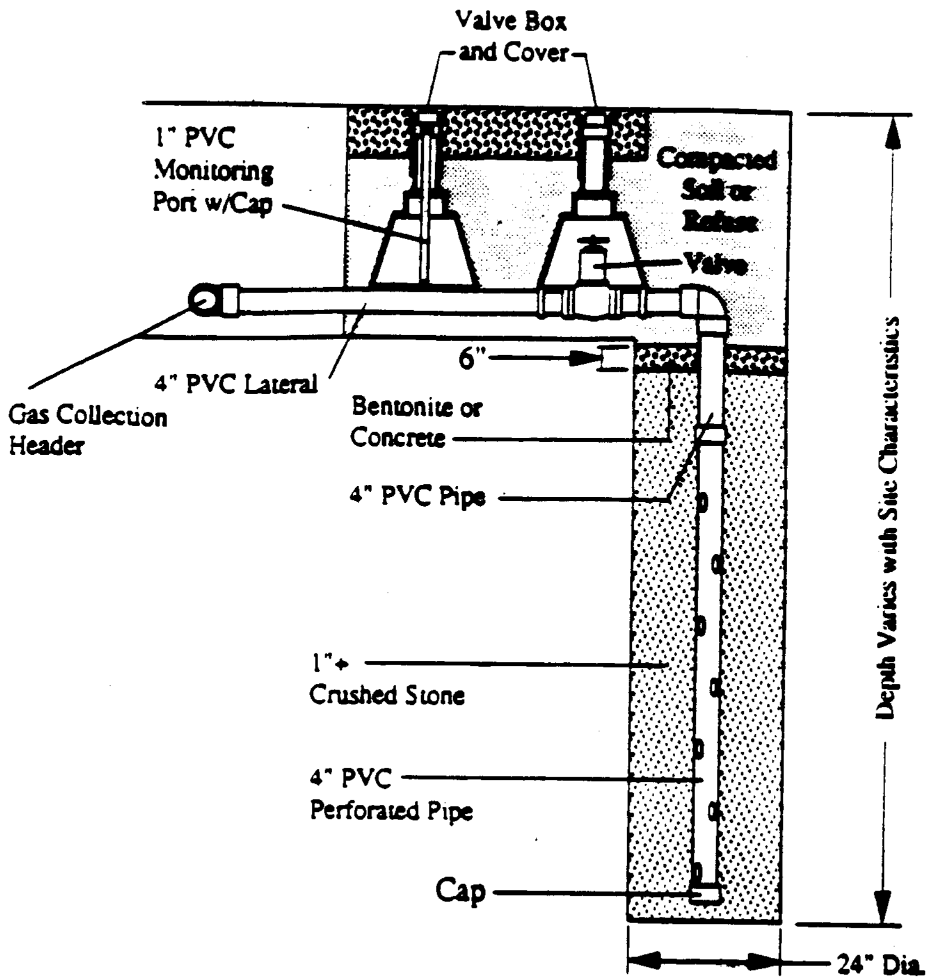


Source: E.C. Jordan Co., 1990.

Control Panel operates safety features including automatic shutdown procedures in the event of a temperature detected flame flash back or failure of flame sensor to detect a flame. Auto shutdown closes the self-actuated valve and shuts down the blower to isolate gas in the landfill.

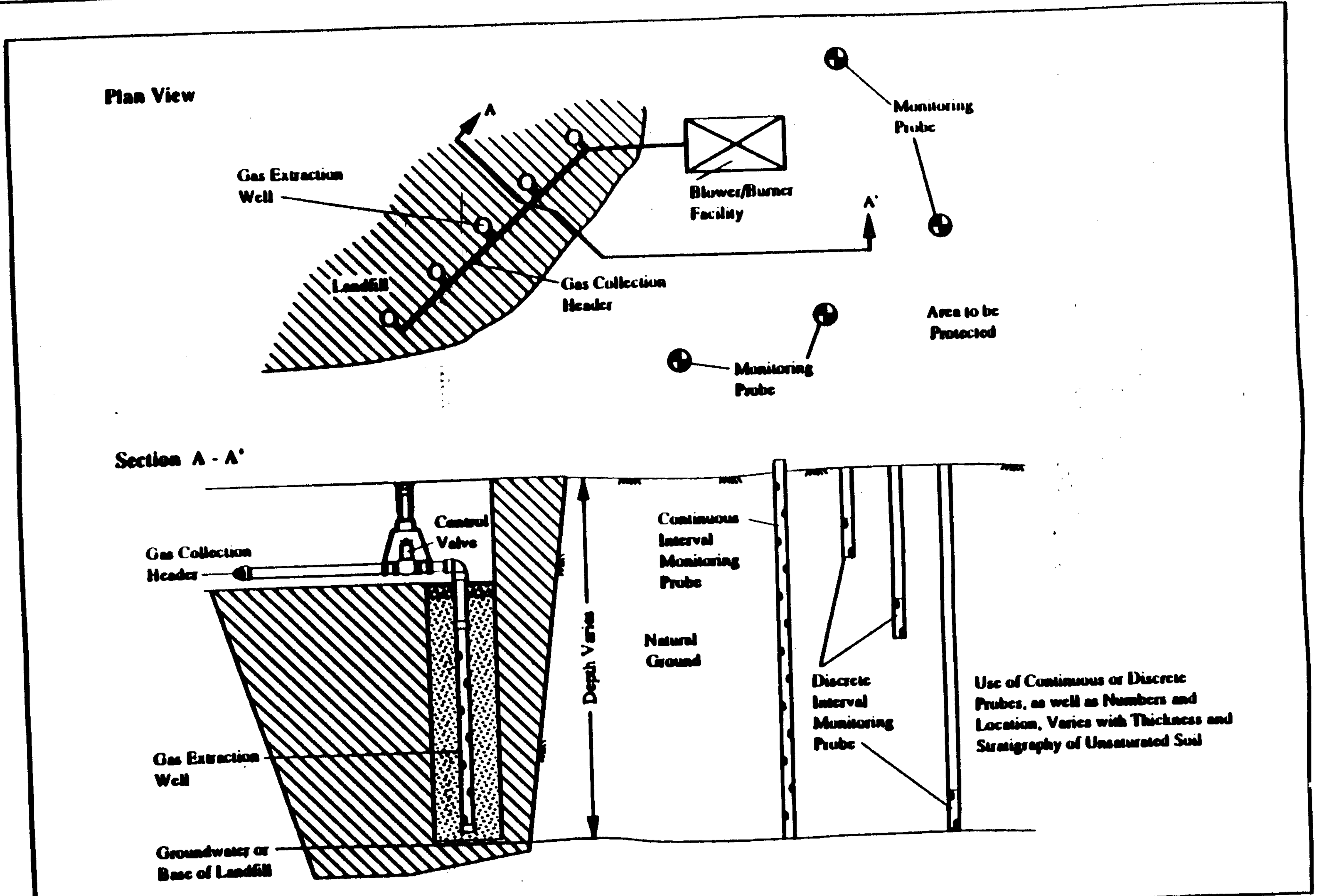
Propane source is for pilot light used in igniting the flare. The flare may be operated on a timed sequence or with methane concentration detectors in the gas inlet line.

FIGURE 3-5
Schematic Diagram of a Landfill Gas Flare



Source: SCS, 1980

FIGURE 3-6
Gas Extraction Well



Source: SCS, 1980

FIGURE 3-7
Active Perimeter Gas Control System

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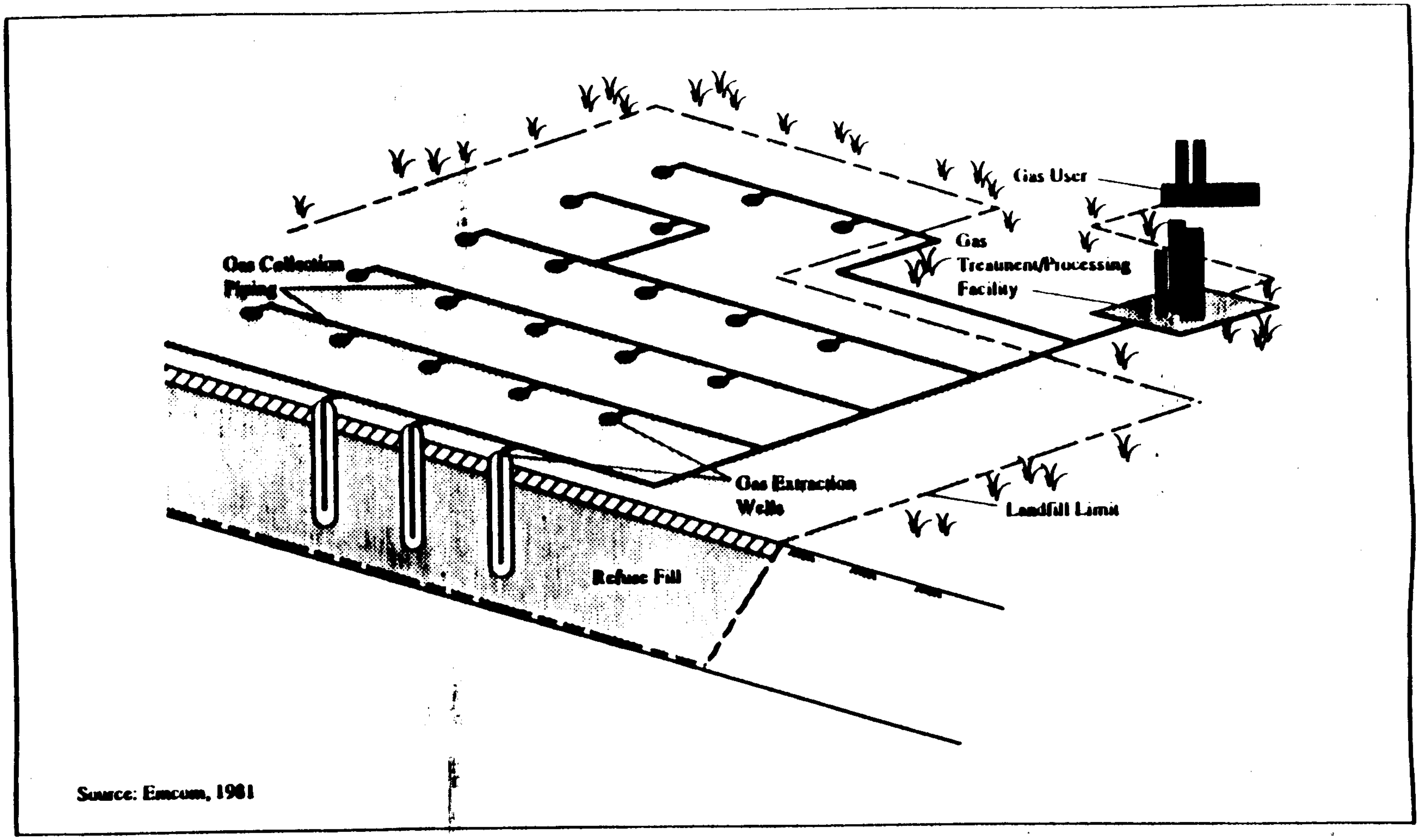


FIGURE 3-8
Interior Gas Collection/Recovery System

gas from the landfill, capital, operation, and maintenance costs of such systems will be higher and these costs continue throughout the post-closure period. At some future time, owners and operators may wish to convert active gas controls into passive systems when gas production diminishes. The conversion option and its environmental effect (i.e., gas release causing odors and health and safety concerns) should be addressed in the original design.

There are many benefits to recovering landfill gas. Landfill gas recovery systems can reduce landfill gas odor and migration, reduce the danger of explosion and fire, and may be used as a source of revenue which may help to reduce the cost of closure. Landfill gas can be used with a minimal amount of treatment or can be upgraded to pipeline standard (GRCDA, 1985). An upgraded gas has had the carbon dioxide and other noncombustible constituents removed.

Raw landfill gas may be used for heating small facilities and water, and may require removal of only water and particulates for this application. A slightly upgraded gas can be used for both water and space heating as well as lighting, electrical generation, cogeneration, and as a fuel for industrial boilers-burners. Landfill gas may also be processed to pipeline quality to be sold to utility companies and even used to fuel conventional vehicles. The amount of upgrading and use of landfill gas is dependent on the landfill size (GRCDA, 1985).

3.6 AIR CRITERIA
40 CFR §258.24

3.6.1 Statement of Regulation

(a) Owners or operators of all MSWLFs must ensure that the units do not violate any applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the Administrator pursuant to section 110 of the Clean Air Act, as amended.

(b) Open burning of solid waste, except for the infrequent burning of agricultural wastes, silvicultural wastes, land-clearing debris, diseased trees, or debris from emergency clean-up operations, is prohibited at all MSWLF units.

3.6.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions to existing MSWLFs, and new MSWLFs. Routine open burning of municipal solid waste is prohibited. Infrequent burning of agricultural and silvicultural wastes, diseased trees, or debris from land clearing or emergency clean-up operations is allowed when in compliance with any applicable requirements developed under a State Implementation Plan (SIP) of the Clean Air Act. Agricultural waste does not include empty pesticide containers or waste pesticides.

3.6.3 Technical Considerations

Air pollution control requirements are developed under an SIP which is approved by the Administrator of an approved State. The owner or operator of

MSWLF should consult the state or local agency responsible for air pollution control to ascertain that the burning of wastes complies with applicable requirements developed under the SIP. The SIP may include variances, permits, or exemptions for burning agricultural wastes, silvicultural wastes, land-clearing debris, diseased trees, or debris from emergency clean-up operations. Routine burning of wastes is banned in all cases, and the SIP may limit burning of waste such as agricultural wastes to certain hours of the day; days of the year; designated burn areas; specific types of incinerators; atmospheric conditions; and distance from working face, public thoroughfares, buildings and residences.

Requirements under the SIP also may include notifying applicable state or local agencies whose permits may: (1) restrict times when limited burning of waste may occur; (2) specify periods when sufficient fire protection is deemed to be available; or (3) limit burning to certain areas.

Open burning is defined under §258.2 as the combustion of solid waste: (1) without control of combustion air to maintain adequate temperature for efficient combustion; (2) without containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion; and (3) without the control of the emission of the combustion products. Trench or pit burners, and air curtain destructors, are considered open burning because the particulate emissions are similar to particulate emissions from open burning and these devices do not control the emission of combustion products.

3.7 ACCESS REQUIREMENT 40 CFR §258.25

3.7.1 Statement of Regulation

Owners or operators of all MSWLF units must control public access and prevent unauthorized vehicular traffic and illegal dumping of wastes by using artificial barriers, natural barriers, or both, as appropriate to protect human health and the environment.

3.7.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions, and new MSWLFs. The owner or operator is required to prevent public access to the landfill, except under controlled conditions during hours when wastes are being received.

3.7.3 Technical Considerations

Owners and operators are required to control public access to prevent illegal dumping, public exposures to hazards at MSWLFs, and unauthorized vehicular traffic. Frequently, unauthorized persons are unfamiliar with the hazards associated with landfill facilities, and consequences of uncontrolled access may include injury and even death. Potential hazards are related to inability of equipment operators to see unauthorized individuals during operation of equipment and haul vehicles; direct exposure to waste (e.g., sharp objects and pathogens); inadvertent or deliberate fires; and earth-moving activities.

Acceptable measures used to limit access of unauthorized persons from entering the disposal facility include gates and fences, trees, hedges, berms, ditches, and embankments. Chain link, barbed wire added to chain link, and open farm-type fencing are examples of fencing that may be used. Access to facilities should be controlled through gates which can be locked when the site is unsupervised. Gates may provide the only additional measure needed at remote facilities.

3.8 RUN-ON/RUN-OFF CONTROL SYSTEMS 40 CFR §258.26

3.8.1 Statement of Regulation

(a) Owners or operators of all MSWLF units must design, construct, and maintain:

(1) A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm;

(2) A run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

(b) Run-off from the active portion of the landfill unit must be handled in accordance with §258.27(a) of this Part.

3.8.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions, and new MSWLFs. The owner or operator is required to prevent run-on onto the active portion of the landfill and to collect and control run-off from the active portion for a 24-hour, 25-year storm. Management of run-off must comply with the point and non-point source discharge requirements of the Clean Water Act.

3.8.3 Technical Considerations

The purpose of a run-on control system is to collect and redirect surface waters to minimize the amount of surface water entering the landfill facility within solid waste unit boundaries. Run-off control systems are designed to collect and control run-off from the active portion of the landfill which may have contacted waste materials. With sequential closure of a landfill facility, waters running off the final cover system of closed areas may not require treatment and can be combined with run-on waters. Run-on and run-off must be managed in accordance with the requirements of the Clean Water Act including, but not limited to, the National Pollutant Discharge Elimination System (NPDES). See Section 3.9 for further information on compliance with the Clean Water Act.

Run-on and run-off control systems must be designed based on a 24-hour, 25-year storm. Information on the 24-hour, 25-year recurring storm can be obtained from Technical Paper 40 "Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years", prepared by the Weather Bureau under the Department of Commerce. Alternatively, local meteorological data can be analyzed to estimate the criterion storm. To estimate run-on, the local watershed should be identified and evaluated to document the basis for run-on design flows.

The Soil Conservation Service Method (SCS) and/or the Rational Method are generally adequate for estimating storm flows for designing run-on and/or run-off control systems. The SCS method estimates run-off volume from accumulated rainfall and then applies the run-off volume to a simplified triangular unit hydrograph for peak discharge estimation and total run-off hydrograph. A discussion of the development and use of this method is available from the U. S. Department of Agriculture, Soil Conservation Service (1986).

The Rational Method approximates the majority of surface water discharge is supplied by the watershed upstream from the facility. A discussion of the Rational Method may be found in USEPA (1988).

Run-on/run-off control structures, both temporary and permanent, may be incorporated into the system design. The structures most frequently used for run-on/run-off control are presented in Table 3-1 and include dikes and berms, channels, waterways, terraces and benches, chutes, downpipes, seepage ditches and basements, sedimentation basins, levees and flood walls. USEPA (1985) provides an in-depth discussion for each of the structures found in Table 3-1. Release of run-on and overland flow from closed portions of the landfill should avoid high-energy and possibly environmentally disruptive configurations.

TABLE 3-1
SURFACE WATER DIVERSION AND CONTAINMENT STRUCTURES

STRUCTURE	DURATION
Dikes and Berms	Temporary
Channels	Temporary
Waterways	Permanent
Terraces, Benches	Temporary, Permanent
Chutes	Permanent
Downpipes	Temporary
Seepage ditches, basins	Temporary
Sedimentation basins	Temporary

3.9 SURFACE WATER REQUIREMENTS 40 CFR §258.27

3.9.1 Statement of Regulation

MSWLF units shall not:

(a) Cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to section 402.

(b) Cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or State-wide water quality management plan that has been approved under section 208 or 319 of the Clean Water Act, as amended.

3.9.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions, and new MSWLFs. The owner or operator is required to comply with the Clean Water Act for any discharges to surface water or wetlands.

3.9.3 Technical Considerations

The owner or operator of a MSWLF should determine if the facility is in conformance with applicable requirements of water quality plans developed under Sections 208 and 319 of the Clean Water Act, and the National Pollutant Discharge Elimination System (NPDES) requirements under Section 402 of the Clean Water Act. The EPA and approved States have jurisdiction for discharge of pollutants (other than dredge and fill materials) in waters of the United States including wetlands. MSWLF units discharging pollutants or disposing of fill material into waters of the United States require a Section 402 (NPDES) permit. Discharge of dredge and fill material into waters of the United States is under the jurisdiction of the U.S. Army Corps of Engineers.

A MSWLF facility that requires a point source discharge must have a NPDES permit. Point source discharges for landfills include, but are not limited to: (1) the release of leachate from a leachate collection or on-site treatment system into the waters of the United States; (2) disposal of solid waste into waters of the United States; or (3) release of surface water run-off which is directed by a run-off control system into the waters of the United States. Leachate that is piped or trucked off-site to a treatment facility is not regarded as a point source discharge.

The Clean Water Act (CWA) provides clarifications of terms such as point source, waters of the United States, pollutants, and discharge of pollutants.

3.10 LIQUIDS RESTRICTIONS 40 CFR §258.28

3.10.1 Statement of Regulation

(a) Bulk or noncontainerized liquid waste may not be placed in MSWLF units unless:

(1) The waste is household waste other than septic waste; or

(2) The waste is leachate or gas condensate derived from the MSWLF unit and the MSWLF unit, whether it is an existing or new unit, is designed with a composite liner and leachate collection system as described in §258.40 (a)(2) of this part. The owner or operator must place the demonstration in the operating record and notify the State Director that it has been placed in the operating record.

(b) Containers holding liquid waste may not be placed in a MSWLF unit unless:

(1) The container is a small container similar in size to that normally found in household waste;

(2) The container is designed to hold liquids for use other than storage; or

(3) The waste is household waste.

(c) For purposes of this section:

(1) Liquid waste means any waste material that is determined to contain "free liquids" as defined by Method 9095 (Paint Filter Liquids Test), as described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods" (EPA Pub. No. SW-846).

(2) Gas condensate means the liquid generated as a result of gas recovery process(es) at the MSWLF unit.

3.10.2 Applicability

The regulation applies to new MSWLFs, existing MSWLFs, and lateral expansions of existing MSWLFs. The owner or operator is prohibited from placing bulk or non-containerized liquid waste, or containerized liquid waste into the MSWLF unit. Liquids from households are exempt. Tank trucks of wastes are not exempt.

3.10.3 Technical Considerations

The restriction of bulk or containerized liquids is intended to control a source of liquids that may become a source of leachate. Liquid waste refers to any waste material that is determined to contain free liquids as defined by SW-846 Method 9095 - Paint Filter Liquids Test. The paint filter test is performed by placing a 100 milliliter sample of waste on a conical, 400 micron paint filter. The waste is considered a liquid if it passes through the filter within five minutes. Apparatus used for performing the paint filter test is illustrated in Figure 3-9.

If the waste is considered a liquid, it can be treated with absorbent material to render a "solid" material (i.e., waste/absorbent mixture that no longer fails the paint filter liquids test).

One common waste stream that may contain a significant quantity of liquid is sludge. Sludge is a mixture of water and solids that has been concentrated from, and produced during, water and wastewater treatment. Sludges may be produced as a result of providing municipal services (e.g., potable water supply, sewage treatment, storm drain maintenance) or commercial or industrial operations. Sewage sludge is a mixture of organic and inorganic solids and water, removed from wastewater containing domestic sewage. Sludge disposal is acceptable provided the sludge passes the paint filter test.

Owners and operators of MSWLFs may return leachate and gas condensate generated from the gas recovery process provided the MSWLF has been designed and constructed with a composite liner and leachate collection system in compliance with 40 CFR §258.40(a)(2).

Returning gas condensate to the landfill may represent a reasonable long-term solution for relatively small volumes of condensate.

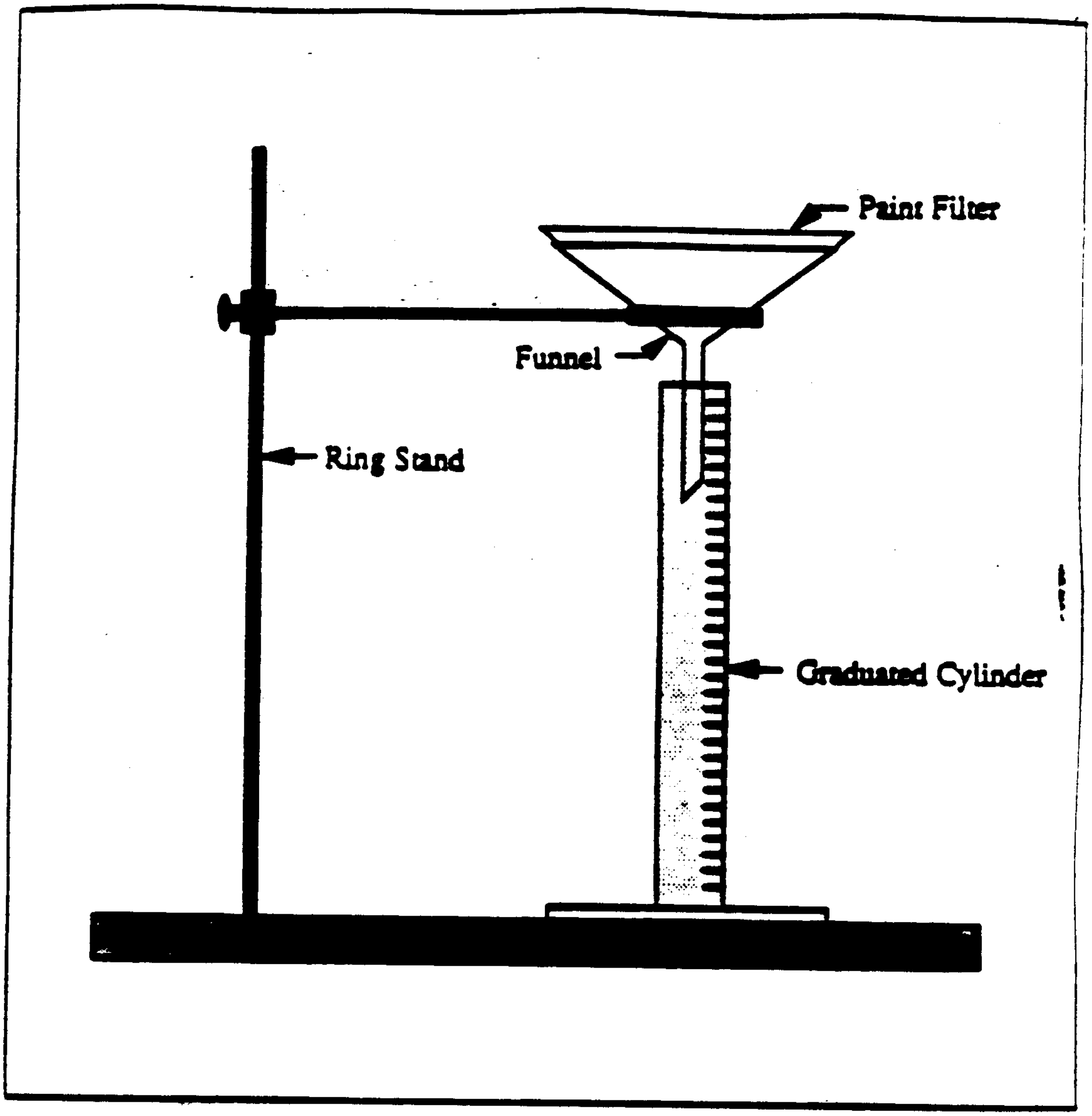


FIGURE 3-9
Paint Filter Test Apparatus

Leachate may be recirculated to a MSWLF unit as a temporary measure for managing leachate or as a means of controlling and managing liquid and solid waste decomposition. In general, leachate is returned to the landfill to encourage and accelerate the rate of organic degradation.

3.11 RECORDKEEPING REQUIREMENTS 40 CFR §258.29

3.11.1 Statement of Regulation

(a) The owner or operator of an MSWLF unit must record and retain near the facility in an operating record, or in an alternative location approved by the Director of an approved state, the following information as it becomes available:

(1) Any location restriction demonstration required under Subpart B of this part;

(2) Inspection records, training procedures, and notification procedures required in §258.20 of this Part;

(3) Gas monitoring results from monitoring and any remediation plans required by §258.23 of this Part;

(4) Any MSWLF unit design documentation for placement of leachate or gas condensate in a MSWLF unit as required under §258.28 (a)(2) of this Part;

(5) Any demonstration, certification, finding, monitoring, testing, or analytical data required by Subpart E of this Part;

(6) Closure and post-closure care plans and any monitoring, testing, or analytical data as required by §§258.60 and 258.61 of this Part; and

(7) Any cost estimates and financial assurance documentation required by Subpart G of this Part.

(8) Any information demonstrating compliance with small community exemption as required by §258.1(f)(2).

(b) The owner/operator must notify the State Director when the documents from paragraph (a) of this section have been placed or added to the operating record, and all information contained in the operating record must be furnished upon request to the State Director or be made available at all reasonable times for inspection by the State Director.

(c) The Director of an approved State can set alternative schedules for recordkeeping and notification requirements as specified in paragraphs (a) and (b), except for the notification requirements in §258.10(b) and §258.55(g)(1)(iii).

3.11.2 Applicability

The regulation applies to existing MSWLFs, lateral expansions of existing MSWLFs, and new MSWLFs. The recordkeeping requirements are intended to be self-implementing so that owners/operators can comply without State and EPA involvement. Specific self-implementing requirements should be easy for the owner/operator to interpret and citizens to enforce through citizen suits. The owner or operator is required to maintain records of demonstrations, inspections, monitoring results, design documents, plans, operational procedures, notices, cost estimates, and financial assurance documentation.

3.11.3 Technical Considerations

The operating record should be maintained in a single location. The location may be at the facility, or at corporate headquarters or city hall but should be near the facility. Records should be maintained throughout the life of the facility, including the post-closure care period. Upon completion of each document required in the operating record, the State Director should be notified of its placement in the operating record. The Director of an approved State may establish alternative requirements for recordkeeping.

Recordkeeping at the landfill should include the following:

(a) Location restriction demonstrations: Demonstrations are required for any location restrictions under Subpart B. The location restrictions apply to:

- Airports;
- Floodplains;
- Faulted areas;
- Seismic impact zones; and
- Unstable areas.

- (b) Inspection records, training procedures, and notification procedures: Inspection records should include:

- Date and time wastes were received during the inspection;
- Names of the transporter and the driver;
- Source of the wastes; and
- Vehicle identification numbers;
- All observations made by the inspector.

Training records should include procedures used to train personnel on hazardous waste and PCB waste recognition.

Notification to EPA, state, and local agencies should be documented.

(c) Gas monitoring results and any remediation plans: If gas levels exceed 25 percent of the LEL for methane in any facility structures or exceed the LEL for methane at the facility boundary, the owner or operator must place in the operating record, within seven days, the methane gas levels detected, and a description of the steps taken to protect human health. Within 60 days of detection, the owner or operator must place a copy of the remediation plan used for gas releases, in the operating record.

(d) MSWLF unit design documentation for placement of leachate or gas condensate in a MSWLF: If leachate and/or gas condensate are recirculated into the MSWLF, documentation of a composite liner and a leachate collection system capable of maintaining a maximum of 30 cm of leachate head in the MSWLF must be placed in the operating record.

(e) Demonstration, certification, monitoring, testing, or analytical finding required by the ground-water criteria: Documents to be placed in the operating record include:

- Documentation of design, installation, development, and decommission of any monitoring wells, piezometers, and other measurement, sampling, and analytical devices;
- Certification by a qualified ground-water scientist of the number, spacing, and depths of the monitoring systems;
- Documentation of sampling and analysis programs and statistical procedures;
- Notice of finding a statistically significant increase over background for one or more of the constituents listed in Appendix I (or alternative list in approved States) at any monitoring well at the waste management unit boundary (unapproved States) or the relevant point of compliance (approved States);
- Certification by a qualified ground-water scientist that an error in sampling, analysis, statistical evaluation, or natural variation in ground-water caused an increase (false positive) on Appendix I constituents, or that a source other than the MSWLF unit caused the contamination (if appropriate);
- A notice identifying any Appendix II constituents that have been detected in ground-water and their concentrations;
- A notice identifying the Appendix II constituents that have exceeded the ground-water protection standard;
- A certification by a qualified ground-water scientist that a source other than MSWLF caused the contamination or an error in sampling, analysis, statistical evaluation, or natural ground-water variation caused the statistical significant increase (false positive) in Appendix II constituents (if applicable);
- The remedies selected to remediate ground-water contamination; and
- Certification of remediation completion.

(f) Closure and post-closure plans and any monitoring, testing, or analytical data associated with these plans: The landfill owner or operator is required to place a copy of the closure plan, post closure plan, and a notice of intent to close the facility in the operating record. Monitoring, testing, or analytical data associated with closure and post-closure information generated from ground-water and landfill gas monitoring must be placed in the operating record. A copy of th notation on the deed to the MSWLF facility property, as required following closure along with certification and verification that closure and post-closure activities have been completed in accordance with their respective plans, also must be placed in the operating record.

(g) Estimates and financial assurance documentation required: The following documents must be placed in the operating record:

- An estimate of the cost of hiring a third party to close the largest area of all MSWLF units ever requiring final cover;
- Justification for the reduction of the closure cost estimate and the amount of financial assurance (if appropriate);
- A cost estimate cost of hiring a third party to conduct post-closure care;
- The justification for the reduction of the post-closure cost estimate and financial assurance (if appropriate);
- An estimate and financial assurance for the cost of a third party to conduct corrective action:
- A trust agreement:
- A copy of the surety bond:
- A copy of the letter of credit:
- A copy of the insurance policy: and
- A copy of the guarantee.

3.12 FURTHER INFORMATION

3.12.1 References

FLOWER, et al., (1982). "Vegetation Kills in Landfill Environs"; Franklin B. Flower, Ida A. Leone, Edward F. Gilman and John J. Arthur; Cook College, Rutgers University; New Brunswick, New Jersey 08903.

GRCDA, (1985). "A Compilation of Landfill Gas Laboratory and Field Practices and Procedures"; GRCDA Landfill Gas Committee; October, 1985.

U.S. Department of Agriculture Soil Conservation Service, (1986). "Urban Hydrology for Small Watersheds"; PB87-101580.

U.S. EPA, (1982). "Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods"; SW-846. U.S. EPA; Office of Solid Waste and Emergency Response; Washington, D.C. 20460.

U.S. EPA, (1985). "Handbook - Remedial Action at Waste Disposal Sites"; EPA/625/6-85/006; U.S. EPA, Office of Research and Development; Cincinnati, Ohio 45268.

U.S. EPA, (1988). "Guide to Technical Resources for the Design of Land Disposal Facilities"; EPA/625/6-88/018; U.S. EPA; Risk Reduction Engineering Laboratory and Center for Environmental Research Information; Cincinnati, Ohio 45268.

3.12.2 Addresses

Governmental Refuse Collection and Disposal Association (GRCDA)/SWANA
P.O. Box 7219
Silver Spring, MD 20910
(301) 585-2898
(800) 456-4723

4.0
SUBPART D
DESIGN CRITERIA

4.1 INTRODUCTION

New municipal solid waste units and lateral expansions of existing units must comply with either a design standard or performance standard. The design standard is a composite liner comprised of two feet of soil with a hydraulic conductivity of 1×10^{-7} cm/sec, overlain by a flexible membrane liner (FML) and a leachate collection system. The performance standard is available only to MSWLFs located in approved States. The performance standard will be available to MSWLFS in unapproved States if EPA does not promulgate procedures and requirements for state approval by October 9, 1993. A performance-based alternative design must demonstrate the capability of maintaining contaminant concentrations below maximum contaminant levels (MCLs) at the facility's relevant point of compliance. The alternative design has been established to allow design innovation and consideration of site-specific conditions.

The technical considerations are intended to identify the key design features and system components for the composite liner and leachate collection system standards, and the alternative performance standard. The technical considerations include design concepts, design calculations, physical properties, and construction methods for the following:

1) Alternative designs (Subsection 4.2)

   - Leachate characterization and assessment; and

   - Relevant point of compliance assessment.

2) Composite liner and leachate collection system (Subsection 4.3)

   - Soil liner component (soil properties, construction, and quality assurance/quality control testing);

   - Flexible membrane liners (FML properties, installation, and quality assurance/quality control testing);

   - Leachate collection systems (strength and compatibility, grading and drainage, and filtration);

   - Leachate removal systems (pumps, sumps and standpipes); and

   - Inspections (field observations and field and laboratory testing).

This chapter is organized to address these topics in the above sequence, which results in some regulations not appearing in numerical sequence. These topics represent the minimal regulatory requirements that should be addressed during design, construction, and operation of MSWLFs to function and perform in a manner protective of human health and environment. Additional features or procedures may be used to demonstrate conformance with the regulations or to control leachate release and subsequent effects. For example, during construction of a new MSWLF, or a lateral expansion of an existing MSWLF, quality control and quality assurance procedures and documentation may be used to establish that both material properties and construction meet the design specifications that are intended to provide the expected level of component system performance. For alternative designs this chapter also presents methods to assess water quality at the relevant point of compliance.

4.2 ALTERNATIVE DESIGN
40 CFR §258.40

4.2.1 Statement of Regulation

(a) New MSWLF units and lateral expansions shall be constructed:

(1) In accordance with a design approved by the Director of an approved State or as specified in §258.40(e) for unapproved States. The design must ensure that the concentration values listed in Table 1 will not be exceeded in the uppermost aquifer at the relevant point of compliance as specified by the Director of an approved State under paragraph (d) of this section, or

(2) (See Technical Considerations in section 4.3 for requirements of uniform standard composite liner).

(b) (See Technical Considerations in section 4.3 for requirements pertaining to composite liner and leachate collection system)

(c) When approving a design that complies with paragraph (a)(1) of this section, the Director of an approved State shall consider at least the following factors:

(1) The hydrogeologic characteristics of the facility and surrounding land;

(2) The climatic factors of the area; and

(3) The volume and physical and chemical characteristics of the leachate.

(d) (See Technical Considerations in section 4.4 for discussion on determination of relevant point of compliance.)

TABLE 1

Chemical	MCL(mg/l)
Arsenic	0.05
Barium	1.0
Benzene	0.005
Cadmium	0.01
Carbon tetrachloride	0.005
Chromium (hexavalent)	0.05
2,4-Dichlorophenoxy acetic acid	0.1
1,4-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
Endrin	0.0002
Fluoride	4.0
Lindane	0.004
Lead	0.05
Mercury	0.002
Methoxychlor	0.1
Nitrate	10.0
Selenium	0.01
Silver	0.05
Toxaphene	0.005
1,1,1-Trichloroethane	0.2
Trichloroethylene	0.005
2,4,5-Trichlorophenoxy acetic acid	0.01
Vinyl Chloride	0.002

4.2.2 Applicability

The Director of an approved State may approve a site-specific design for new MSWLF units and lateral expansions of existing units (see Section 4.3.2). This design can be an alternative to the uniform design standard of a composite liner with a leachate collection system that is required in unapproved States.

The alternative design does not have to include either a composite liner or a leachate collection system. The design must ensure, however, that the maximum concentration levels (MCLs) listed in Table 1 are not exceeded in ground water at the relevant point of compliance. The relevant point of compliance may be located at the waste management unit boundary or, if approved by the Director of an approved State, up to a maximum of 150 meters from the waste management unit boundary. Procedures and requirements for ground-water monitoring are described in Section 5, and the relevant point of compliance is described in Subsection 4.4.

Approval of the alternative design should consider at least three factors: 1) the hydrogeologic characteristics of the facility and surrounding land; 2) the climate of the area; and 3) the volume and the physical and chemical composition of the leachate generated by the MSWLF.

4.3.3 Technical Considerations

Demonstration requirements

For approval of designs not conforming to the uniform design standard of a composite liner system and leachate collection system (40 CFR §258.40(a)(2)), the owner or operator of the proposed MSWLF must demonstrate to the Director of an approved State that the design will not allow the compounds listed in Table 1 to exceed the MCLs in ground-water at the relevant point of compliance. The demonstration should consider an assessment of leachate quality and quantity, leachate leakage to the subsurface, and subsurface transport to the relevant point of compliance. These factors are governed by the site hydrogeology and climatic factors.

The nature of the demonstration is essentially an assessment of the potential for leachate production and leakage from the landfill to ground-water and the anticipated fate and transport of constituents listed in Table 1 to the proposed relevant point of compliance at the facility. Inherent to this type of approach is the need to evaluate whether leachate will be produced with concentration values in excess of those listed in Table 1. If it will, then there is a need to obtain sufficient site-specific data to adequately characterize the existing ground-water quality and the existing ground-water flow regime (e.g., flow direction, horizontal and vertical gradients, hydraulic conductivity, stratigraphy and aquifer thickness).

The assessment should be made of the effect MSWLF construction will have on site hydrogeology. The assessment should focus on the reduced infiltration over the landfill area and altered surface water run-off patterns. Reduction of recharge and changes in surface water patterns resulting from landfill construction may affect upward ground-water gradients in some cases and result in changes in lateral flow direction in others.

Leachate Characterization

Leachate characterization should include an assessment of both the quantity and composition of leachate anticipated at the proposed facility. Discussion of this assessment follows.

It is possible that a MSWLF unit may be designed and located in a climatic zone such that, in general, leachate would not be produced from sources of water other than that existing within the waste at the time of disposal. An owner or operator may demonstrate that leachate would not be produced. The demonstration should be supported with an historic evaluation of precipitation events and the likelihood for flooding of the unit through heavy rains, surface runoff, or high water tables. It may be possible, through operational controls, to avoid exposing waste to precipitation or infiltration of water from overlying materials. Even if leachate production would not be expected, the Director, when approving the demonstration, should consider the hydrogeologic characteristics of the facility and the surrounding area, in addition to the volume of leachate and climatic factors.

Assuming leachate is produced, the demonstration should evaluate whether constituents listed in Table 1 can be expected to be produced in concentrations greater than the MCLs. It is plausible that leachate from household wastes may not exceed the values, particularly if the area served by the unit has an effective waste prevention and segregation program that prevents the disposal of consumer goods containing significant quantities of the pesticides, herbicides, solvents, and metals listed in Table 2. If such a demonstration is possible, it must still address hydrogeologic characteristics of the facility and surrounding land to comply with §258.40.

When leachate constituents can be expected to exceed MCLs, then the demonstration should focus on developing a profile of leachate quality and production rates (volume) sufficient to be used in evaluating its fate and transport from the point of release to the relevant point of compliance.

If leachate composition data that are representative of the proposed facility are not available, then leachate data with a similar expected composition should be presented. Landfill leachate composition is influenced by:

(1) The annual precipitation infiltration and rate of leaching;

(2) The type and relative amounts of materials in the waste stream; and

(3) The age and the biological maturity of the landfill that may affect types of organic and inorganic acids generated, oxidation/reduction potential (Eh), and pH conditions.

An existing landfill in the region, with a similar waste stream, may be able to provide information that will allow the owner or operator to anticipate leachate composition of the proposed landfill. A review of technical literature may also be required to assess anticipated leachate composition if actual data are unavailable (see USEPA 1987b). A wide range of leachate concentrations are reported in the literature with higher concentrations of specific constituents typically reported for the initial leachate from laboratory or field experimental test fills or test cells. These "batch" one-day landfills do not account for the long-term climatic and meteorological influences of a full-scale landfill operation and leachate generation. Such high initial concentrations are not typical of full-scale operations that are subject to the dilution effects of incident rainfall on unused portions of the unit.

Volumetric production rates of leachate are important in evaluating the fate and transport of the constituents listed in Table 1. Leachate production depends on rainfall incident to the unit, run-on, run-off, evapotranspiration, water table elevation relative to the bottom of the landfill, and prevention of liquid disposal at the site. Run-on, run-off, and water table factors can be eliminated traditionally through design and operational controls. The Criteria prohibit bulk or containerized liquid disposal. Incident precipitation and evapotranspiration can be evaluated using the HELP model or other more site specific methods of estimating leachate production. It is reasonable to expect that leachate production may assume seasonal cyclical characteristics of low and high flows.

Once leachate composition and production have been estimated, it is possible to predict the fate and transport of constituents listed in Table 1 at the relevant point of compliance. Alternately, the demonstration could take the following approach (giving appropriate consideration to hydrogeologic characteristics and the fate and transport of characteristics of constituents listed in Table 1):

1) Use the MCL concentrations at the relevant point of compliance,

2) Back-calculate point of leakage (e.g., the landfill liner), and

3) Project the appropriate combination of concentration and leachate volumes that, if not exceeded, would not cause the Table 1 concentration values to be exceeded at the relevant point of compliance.

This latter approach should provide the planner with information needed to define the performance standard of an alternate design for the active life of the unit. Once the MSWLF unit is closed, leachate volume and concentration can be expected to decrease over time. Therefore, the combination of leachate volume and leachate concentration controlling the assessment can be expected to occur during the active life of the unit.

Leakage Assessment

An assessment of leakage, the volumetric release of leachate from the proposed alternative design, should be based on analytical approaches supported by empirical data from other existing operational facilities of similar design, particularly those that have leak detection monitoring (see USEPA, 1990b). In lieu of the existence or availability of such information, conservative analytical assumptions may need to be made to estimate anticipated leakage rates.

The transport of fluids and waste constituents through geomembranes differs in principle from transport through soil liner materials. Transport through geomembranes where tea[illegible] punctures, imperfections, or seam f[illegible] are not involved, is dominated [illegible] molecular diffusion. Diffusion occurs in response to a concentration gradient and is governed by a relationship known as Fick's first law. Diffusion rates in membranes are very low in comparison to hydraulic flow rates in soil liners, including compacted clays. In synthetic liners, the factor that most influences liner performance is penetration of the liner, including imperfect seams or pinholes which can allow leachate to pass through the membrane (USEPA, 1989a).

The dominant mode of leachate transport through the liner components is flow through holes and penetrations of the geomembrane and Darcian flow through soil components. Synthetic bentonite mats, which have been used successfully in composite liner designs, should probably be considered to transport fluids primarily through diffusion due to their low hydraulic conductivities, i.e. 1×10^{-9} cm/sec reported by manufacturers.

Several researchers have studied the flow of fluids through imperfections in single geomembrane and composite liner systems. Further discussion of leakage action rates can be found on Page D-24. For empirical data and analytical methodologies the reader is referred to literature by Jayawickrama et al. (1988), Kastman (1984), Haxo (1983), Haxo et al. ([illegible]), [illegible] ([illegible]), Giroud and Bonaparte (1989 (Parts I and II)), and Giroud et al. (1989). Leakage assessments also may be conducted by use of the HELP model (USEPA, 1988a). Version 3.0 of the model is under revision and will [illegible] method to assess leakage that is based on recent research and data conducted by Giroud and Bonaparte.

Leachate Migration in the Subsurface

Leachate that leaks from a landfill will migrate through the subsurface. Flow and transport in the subsurface typically occurs through the unsaturated zone, to the water table and into the saturated zone. However, in some instances, the water table may be located below the landfill, so that only saturated flow and transport away from the landfill need to be considered. Similarly, leachate migration may occur only in the vadose zone where ground water is located well below the landfill. Once below the water table, the leachate constituents are transported through the saturated zone to a point of discharge (i.e., a pumping well, a stream, a lake, etc.).

The migration of leachate and leachate constituents in the subsurface depends on factors such as the volume of the liquid component of the waste, the chemical and physical properties of the leachate constituents, the loading rate, the climate, and the chemical and physical properties of the subsurface (saturated and unsaturated zones). A number of physical, chemical, and biological processes influence migration. Because of complex interactions between these processes, specific contaminants may be transported through the subsurface at different rates. Certain processes result in the attenuation and degradation of contaminants. The degree of attenuation is dependent on the time that the contaminant is in contact with the subsurface material, the physical and chemical characteristics of the subsurface material, the distance which the contaminant has traveled, and the volume and characteristics of the leachate. Some of the key processes affecting leachate migration are introduced briefly here. The information is taken from a summary in Travers and Sharp-Hansen (1991), who in turn relied largely on Aller et al. (1987), Keely (1987), Keely (1989), Lu et al. (1985), and U.S. EPA (1988).

Physical Processes Controlling Subsurface Transport

Physical processes that control the transport of contaminants in the subsurface include advection, dispersion and diffusion, mixing and dilution, filtration, physical adsorption, density stratification, immiscible phase flow, and fracture flow. These processes, in turn, are affected by hydrogeologic properties, such as hydraulic conductivity, porosity, and moisture content, and by chemical properties.

Advection is the process by which solute contaminants are transported by the overall motion of flowing ground water. A non-reactive solute will be transported at the same rate and in the same direction as the average linear velocity (Freeze and Cherry, 1979). Advective transport is chiefly a function of the subsurface hydraulic conductivity distribution, porosity, and the hydraulic gradients.

Hydrodynamic dispersion is a non-steady, irreversible mixing process by which a contaminant spreads as it is transported through the subsurface. Dispersion results from the effects of two components operating at the microscopic level: mechanical dispersion and molecular diffusion. Mechanical dispersion derives from variations in pore velocities within the soil or aquifer and dominates over molecular diffusion in environments where the flow rates are moderate to high. Molecular diffusion is caused by a contaminant concentration gradient. Chemicals move from high concentration to low concentration. At very slow velocities, such as through clays and silts, diffusion can be an important transport mechanism.

Spatially variable hydraulic conductivities of the geologic formation cause ground-water flow velocities to vary spatially in the subsurface. The variations in the rate of advection result in plume spreading, which can be confused with dispersion. The changes in aquifer properties that lead to this variability are three dimensional. If the geologic medium is relatively homogeneous it may be appropriate to assume that the aquifer properties also are homogeneous.

Physical sorption is a function of Van der Waals forces, hydrodynamic, and electrokinetic properties of soil particles. Physical sorption is important in the removal of bacteria and viruses, but is usually unimportant for trace contaminant attenuation relative to other processes.

Mechanical filtration removes contaminants that are larger than the pore spaces of the soil. Thus, the effects of mechanical filtration increase with decreasing pore size within a medium. Nonetheless, filtration applies to a wide range of particle sizes. The retention of larger particles may effectively reduce the permeability of the soil or aquifer.

Multiphase flow occurs because many solvents and oils are highly insoluble in water and may be released to the subsurface as a separate liquid phase. If the viscosity and density of fluid differ from that of water, the fluid may have a different flow rate and direction than the water. If the fluid is more dense than water it may reach the bottom of the aquifer and alter its flow direction to conform to the shape and slope of the aquitard surface.

The nature and extent of the geologic material underlying a facility affect the fate and transport of leachate in the subsurface. Ground water flows from recharge zones to discharge zones in response to the hydraulic gradient at any given point. In turn, the hydraulic gradient is influenced by aquifer characteristics, boundary conditions, and natural or man-induced recharge and discharge (USEPA, 1988). For aqueous solutions, information about the hydraulic gradient can be obtained from data on hydraulic head. When variations in leachate density exist, however, the hydraulic gradient must be obtained from water pressure contours.

Hydraulic conductivity depends on both fluid properties and aquifer properties. Keely (1987) points out that differences in density and viscosity of fluids present in the aquifer can cause a wide range of hydraulic conductivity values. He reports that there is a dramatic downward shift in local flow directions near plumes that have as little as a one percent increase in density relative to uncontaminated water. Such density contrasts frequently occur at landfills and waste impoundments. Keely (1989) reports that landfill leachate is often so laden with dissolved contaminants that its density approaches that of seawater.

If the hydraulic conductivity in an aquifer varies with direction, the aquifer is said to be anisotropic. Anisotropy in hydraulic conductivity distributions is caused by structural trends of the aquifer material. In anisotropic media, flow is not at right angles to the equipotential contours. Instead, flow is at oblique angles with the degree of deviation proportional to the amount of anisotropy (Keely, 1987).

Secondary porosity may be caused by the dissolution of rock, regional fracturing, or in soils, by drying cracks or fissures. Fractures or macropores respond quickly to rainfall events and other fluid inputs and can transmit water rapidly along pathways that do not coincide with expectations. Secondary porosity can result in localized high concentrations of contaminants at significant distances from the facility. The relative importance of secondary porosity to the hydraulic conductivity in the subsurface depends on the ratio of fracture hydraulic conductivity to intergranular hydraulic conductivity (Kincaid et al., 1984a). Once fractures dominate flow, the relationships used to describe porous flow (Darcy's Law) do not apply.

Chemical Processes Controlling Subsurface Transport

Chemical processes important in controlling subsurface transport include precipitation/dissolution, sorption, redox reactions, hydrolysis, ion exchange, and complexation. In general, these processes, except for hydrolysis, are reversible. The reversible processes tend to retard transport, but do not permanently eliminate a contaminant from the system. Sorption and precipitation are generally the dominant retarding mechanisms in the saturated zone.

Precipitation/dissolution reactions can control concentration levels. The solubility of a solid controls the equilibrium state of a chemical. When the soluble concentration of a contaminant in leachate is higher than that of the equilibrium state, precipitation occurs. When the soluble concentration is lower than the equilibrium value and solids exist in the system, dissolution occurs. The precipitation of a dissolved substance may be initiated by changes in pressure, temperature, pH, concentration, or redox potential (Aller et al., 1987). Precipitation can cause plugging of an aquifer and result in a decrease in aquifer porosity. Precipitation and dissolution are especially important processes for trace metal migration in soils.

Adsorption/desorption is the most common mechanism affecting contaminant migration in soils. Solutes become attached to the solid phase by means of adsorption. Like precipitation/dissolution, adsorption/desorption is a reversible process. However, adsorption desorption occurs at a relatively rapid rate compared to precipitation reactions.

The dominant mechanism of organic sorption is the hydrophobic attraction between a chemical and natural organic matter associated with aquifers. The organic carbon content of the porous medium, along with the solubility of the contaminant, is an important factor for this type of sorption. Extreme differences are observed in the adsorption of different organics.

There is a direct relationship between the quantity of a substance sorbed on a particle surface and the quantity of the substance suspended in solution. Predictions about the sorption of contaminants often make use of sorption isotherms, which relate the amount of contaminant in solution to the amount associated with the solids. For organic contaminants, these isotherms are usually assumed to be linear and the reaction is assumed to be instantaneous and reversible. The linear equilibrium approach to sorption is not adequate for all situations.

Ion exchange originates primarily from exchange sites on layered silicate clays and organic matter, that have a permanent negative charge. Cation exchange arises from a need to balance the negative charge in order to maintain neutrality. The capacity of soils to exchange cations is called the cation exchange capacity (CEC). CEC is affected by the type and quantity of clay mineral present, the amount of organic matter present, and the pH of the soil. Major cations in leachate (Ca, Mg, K, Na) usually dominate the CEC sites, resulting in little attenuation in soils of trace metals in the leachate.

There is a smaller ion exchange effect for anions associated with hydrous oxides. Since soils typically have more negatively charged clay particles than positively charged hydrous oxides, the transport of cations is attenuated more than the transport of anions.

Oxidation and reduction (redox) reactions involve the transfer of electrons and occur when the redox potential in leachate is different from that of the soil or aquifer environment. Redox reactions are important processes for inorganic compounds and metallic elements. Together with pH, redox reactions affect the solubility, complexing capacity, and sorptive behavior of constituents, and thus control the presence and mobility of many substances in water. Microorganisms are responsible for a large proportion of redox reactions that occur in ground water. The redox state of an aquifer, as well as the identity and quantity of redox-active reactants, is difficult to determine.

Hydrolysis is the chemical breakdown of carbon bonds in organic substances by water and its ionic species H^+ and OH^-. Hydrolysis is dependent on pH and Eh and is most effective at high temperatures, low pH, and low redox potential. For many biodegradable contaminants, hydrolysis is slow compared to biodegradation.

Complexation involves reactions of metal ions with inorganic anions or organic ligands. The metal and the ligand bind together to form a new soluble species called a complex. Complexation can either increase the concentration of a constituent in solution by forming soluble complex ions or decrease the concentration forming a soluble ion complex with a solid. In nature, it is difficult to distinguish among sorption, solid-liquid complexation, and ion exchange, so these processes are usually grouped together as one mechanism.

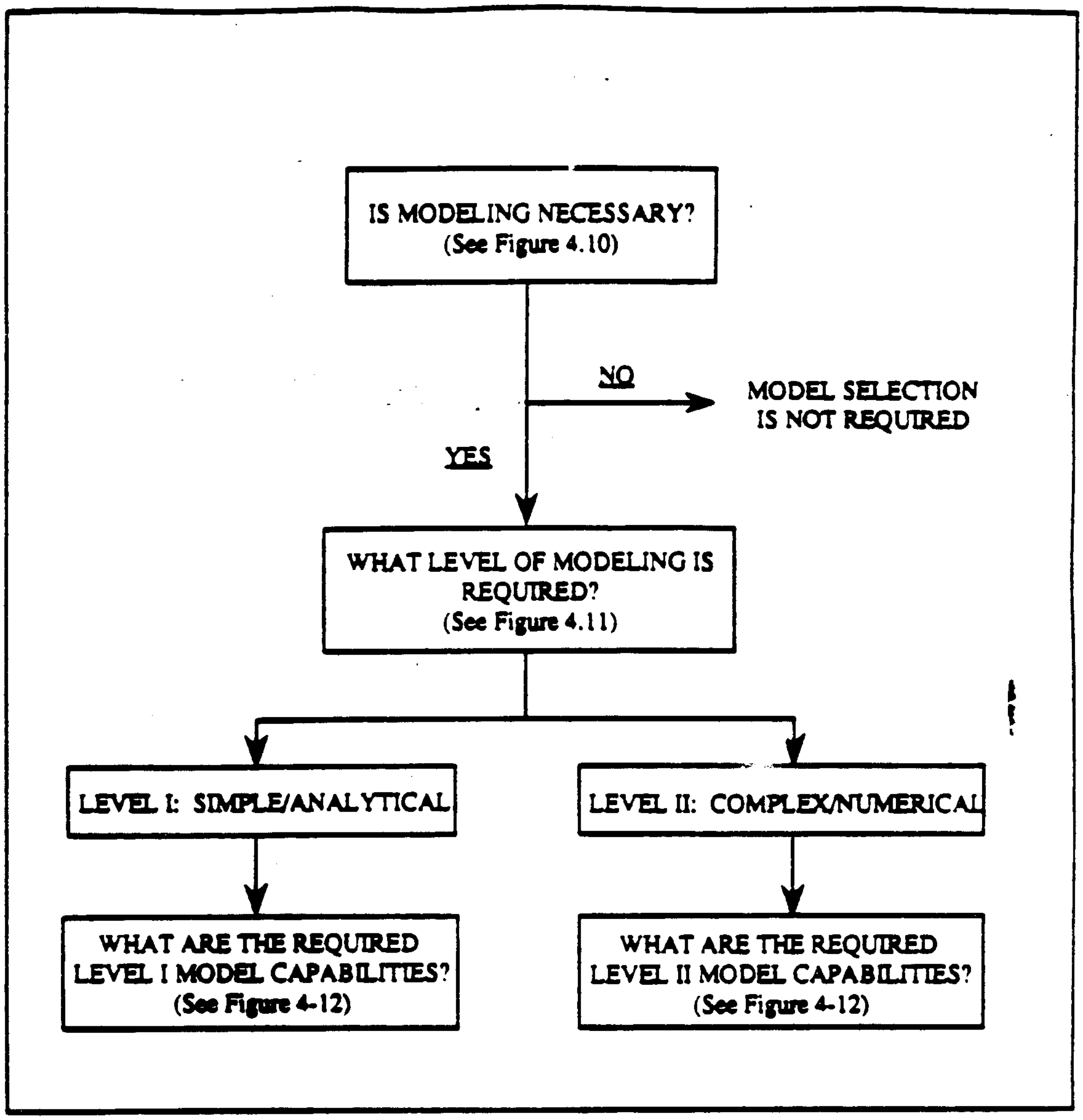


FIGURE 4-1
Three Basic Decisions in Model Selection
(Boutwell et. al., 1986)

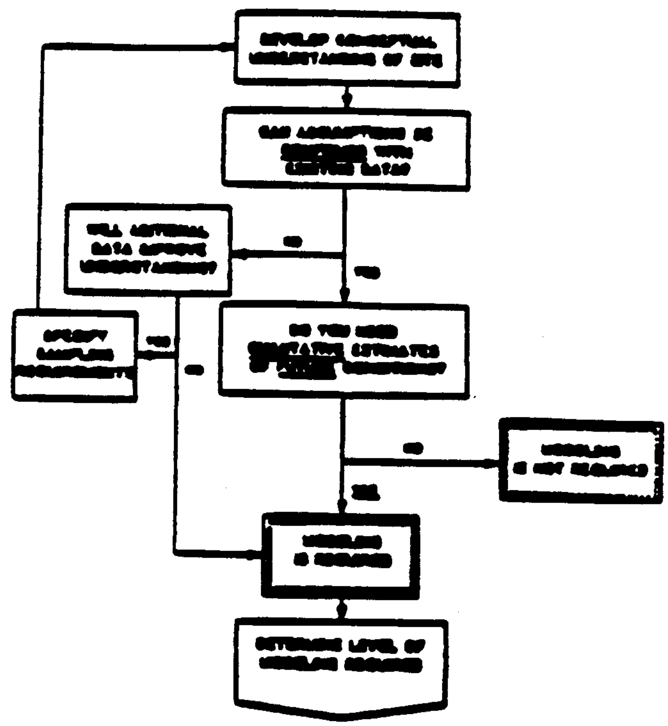


FIGURE 4-2

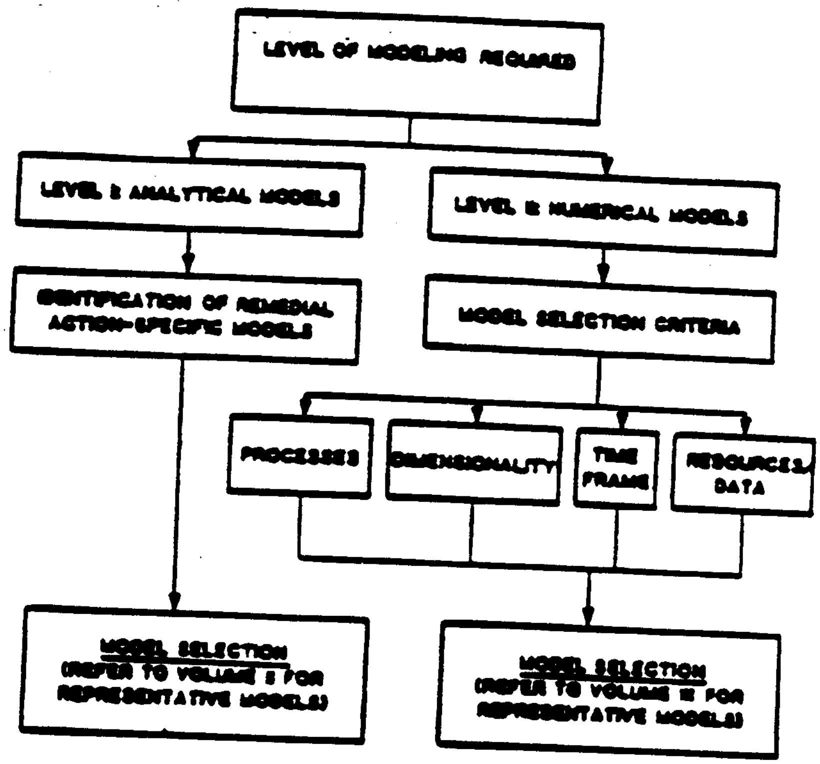


FIGURE 4-3

Flow Char[illegible] Level of [illegible] Soil and [illegible]

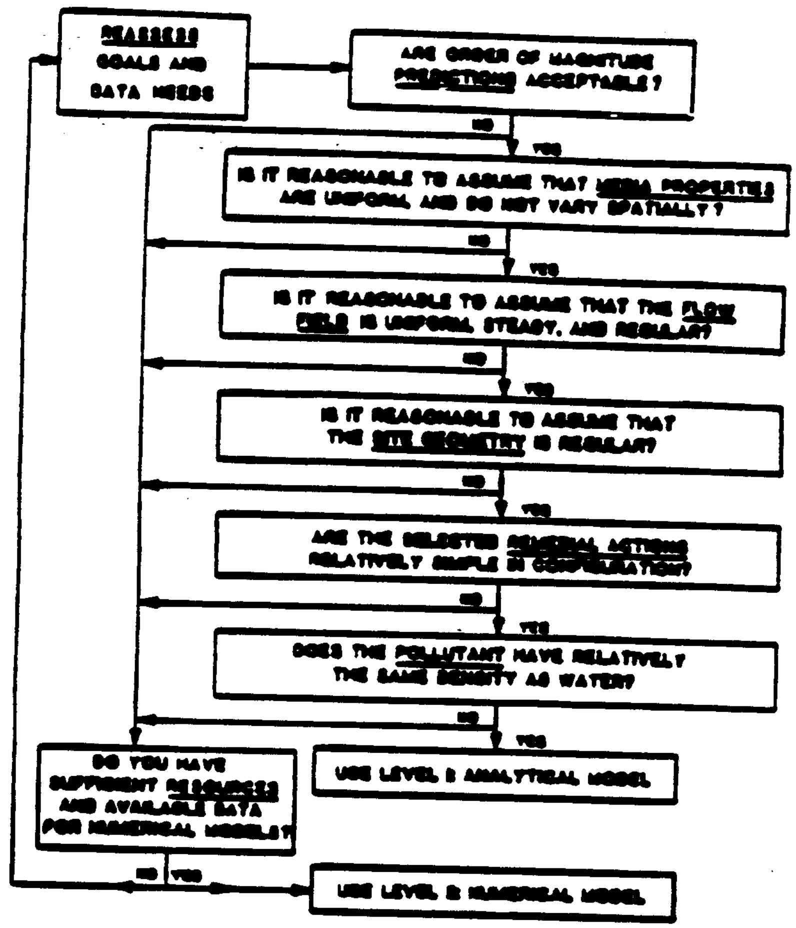

REASSESS GOALS AND DATA NEEDS
ARE ORDER OF MAGNITUDE PREDICTIONS ACCEPTABLE?
NO
YES
IS IT REASONABLE TO ASSUME THAT MEDIA PROPERTIES ARE UNIFORM AND DO NOT VARY SPATIALLY?
NO
YES
IS IT REASONABLE TO ASSUME THAT THE FLOW FIELD IS UNIFORM, STEADY, AND REGULAR?
NO
YES
IS IT REASONABLE TO ASSUME THAT THE SITE GEOMETRY IS REGULAR?
NO
YES
ARE THE SELECTED REMEDIAL ACTIONS RELATIVELY SIMPLE IN CONFIGURATION?
NO
YES
DOES THE POLLUTANT HAVE RELATIVELY THE SAME DENSITY AS WATER?
NO
YES
DO YOU HAVE SUFFICIENT RESOURCES AND AVAILABLE DATA FOR NUMERICAL MODELS?
USE LEVEL 2 ANALYTICAL MODEL
NO
YES
USE LEVEL 2 NUMERICAL MODEL

FIGURE 4-4

Biological Processes Controlling Subsurface Transport

Biodegradation results from the enzyme-catalyzed transformation of organic compounds by microbes. Contaminants can be degraded to harmless byproducts or to more mobile and/or toxic products through one or more of several biological processes. Biodegradation of a compound depends on environmental factors such as redox potential, dissolved oxygen concentration, pH, temperature, the presence of other compounds and nutrients, salinity, the depth below land surface, competition among different types of organisms, and the concentrations of compounds and organisms. The exact transformations that will occur in a subsurface system are difficult to predict because of the complexity of the chemical and biological reactions that occur. Quantitative predictions of the fate of biologically reactive substances are not advanced and little information is available on biodegradation rates in soil systems or ground water. First-order decay constants are often used.

The operation of Subtitle D facilities can introduce bacteria and viruses into the subsurface. The fate and transport of bacteria and viruses in the subsurface is an important consideration in the evaluation of the effects of MSWLFs on human health and the environment. A large number of biological, chemical, and physical processes are known to influence virus and bacterial survival and transport in the subsurface. Unfortunately, the present knowledge of the processes and the available data are insufficient to develop models which can simulate a wide variety of site-specific conditions.

Leachate Migration Models

After defining the hydrogeologic characteristics of the site, the nature of leakage, and leachate concentrations, it may be appropriate to develop a mathematical model to describe and simulate the expected fate and transport of the constituents listed in Table 1 to the unit's relevant point of compliance. Solute transport and ground-water modeling efforts should be conducted by a qualified ground-water scientist. It is necessary to address many factors when selecting and applying a model to a site. Travers and Sharp-Hansen (1991) provide a thorough review of these issues. The text provided below is excerpted from their report.

Overview of the Modeling Process

A number of factors can influence leachate migration from MSWLFs. These include, but are not limited to, climatic effects, the hydrogeological setting, and the nature of the disposed waste. Each facility is different, and no one generic model will be appropriate in all situations.

To develop a model for a site, the modeling needs and the objectives of the study should be determined first. Next, it will be necessary to collect data for characterizing the hydrological, geological, chemical, and biological conditions present in the system. These data are used to assist in the development of a conceptual model of the system, including spatial and temporal characteristics and boundary conditions. The conceptual model and data are then used to select a mathematical model that accurately represents the conceptual model. The model selected should have been tested and evaluated by qualified investigators, should adequately simulate the significant processes present in the actual system, and should be consistent with the complexity of the study area, amount of available data, and objectives of the study.

Three basic decisions are required when selecting a model for soil and ground-water contamination (Boutwell et al., 1986). First, the necessity for a model should be determined (Figure 4-1). Not all studies require the use of a mathematical model. This decision should be made at the beginning of the study since modeling requires a substantial amount of resources and effort. Next, the level of modeling required for a specific study should be determined (Figure 4-2). Boutwell et al. (1986) classify models into Level I (simple/analytical) and Level II (complex/numerical) models. A flow chart for determining the level of modeling required is shown in Figure 4-3. Finally, the model capabilities which will be necessary for representing a particular system should be considered (Figure 4-4). Several models may be equally suitable for a particular study: conversely, a suitable model may not be available to simulate a given system. In some cases, it may be necessary to link or couple two or more computer codes to accurately represent the processes at the site. In the section which follows, specific issues which should be considered when developing a scenario and selecting a model or set of models will be described.

Because all models are a simplified representation of the real system, no model will ever reproduce the exact characteristics of a site. Errors are introduced because of 1) assumptions and simplifications, 2) a lack of data, and 3) a poor understanding of some processes influencing the fate and transport of contaminants. Therefore, model results should always be interpreted as estimates of ground-water flow and contaminant transport. Bond and Hwang (1988) recommend that models be used for comparing various cases or scenarios, since all cases are subject to the same limitations and simplifications.

The quality of model results can depend to a large extent on the experience and judgement of the modeler, and on the quality of the data used to develop model input. The process of applying the model may delineate data deficiencies which may require additional data collection. The model results should be calibrated to obtain the best fit to the observed data. After that, the accuracy of the results which are obtained from the mathematical model should be validated. Model validation, which is the comparison of model results with numerical data independently derived from experiments or observations of the environment, is a critical aspect of model application, and is particularly important for site-specific studies.

Several recent reports present detailed discussions of the issues surrounding model selection, application and validation. Donigian and Rao (1990) address each of these issues, and present several considerations for developing a generalized framework for model validation. EPA's Exposure Assessment Group has developed suggested definitions and guidance on model validation (Versar Inc., 1987). A recent report by the

National Resource Council (1989) discusses the issues related to model application and validation, and provides recommendations for the proper use of ground-water models. Weaver et al. (1989) discuss considerations for selection and field validation of mathematical models.

Model Selection

Ground-water flow and solute transport models range from simple, analytical calculations to sophisticated computer programs that provide a numerical solution to otherwise intractable solutions to the mathematical equations describing flow and transport. A sophisticated model may not yield a definitive estimate of water quality at the relevant point of compliance for a given set of site conditions, but it may allow an estimate of the effects of complex physical and chemical processes. On the other hand, depending on the complexity of the site conditions and the ability to make simplifying assumptions as part of data input, a fairly sophisticated numerical model may be the only way to adequately estimate water quality at the relevant point of compliance.

Specific considerations to be addressed when selecting a model are discussed below.

Analytical Versus Numerical Models --

Mathematical models use either analytical, semi-analytical, or numerical solutions. Each technique has advantages and disadvantages. Analytical solutions are computationally more efficient than numerical simulations and are more conducive to uncertainty analysis (i.e., Monte Carlo techniques). Typically, input data for analytical models are simple and do not require detailed familiarity with the code or extensive modeling experience. Analytical solutions are typically the most efficient alternative when data necessary for characterization of the system are sparse (Javandel et al., 1984). The limited data available in most field situations may not justify the use of a detailed numerical model; in some cases, results from simple analytical models may be just as meaningful (Huyakorn et al., 1986). However, analytical models require simplifying assumptions about the system; these simplifying assumptions are not necessary for numerical models. The simplifications result in a model that includes relatively few processes and a limited number of parameters that are often required to be constant in space and time (van der Heijde and Beljin, 1988).

In semi-analytical models, complex analytical solutions are approximated by numerical techniques (van der Heijde and Beljin, 1988). Semi-analytical methods allow for more complex site conditions than those that can be simulated with a purely analytical solution. Semi-analytical solution methods can consider multiple sources or recharging and discharging wells. However, they still require simplifying assumptions about the dimensionality and homogeneity of the system. Furthermore, semi-analytical models generally do not include the effects of dispersion and diffusion (Javandel et al., 1984)

Numerical models are able to handle more complex site conditions than either analytical or semi-analytical models.

Numerical models provide the user a large amount of flexibility, since irregular boundaries as well as spatial and temporal variations in the system can be simulated. In some cases, the analytical solution that is available for a problem is so complex that the numerical calculation of its values requires far more effort than the direct use of a numerical model (de Marsily, 1986). However, numerical models require significantly more data than analytical models, and are typically more computationally intensive. Use of a numerical model often requires an experienced modeler, and can involve a larger amount of computer time than simulations using an analytical or semi-analytical method.

In selecting a model, the database available for the development of the model of the system should be considered. If data are insufficient, a highly sophisticated and complex model should not be considered. In some situations, it may be beneficial to use an analytical or semi-analytical model as a "screening level" model which would allow a user to obtain an understanding of the system, and to use a numerical model when there is sufficient data and necessity to justify the use of a more complex model.

A highly complex hydrogeological system can not be accurately represented with a simple analytical model. Heterogeneous or anisotropic aquifer properties, multiple aquifers and complicated boundary conditions can be simulated using most numerical models. In addition, some sophisticated numerical models can simulate processes, such as flow in fractures and chemical reactions, which can have a significant effect on the concentration of contaminants at a site. Since each site is unique, the modeler should determine which conditions and processes are important at a specific site, and to select a suitable model.

Spatial Characteristics of the System --

Although actual landfills and hydrogeologic systems are three-dimensional, it is often desirable to reduce the number of dimensions simulated in a mathematical model to one or two. Two and three-dimensional models are generally more complex and computationally expensive than one-dimensional models, and therefore require more data. In some instances, a one-dimensional model may adequately represent the system. Furthermore, the available data may not warrant the use of a multidimensional model. However, modeling a truly three-dimensional system using a two-dimensional model may produce results without adequate spatial detail. Three-dimensional effects are often very significant in describing processes such as contaminant plume migration. The choice of the number of dimensions in the model should be made for a specific site, based on the conditions present at that site. The information which is desired from the model output should also be considered.

Steady-State Versus Transient Models --

Models can simulate either steady-state or transient flow conditions. Some ground-water flow systems are in an approximate "steady-state," in which the water entering the flow system is balanced by the water leaving the system. There is no significant temporal variation in the system. The assumption of steady-state conditions in a model generally simplifies the mathematical equations used to describe flow processes, and reduces the amount of input data, since no information about temporal variability is necessary.

However, assuming steady-state conditions in a system which exhibits transient behavior may produce inaccurate results. For example, climatic variables, such as precipitation, vary in time and may have strong seasonal components. In such settings, the assumption of constant recharge of the ground-water system is incorrect. Steady-state models are also inappropriate when the simulation includes chemicals which sorb or transform significantly (Mulkey et al., 1989). The choice of simulating steady-state or transient conditions should be determined based on the degree of temporal variability in the system.

Boundary and Initial Conditions --

The solution of the differential equations describing flow and transport processes requires that initial and boundary conditions be specified. The initial condition describes the conditions present in the system at the beginning of the simulation. In many ground-water flow and transport models, these conditions are related to the initial hydraulic head distribution in the aquifer and the initial concentration of contaminants. Boundary conditions define the conditions present on the borders of the system, which may be steady-state or temporally variable. The initial and boundary conditions chosen to represent a specific field situation can significantly affect the results of the simulation, especially since they often affect representation of the contaminant source.

One of the boundary conditions for a solute transport model commonly relates to the introduction of a contaminant to the system. A source of ground-water contamination should be described in terms of its spatial, chemical, and physical characteristics, and its temporal behavior. Spatially, a source may be classified as a point source, line source, a distributed source of limited areal or three-dimensional extent, or as a non-point source of unlimited extent (van der Hjeide et al., 1988). Typically, temporal descriptions of the source term boundary conditions for models with analytical solutions are constant, constant pulse, and/or exponential decay (Mulkey et al., 1989). Numerical models typically handle a much wider range of source boundary conditions, allowing an infinite possibility of contaminant loadings.

Homogeneous Versus Heterogeneous Aquifer/Soil Properties --

The extent of the spatial variability of the properties of each aquifer will significantly affect the selection of a mathematical model. Many models assume uniform aquifer properties, which simplifies the governing equations and improves computational efficiency. For example, one value of hydraulic conductivity may be assumed at every point in the aquifer. However, this assumption ignores the heterogeneity in the natural hydrogeologic system. Bond and Hwang (1988) present guidelines for determining whether the assumption of uniform aquifer properties is justified at a particular site. They state that the error associated with using an average value versus a spatial distribution is site-specific and extremely difficult to determine.

When site-specific data are limited, it is common to assume homogeneous and isotropic aquifer properties, and to develop a "worst-case" scenario for contaminant migration in the subsurface. However, as Auerbach (1984) points out, the assumption of homogeneous and isotropic aquifers often will not provide a "worst case" scenario. For example, a continuous zone of higher hydraulic conductivity in the direction of ground-water flow can result in much higher rates of contaminant movement than would be predicted in a completely homogeneous aquifer. Therefore, in order to develop a true "worst-case" model, information on the probable heterogeneity and anisotropy at the site should be collected. This is important for all flow and transport models which are used as a representation of the conditions at a specific site.

The number of aquifers in the hydrogeological system will affect the selection of a mathematical model. Some systems include only a single unconfined or confined aquifer, which is hydraulically isolated from the surrounding layers. Some mathematical models, and in particular those with analytical solutions, can simulate only single layers. In other cases, the upper aquifer may be hydraulically connected to several other underlying aquifers.

The MSWLF Criteria specify that MCLs not be exceeded at the relevant point of compliance within the uppermost aquifer. The uppermost aquifer includes not only the aquifer that is nearest the natural ground surface, but also all lower aquifers which are hydraulically connected to the uppermost aquifer within the facility property boundary. This is expected to raise several issues related to determining the degree of hydraulic connection between aquifers. Model selection will also be affected since a more sophisticated model will be necessary to simulate multiple aquifer systems.

Availability of Data --

Although computer models can be used to make predictions about leachate generation and migration, these predictions are highly dependent on the quantity and quality of the available data. Unfortunately, one of the most severe limitations to modeling is insufficient data. Uncertainty in model predictions results from the inability to characterize a site in terms of the boundary conditions or the key parameters describing the important flow and transport processes (National Resource Council, 1990). The application of a mathematical model to a site typically requires a large amount of data. Inexperienced modelers may attempt to apply a model when the lack of site-specific data causes the model results to be highly speculative. It must be emphasized that a mathematical model should never be used as a <u>substitute</u> for data.

To obtain accurate model results, it is essential to obtain data that are specific to the particular site being modeled. Models that include generic parameters, based on average values for similar sites, can be used to provide initial guidance and general information about the behavior of a system, but it is very dangerous to apply generic parameters to a specific hydrogeologic system. A great deal of literature exists which describes data collection and parameter estimation. An excellent summary of the data which are necessary to model the processes of saturated and unsaturated flow, surface water flow, geochemistry and solute transport is presented in Mercer et al. (1983). This report provides definitions and possible ranges of values for equation parameters, source terms, dependent variables, boundary conditions and initial conditions.

Summary of Available Models --

Several detailed model reviews are available in the literature. A number of ground-water models, including saturated, variably saturated, solute transport, heat transport, hydrochemical, fractured rock, and multiphase models, are summarized in van der Heijde et al. (1988). van der Heijde and Beljin (1988) provide detailed descriptions of 64 ground-water flow and solute transport models that were selected for use in determining wellhead protection areas. A review of ground-water flow and transport models for the unsaturated zone is presented in Oster (1982). A large number of ground-water flow and transport models are summarized in Bond and Hwang (1988). Finally, Travers and Sharp-Hansen (1991) summarize models that may be applicable to problems of leachate generation and migration from MSWLFs. (See References supplied in Section 4.6.)

Tables 4-1a, b, and c, taken from Travers and Sharp-Hansen (1991), contain a few of the many models that can be used to predict contaminant transport. The factors considered when selecting models to present in the tables included availability, attainability, documentation, uniqueness, and the size of the user community. The models in Tables 4-1a, b, and c are subdivided by solution techniques used to solve the equations which describe flow and transport. Table 4-1a contains analytical and semi-analytical models, and Tables 4-1b and 4-1c contain numerical models that are solved by the finite-difference and finite-element method respectively.

Leachate migration models simulate contaminant transport in the subsurface from the bottom of the landfill to a downgradient point of compliance. Most models focus on the saturated zone. Some also include unsaturated flow and/or transport, which is necessary if the water table is significantly below the bottom of the landfill. Information about the source of contamination is usually supplied as an input parameter and can be estimated by a leachate generation model. The complexity of the available leachate migration models ranges from simple equations to highly sophisticated numerical models.

Advection and dispersion are handled by most solute transport codes since they are typically based on the advective-dispersive equation. Many models simulate adsorption and degradation (decay), which decrease contaminant concentrations in the ground water. Models that do not consider these processes should be considered "worst-case" scenarios, and will

TABLE 4-1a. Analytical and Semi-Analytical Models for Application to Leachate Migration Problems (adapted from Travers and Sharp-Hansen, 1991)

Model reference	Model dimensions	Flow conditions	Aquifer conditions	Model processes	Chemical species	Additional information
Beljin (1985) SOLUTE	1D(H),2D(H) or 3D	Ss,Sat	C,Hom,Iso	Adv,Dis, Ads,Dec	single	A package of 8 analytical models for solute transport in groundwater. Also includes programs for unit conversion and error function calculation.
Domenico and Palciauskas (1982) VHS	1D advection 2D dispersion	Ss,Sat	C,Hom,Iso	Adv,Dis	single	Model for Vertical and Horizontal Spreading. Assumes infinite aquifer thickness. EPA considers VHS to be a conservative model since retardation, sorption, precipitation,aquifer recharge not considered. Source is continuous constant strip source.
Domenico and Robbins (1985)	3D(transport)	Ss,Sat	C,Hom,Iso	Adv,Dis	single	Contaminant transport from a finite or continuous source in a continuous flow regime. Assumes infinite thickness.
Huyakorn et al. (1987)	3D	Ss,Sat	C,Uc,Hom Iso,An	Adv,Dis, Ads,Dec	single	Model allows for estimation of maximum concentration concentration distribution along center line of a leachate plume. Gaussian vertical strip source.
Javandel et al. (1984) RESSQ	2D(H)	Ss,Sat	C,Hom,Iso	Adv,Ads	single	Calculates transport by advection and adsorption in a homogeneous, isotropic, uniform-thickness, confined aquifer. Uses semi-analytical solution methods.
Lindstrom and Boersma (1989) CXPMPM	1D(H)	Ss,Sat	C,Hom,Iso	Adv,Dis,Dec Ads,Rxn	single	Analytical solutions of the general one-dimensional transport equation for confined aquifers, with several different initial and boundary conditions.
Nelson and Schur (1983) PATHS	2D(H)	Ss,Tr,Sat	C,Hom,Iso	Adv,Ads	single	Groundwater flow equations solved analytically, Characteristic pathlines solved by Runge-Kutta method.

(continued)

TABLE 4-1b. Finite-Difference Models for Application to Leachate Migration Problems (adapted from Travers and Sharp-Hansen, 1991)

Model reference	Model dimensions	Flow conditions	Aquifer conditions	Model processes	Chemical species	Additional information
Abriola and Pinder (1985)	1D	Ss,Tr,Sat,Usat	Uc,Iso,Hom	Dis,Dif	multiphase	Multiphase model for modeling aquifer contamination by organic compounds. Simulates simultaneous transport of contaminant in a nonaqueous phase, aqueous phase and as a mobile fraction of gas phase. Effects of capillarity, interphase mass transfer, diffusion, and dispersion considered.
Dillon et al. (1981; 1986) SWIFT/SWIFT-II	3D	Ss,Tr,Sat	C,Hom,Het Iso,An	Adv,Dis,Dif,Dec,Rxn,W	single	Coupled groundwater flow, and heat or solute transport. Includes fracture flow, ion exchange, salt dissolution, in confined aquifers. SWIFT-II includes dual porosity for fractured media.
Erdogan and Neufeld (1983)	1D	Tr,Sat	Hom,Iso	Adv,Dis,Ads Ppt	single	Model describes the desorption process using intraparticle and external film diffusion resistances as rate controlling mechanisms (considers fluid velocity and particle size). Predicts leachate concentration profiles at the boundary of the landfill. Simulates precipitation with interrupted flow conditions.
GeoTrans (1985); Faust et al. (1989) SWANFLOW	3D	Ss,Tr,Sat Usat	Uc,Hom,Het Iso,An,		multiphase	Faust (1989) extends SWANFLOW to include a solution technique which takes advantage of parallel computer processing.
Kipp (1987) HST3D	3D	Tr,Sat	C,Uc,Hom, Het,Iso,An	Adv,Dis,Dif, Ads,Dec,W	single	Simulates coupled density dependent groundwater flow and heat or mass transport in an anisotropic, heterogeneous aquifer.
Konikow and Bredehoeft (1985) USGS-MOC	2D(H,V)	Ss,Tr,Sat	C,Uc,Hom, Het,Iso,An	Adv,Dis,Dif, Ads,Dec,ET,W	single	Groundwater flow solved by finite difference, solute transport by the method of characteristics.

(continued)

TABLE 4-1a. Analytical and Semi-Analytical Models for Application to Leachate Migration Problems (concluded) (adapted from Travers and Sharp-Hansen, 1991)

Model reference	Model dimensions	Flow conditions	Aquifer conditions	Model processes	Chemical species	Additional information
Ostendorf et al. (1984)	1D (H,V)	Ss,Sat	Uc,Hom,Iso	Adv,Ads Dec	single	Assumes transport of a simply reactive contaminant through a landfill and initially pure, underlying, shallow, aquifer with plane, sloping bottom.
Prakash (1984)	1D,2D or 3D	Ss,Sat	C,Hom,Iso	Adv,Dis,Ads Dec	single	Source boundary condition: instantaneous or finite-time release of contaminants from a point, line, plane or parallel piped source.
Salhotra et al. (1990) MULTIMED	1D(vadose zone) 3D(transport in saturated zone)	Ss,Sat Usat	Uc,Hom,Iso L(Usat)	Adv,Dis Ads,Dec,Vol	single	Model simulates movement of contaminants in saturated and unsaturated groundwater zones, in surface water and emissions to the air. Includes Monte Carlo capability. Unsaturated zone transport solution is analytical, saturated zone is semi-analytical. Gaussian or patch source boundary condition.
Ungs et al. (1986); Summers et al. (1989) HYGRT (Version 1.0, 2.0)	1,2(H,V)	Ss,Sat	Uc,Hom,Iso	Adv,Dis,Ret Dec	single	Simulates migration of organic and inorganic solutes. Constant pulse source boundary condition. Proprietary code.
van Genuchten and Alves (1982)	1D(H,V)	Ss,Sat	C,Hom,Iso	Adv,Dis,Dif Ads	single	Three types of source boundary conditions are considered: constant, exponential decay and pulse step function.
Yeh (1981) AT123D	1D,2D or 3D	Tr,Sat	C,Uc,Hom Iso,An	Adv,Dis,Dif, Ads,Dec	single	Analytical, semi-analytical, solution techniques based on Green's function. Source boundary conditions include: constant, instantaneous pulse, or finite-time release from a point, line, area or volume source.

1D = One-dimensional
2D = Two-dimensional
3D = Three-dimensional
H = Horizontal
V = Vertical
Ss = Steady-state
Tr = Transient

Sat = Saturated
Usat = Unsaturated
Hom = Homogeneous
Het = Heterogeneous
Iso = Isotropic
An = Anisotropic
C = Confined aquifer

Uc = Unconfined aquifer
Adv = Advection
Dis = Dispersion
Dif = Diffusion
Dec = Decay
Ads = Adsorption
Ret = Retardation

Inf = Infiltration
ET = Evapotranspiration
Ppt = Precipitation
RO = Run-off
Rxn = Reactions
W = Discharging or pumping wells
L = Layers

TABLE 4-1b. Finite-Difference Models for Application to Leachate Migration Problems (concluded) (adapted from Travers and Sharp-Hansen, 1991)

Model reference	Model dimensions	Flow conditions	Aquifer conditions	Model processes	Chemical species	Additional information
Narasimhan et al. (1986) DYNAMIX	3D	Ss,Tr,Sat	C,Uc,Hom Het,Iso,An	Adv,Dis,Dif, Dec	multiple	Model couples a chemical speciation model PHREEQE (Parkhurst et al., 1980) with a modified form of the transport code TRUMP (Edwards, 1969;1972). Considers equilibrium reactions (see geochemical codes).
Prickett et al. (1981) RANDOM WALK or TRANS	1D or 2D(H)	Ss,Tr,Sat	C,Uc,Hom Het,Iso,An L	Adv,Dis,Ads Dec,ET,W	single	Finite-difference solution to groundwater flow, random walk approach used to simulate dispersion. Simulates random movement. Aquifer properties vary spatially and temporally.
Runchal (1985) PORFLOW-II and III	2D(H,V) or 3D	Ss,Tr,Sat	C,Uc,Hom, Het,Iso,An L	Adv,Dis,Dif, Ads,Dec,Rxn,W	single	Simulates density dependent flow, heat and mass transport. Aquifer and fluid properties may be spatially and temporally variable. Integrated finite-difference solution. Includes phase change.
Travis (1984) TRACR3D	3D	Ss,Tr,Sat Usat	C,Hom,Het Iso,An,	Adv,Dis,Dif Ads,Dec,	two-phase, multiple	Simulates transient two-phase flow and multicomponent transport in deformable, heterogeneous, reactive, porous media.
Walton (1984) 35 Microcomputer Programs	1D,2D(H) or 3D(radial,cyl)	Ss,Tr,Sat	C,Uc,Hom, Het,L	Adv,Dis,Ret	single	A series of analytical and simple numerical programs to analyze flow and transport of solutes in aquifers with simple geometry.

1D = One-dimensional
2D = Two-dimensional
3D = Three-dimensional
H = Horizontal
V = Vertical
Ss = Steady-state
Tr = Transient

Sat = Saturated
Usat= Unsaturated
Hom = Homogeneous
Het = Heterogeneous
Iso = Isotropic
An = Anisotropic
C = Confined aquifer

Uc = Unconfined aquifer
Adv = Advection
Dis = Dispersion
Dif = Diffusion
Dec = Decay
Ads = Adsorption
Ret = Retardation

Inf = Infiltration
ET = Evapotranspiration
Ppt = Precipitation
RO = Run-off
Rxn = Reactions
W = Discharging or pumping wells
L = Layers

TABLE 4-1c. Finite-Element Models for Application to Leachate Migration Problems (adapted from Travers and Sharp-Hansen, 1991)

Model reference	Model dimensions	Flow conditions	Aquifer conditions	Model processes	Chemical species	Additional information
Cederberg et al. (1985) TRANQL	1D, radial	Ss,Sat	C,Uc,Hom	Adv,Dis,Dif, Ads,Dec	multiple	Multicomponent transport model which links chemical equilibrium code MICROQL (Westall, 1976) and transport code ISOQUAD (Pinder, unpublished manuscript, 1976). Includes complexation in aqueous phase.
Dean et al. (1989) RUSTIC	1D(root zone, vadose zone); 2DH,V,radial (saturated zone)	Ss,Tr,Unsat Sat	C,Uc,Hom, Het,Iso, An,L	Adv,Dis,Ads, Dif,Dec,ET,W Ppt,RD,Ret	1,2,or 3	Simulates fate and transport of chemicals through three linked modules: root, vadose and saturated zone. Includes PRZM (Carsel et al., 1984). RUSTIC is in Beta-testing phase. Includes Monte Carlo capability. PRZM solution by finite-difference.
Gupta et al. (19[illegible] CFEST	2D(H,V) or 3D	Ss,Tr,Sat	C,Uc,Hom, Het,Iso, An,L	Adv,Dis,Dif Ads,Dec,W	single	Solves coupled groundwater flow, solute and heat transport equations. Fluid may be heterogeneous.
Gureghian et al. (1980)	2D	Ss,Sat	C,Uc, Iso,An	Adv,Dis, Ads,Dec	single	Source boundary condition: Gaussian distributed source. Transport only.
Guvanasen (1986) MOTIF	1D,2D or 3D	Ss,Tr,Sat Unsat	C,Uc,Hom Het,Iso,An	Adv,Dis,Dif Ads,Dec	single	Groundwater flow and solute transport in fractured porous media.
Haji-Djafari and Wells (1982) GEOFLOW	3D	Ss,Tr,Sat	C,Uc,Hom, Het,Iso, An,L	Adv,Dis,Dif, Dec,Rxn,Ret,W	single	Simulation of areal configuration only. Proprietary code.
Huyakorn et al. (1984) SEFTRAN	1D or 2D(H,V)	Ss,Tr,Sat	C,Uc,Hom,Het Iso,An,L	Adv,Dis,Dif Ads,Dec,W	single	Proprietary code.
Huyakorn et al. (1986) TRAFRAP	2D(H,V)	Ss,Tr,Sat	C,Uc,Hom, Het,Iso,An	Adv,Dis,Dif, Ads,Dec,Rxn, W,Ppt	single	Simulates groundwater flow and solute transport in fractured porous media. Includes precipitation.

(continued)

TABLE 4-1c. Finite-Element Models for Application to Leachate Migration Problems (concluded) (adapted from Travers and Sharp-Hansen, 1991)

Model reference	Model dimensions	Flow conditions	Aquifer conditions	Model processes	Chemical species	Additional information
Osborne and Sykes (1986) MSTIF	2D	Tr,Sat,Usat	Uc,Hom,Het, Iso,An,L		two-phase	Model simulates transport of immiscible organics in groundwater. Assumes no mass transport between phases.
Theis et al. (1982) FIESTA	1D	Sat	Hom,Iso	Adv,Dis, Ads,Dec	multiple	Combination of a component transport model, FEAP, and the chemical equilibrium speciation model MINEQL (Westall et al., 1976). Simulates up to 6 chemical components, including all solution and sorbed phase complexes.
van Genuchten (1978) SUMATRA-1	1D(V)	Tr,Sat, Usat	C,Uc,Hom, Het,Iso,L	Adv,Dis,Ads, Dec,Ret	single	Simulates simultaneous flow of water and solutes in a one-dimensional, vertical soil profile.
Voss (1984) SUTRA	2D(H,V)	Ss,Tr, Sat,Usat	C,Uc,Hom, Het,Iso,An	Adv,Dis,Dif, Ads,Dec,Rxn,W	single	Fluid may be heterogeneous (density-dependent groundwater flow).
Yeh and Ward (1981) FEMWATER/FEMWASTE	2D(H,V)	Ss,Tr,Sat Usat	Uc,Hom, Het,Iso,An	Adv,Dis,Ads Dec,Ppt,W	single	FEMWATER simulates groundwater flow, FEMWASTE simulates waste transport through saturated-unsaturated porous media. Simulates capillarity, infiltration, and recharge/discharge sources (e.g., lakes, reservoirs, and streams).
Yeh (1990) LEWASTE,3DLEWASTE	2D/3D	Ss,Tr,Sat Usat	Uc,C,Hom, Het,Iso,An	Adv,Dis, Ads,Dec,W	single	Transport codes based on the Lagrangian-Eulerian approach. Can be applied to Peclet Numbers from 0 to infinity. LEWASTE is intended to simulate 2D local flow systems. 3DLEWASTE can simulate regional or local flow systems. The LEWASTE series replaces the FEMWASTE models.

1D = One-dimensional
2D = Two-dimensional
3D = Three-dimensional
H = Horizontal
V = Vertical
Ss = Steady-state
Tr = Transient

Sat = Saturated
Usat = Unsaturated
Hom = Homogeneous
Het = Heterogeneous
Iso = Isotropic
An = Anisotropic
C = Confined aquifer

Uc = Unconfined aquifer
Adv = Advection
Dis = Dispersion
Dif = Diffusion
Dec = Decay
Ads = Adsorption
Ret = Retardation

Inf = Infiltration
ET = Evapotranspiration
Ppt = Precipitation
RO = Runoff
Rxn = Reactions
W = Discharging or pumping wells
L = Layers

probably predict higher concentrations of contaminants than those that will actually be observed in the system. In addition, some models simulate other processes that can effect contaminant concentrations including chemical reactions, diffusion, and retardation (which includes sorption). In general, however, current available models do not incorporate the entire set of chemical processes known to affect rates of contaminant migration. In addition, many models assume that the chemical systems are at equilibrium, since this allows considerable simplification of the equations used to describe the processes.

Some models simulate the influence of discharging or recharging wells on ground-water flow and solute transport. This capability to simulate wells can be important since an estimated 46 percent of all MSWLFs are located within one mile of a public or private well that provides drinking water (Temple, Barker and Sloane, 1988). Although most of the models simulate transport of a single chemical species, some models are capable of simulating multispecies fate and transport. Multispecies models are typically solved by numerical methods because of the additional complexity involved.

Most of the ground-water flow and solute transport models are deterministic. However, the use of stochastic models, which allow for characterization of spatial and temporal variability in systems, is increasing. A few of the models include a Monte-Carlo capability for characterizing uncertainty related to parameter variability.

In many igneous and metamorphic rocks, flow occurs primarily through fractures in the rocks. Sedimentary rocks, such as sandstone, may contain joints, faults and other fractures as well. Flow in fractured rocks may be simulated either by assuming an equivalent porous medium and assigning representative aquifer properties to the medium, or estimating the hydraulics of flow in the individual fractures (Freeze and Cherry, 1979). Keely (1987) notes the necessity for continued research in the area of fracture flow and transport, since there is a great likelihood of fracture flow at sites used for waste disposal. Fracture-flow and transport modeling is a subject of current research. However, very few models for modeling flow and transport in fractured media exist at this time and those that do exist have not been widely used.

An estimated four percent of all MSWLFs are located in karst terrain, which is dominated by enlarged fractures, conduits, and caverns or caves (Temple, Barker and Sloane, 1988). The most common methods for studying flow and transport in karst aquifers involve aqueous geochemistry or tracing. Because of the complexity of karst flow systems, widely-accepted mathematical models which could be applied to a variety of karst terrain scenarios have not yet been developed.

Most ground-water flow and solute transport models consider contaminants that are miscible with water, and that therefore, have transport processes dominated by advection and dispersion. However, in many cases ground-water contamination occurs due to a pollutant which is immiscible with water.

Immiscible fluids may be either more or less dense than the native ground water. Multiphase models may be applicable to simulation of leachate migration from MSWLFs. In recent years, several investigators have focused on the problem of simulating multiphase flow. Several of these multiphase flow models are summarized in Table 4-1. Multiphase models typically are numerical, since the equations developed for multiphase flow are nonlinear, and cannot be solved easily using analytical solution techniques (Faust et al., 1989).

The EPA Multimedia Exposure Assessment Model (MULTIMED)

EPA has developed a modeling package to meet the needs of a large percentage of MSWLF owners and operators who will require fate and transport modeling as part of the alternative design demonstration. This model is called the Multimedia Exposure Assessment Model (MULTIMED) and is intended for use at sites where certain simplifying assumptions can be made to qualify this model's selection. MULTIMED can be used in conjunction with a separate source model, such as HELP (Schroeder et al., 1984), to demonstrate that either a landfill design, or the specific hydrogeologic conditions present at a site, will adequately prevent contaminant concentrations in ground water from exceeding concentrations listed in Table 1 of §258.40. A description of MULTIMED follows with guidance for determining if its use is appropriate for a given site.

Overview of the Model

The MULTIMED model consists of modules that estimate releases to either air or soil, including the unsaturated and the saturated zones, as well as possible interception of the subsurface contaminant plume by a surface stream. When applying MULTIMED to a MSWLF, only flow and transport through the unsaturated zone and transport in saturated zone can be considered. General information about the model and its theory is provided in Salhotra et al. (1990). Additionally, a manual for the application of MULTIMED to MSWLFs was developed by Sharp-Hansen et al. (1990) and the material is presented here. In MULTIMED, a steady-state, one-dimensional, semi-analytical module simulates flow in the unsaturated zone. The output from this module, water saturation as a function of depth, is used as input to the unsaturated zone transport module. The latter simulates transient, one-dimensional (vertical) transport in the unsaturated zone and includes the effects of longitudinal dispersion, linear adsorption, and first-order decay. The unsaturated zone transport module calculates steady-state or transient contaminant concentrations. Output from both unsaturated zone modules is used to couple the unsaturated zone transport module with the steady-state or transient, semi-analytical saturated zone transport module. The latter includes one-dimensional uniform flow, three-dimensional dispersion, linear adsorption, first-order decay, and dilution due to direct infiltration into the groundwater plume. In addition, MULTIMED has the capability to analyze the impact of uncertainty and variability in the model inputs on the model outputs (concentrations at specified points in the multimedia environment), using the Monte Carlo simulation technique.

The simplifying assumptions required to obtain the analytical solutions limit the complexity of the systems that can be represented by MULTIMED. The model does not account for site-specific spatial variability, the shape of the land disposal facility, site-specific boundary conditions, or multiple aquifers and pumping wells. Nor can MULTIMED simulate processes, such as flow in fractures and chemical reactions between contaminants, which can have a significant effect on the concentration of contaminants at a site. In more complex systems, it may be beneficial to use MULTIMED as a "screening level" model to allow a user to obtain an understanding of the system. A numerical model could then be used if there are sufficient data and it is necessary to use a more complex model.

Application of MULTIMED to MSWLFs

Procedures have been developed for the application of MULTIMED to the design of MSWLFs. They are explained in Sharp-Hansen et al. (1990) and are briefly summarized here. The procedures are:

- Collect site-specific hydrogeologic data;
- Determine the contaminant to be simulated and the active modules in MULTIMED and the point of compliance;
- Propose a landfill design and determine the corresponding infiltration rate; then
- Run MULTIMED and calculate the dilution attenuation factor (i.e., the factor by which the concentration is expected to decrease between the landfill and the point of compliance);
- Based on the resulting dilution attenuation factor, determine if the design is acceptable.

Only the unsaturated and/or saturated zones can be modeled because the other options have not been sufficiently tested at this time. In addition, only steady-state transport simulations are allowed. No decay of the source term is permitted; the concentration of contaminants entering the aquifer system must be constant in time. The contaminant pulse is assumed continuous and constant for the duration of the simulation. The receptor must be located directly downgradient of the facility, so that it intercepts the center of the contaminant plume, and the contaminant concentration must be calculated at the top of aquifer.

The user should bear in mind that MULTIMED may not be an appropriate model for application to some sites. Some of the issues which should be considered before modeling efforts proceed are summarized in Table 4-2. As stated above, MULTIMED utilizes analytical and semi-analytical solution techniques to solve the mathematical equations describing flow and transport. As a result, the representation of a system simulated by the model is simple, and little or no spatial or temporal variability is allowed for the parameters in the system. Thus, a highly complex hydrogeological system cannot be accurately represented with MULTIMED.

The spatial characteristics assumed in MULTIMED should be considered when applying MULTIMED to a site. The assumption of vertical, one-dimensional unsaturated flow may be valid for facilities which receive uniform areal recharge. However, the assumption may not be valid in facilities where surface soils (covers or daily backfill) or surface slopes result in an increase of runoff in certain areas of the facility, and ponding of precipitation in others. In addition, the simulation of one-dimensional, horizontal flow in the saturated zone requires several assumptions. The saturated zone is treated as a single, horizontal aquifer with uniform properties. The effects of pumping or discharging wells on the ground-water flow system cannot be considered.

The MULTIMED model assumes steady-state flow in all applications. Some ground-water flow systems are in an approximate "steady-state", in which the water entering the flow system is balanced by the water leaving the system. However, assuming steady-state conditions in a system which exhibits transient behavior may produce inaccurate results.

MULTIMED may be run in either a deterministic or a Monte Carlo framework. The Monte Carlo method provides a means of estimating the uncertainty in the results of a model, if the uncertainty of the input variables is known or can be estimated. However, it is

TABLE 4-2
ISSUES TO BE CONSIDERED BEFORE APPLYING MULTIMED
(from Sharp-Hansen et al., 1990)

Objectives of the Study

- **Is a 'screening level' approach appropriate?**
- **Is modeling a 'worst-case scenario' acceptable?**

Significant Processes Affecting Contaminant Transport

- **Does MULTIMED simulate all the significant processes occurring at the site?**
- **Is the contaminant soluble in water and of the same density as water?**

Accuracy and Availability of the Data

- **Have sufficient data been collected to obtain reliable results?**
- **What is the level of uncertainty associated with the data?**
- **Would a Monte Carlo simulation be useful? If so, are the cumulative probability distributions for the parameters with uncertain values known?**

Complexity of the Hydrogeologic System

- **Are the hydrogeologic properties of the system uniform?**
- **Is the flow in the aquifer uniform and steady?**
- **Is the site geometry regular?**
- **Does the source boundary condition require a transient or steady-state solution?**

difficult to determine the cumulative probability distribution for a given parameter. Assuming a parameter probability distribution, when the distribution is unknown, does not help reduce uncertainty. Furthermore, in order to obtain a valid estimate of the uncertainty in the output, the model must be run numerous times (typically at least several hundred times) which can be computationally expensive. These issues should be considered before utilizing the Monte-Carlo technique.

4.3 COMPOSITE LINER AND LEACHATE COLLECTION SYSTEM 40 CFR §258.40

4.3.1 Statement of Regulation

(a) New MSWLF units and lateral expansions shall be constructed:

(1) See Subsection 4.2 for alternate liner requirements.

(2) With a composite liner, as defined in paragraph (b) of this section and a leachate collection system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner,

(b) For purposes of this section, composite liner means a system consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

4.3.2 Applicability

New MSWLF facilities and expansions of existing MSWLF facilities must be constructed with a composite liner and a leachate collection system (LCS) that is designed to maintain less than 30-cm (12 in.) depth of leachate above the liner. A composite liner consists of a flexible membrane liner (FML) installed on top of, and in direct and uniform contact with, two-feet of compacted soil. The FML must be at least 30-mil thick unless the FML is made of HDPE, which must be 60-mil thick. The compacted soil liner must be at least two feet thick and must have a hydraulic conductivity of no more than 1 x 10^{-7} cm/sec.

Owners and operators of MSWLFs located in approved States have the option of proposing an alternative design provided certain criteria can be met (see Section 4.2.2).

4.3.3 Technical Considerations

This section provides information on the components of composite liner systems including soils, geomembranes, and leachate collection systems.

Standard Composite Liner Systems

The composite liner system is an e[illegible]tive hydraulic barrier because it comb[illegible] the complimentary properties of two d[illegible]rent materials into one system: 1) compacted soil with low hydraulic conductivity; and 2) an FML (FMLs are also referred to as geomembranes). Geomembranes may contain defects including holes, improperly bonded seams, and pinholes. In the absence of an underlying low-permeability soil liner, flow through a defect in a geomembrane is essentially unrestrained. The presence of a low-permeability soil liner under a defect in the geomembrane reduces leakage by limiting the flow rate through the defect.

Flow through the soil component of the liner is controlled by the size of the area between the two liners into which leachate can flow, the hydraulic conductivity of the soil component, and the hydraulic head. Fluid flow through soil liners is controlled by Darcy's law, where discharge (Q) is proportional to the head loss through the soil (dh/dl) for a given cross-sectional flow area (A) and hydraulic conductivity (K) where:

$$Q = KA(dh/dl)$$

Leakage through a geomembrane without defects is controlled by Fick's first law, which describes the process of liquid diffusion through the liner membrane. The diffusion process is similar to flow governed by Darcy's law for soil liners except that diffusion is driven by concentration gradients and not by hydraulic head. Although diffusion rates in geomembranes are several orders of magnitude lower than comparable hydraulic flow rates in low-permeability soil liners, a geomembrane is not completely impermeable. The factor that most strongly influences geomembrane performance is the presence of imperfections, including improperly bonded seams, punctures and pinholes. A detailed discussion of leakage through geomembranes and composite liners can be found in Giroud and Bonaparte (1989 (Part I and Part II)). A geomembrane installed with excellent control over defects may yield the equivalent of a one-centimeter-diameter hole per acre of liner installed (Giroud and Bonaparte, 1989 (Part I and Part II)). If the geomembrane were to be placed over sand, this size imperfection under one foot of constant hydraulic head could be expected to account for as much as 3,300 gal/day/acre (31,000 liters/hectare/day) of leakage. In the presence of a composite system with good soil/geomembrane contact, the leakage could be expected to be reduced to less than one gal/day/acre (USEPA, 1990a and 1990b).

Based upon measurements of actual leakage through top liners at facilities that have been built under rigorous control, Bonaparte and Gross (1990) have suggested an action leakage rate, under one foot of constant head, of 200 liters/hectare/day or about 21 gallons/acre/day for landfills.

The uniformity of the contact between the geomembrane and the soil liner is extremely important in controlling the effective flow area of leachate through the soil liner. Porous material, such as drainage sand, filter fabric, or other geofabric, should not be placed between the geomembrane and the low permeability soil liner. Porous materials will create a layer of higher hydraulic conductivity which will increase the amount of leakage below an imperfection in the geomembrane. If a geosynthetic material is treated to a point where it has a hydraulic conductivity $\leq 1x10^{-7}$cm/sec it should be acceptable. The geosynthetic clay liners (e.g. claymax) now are opening the top textile and putting clay on top to provide the intimate contact. Construction practices during the installation of the soil and the geomembrane affect the uniformity of the geomembrane/soil interface, and strongly influence the performance of the composite liner system.

Soil Liner

The following subsections discuss soil liner construction practices including thickness requirements, lift placement, bonding of lifts, test methods, prerequisite soil properties, quality control and quality assurance activities.

Thickness --

Two feet of soil is generally considered the minimum thickness needed to obtain adequate compaction to meet the hydraulic conductivity requirement. This thickness is considered necessary to minimize the amount of cracks or imperfections through the entire liner thickness which could allow leachate flow. Both lateral and vertical imperfections may exist in a compacted soil, and the two-foot minimum thickness is believed sufficient to inhibit hydraulic short-circuiting of the entire layer.

Lift Thickness

Soil liners should be constructed in a series of compacted lifts. Determination of appropriate lift thickness is dependent on the soil characteristics, compaction equipment, and the anticipated compactive effort needed to achieve the required soil hydraulic conductivity. Soil liner lifts should be thin enough to allow adequate compactive effort to reach the lower portions of the lift. Thinner lifts also provide greater assurance that sufficient compaction can be achieved to provide good, homogeneous bonding between subsequent lifts. Adequate compaction of lift thickness between five and ten inches is possible if heavy enough compaction equipment is used. (USEPA, 1988a). Nine-inch loose lift thicknesses that will yield a 6-inch soil layer have also been recommended prior to compaction (USEPA, 1990a).

Soil liners are usually designed to be of uniform thickness with smooth slopes over the entire facility. Thicker areas may be considered wherever recessed areas for leachate collection pipes or collection sumps are located. Extra thickness and compactive efforts near edges of the side slopes may enhance bonding between the side slopes and the bottom liner. In smaller facilities, a soil liner may be designed for installation over the entire area, but in larger or multi-cell facilities, liners may be designed in segments. If this is the case, the design should address how the old and new liner segments will be bonded together (USEPA, 1988a).

Bonding Between Lifts --

It is not possible to construct soil liners without some microscopic and/or macroscopic zones of higher and lower hydraulic conductivity. Within individual lifts, these preferential pathways for fluid migration are truncated by the bonded zone between the lifts. If good bonding between the lifts is not achieved during construction, the vertical pathways may become connected by horizontal pathways at lift interfaces and the hydraulic barrier performance would be diminished.

Two methods may be employed to ensure proper bonding between lifts. Kneading or blending a thinner, new lift with the previously compacted lift may be achieved by using a footed roller with long feet that fully penetrate a loose lift of soil. If the protruding rods or feet of a sheepsfoot roller are sufficient in length to penetrate the top lift and knead the previous lift, good bonding may be achieved. Another method includes scarifying (roughening), and possibly wetting, the top inch or so of the last lift placed with a disc harrow or other similar equipment before placing the next lift.

Placement on Slopes --

The method to place the soil liner on side slopes is dependent on the angle and length of the slope. Gradual inclines from the toe of the slope enable continuous placement of the lifts up the slopes and provides better continuity between the bottom and sidewalls of the soil liner. When steep slopes are encountered, however, lifts may have to be placed and compacted horizontally due to the difficulties of operating heavy compaction equipment on steeper slopes. When sidewalls are compacted horizontally, it is important to tie in the edges with the bottom of the soil liner to reduce the probability of seepage planes (USEPA, 1988a).

Hydraulic Conductivity --

Achieving the hydraulic conductivity standard depends on the degree of compaction, compaction method, soil moisture content, and density of the soil during liner construction. The hydraulic conductivity is the key design parameter when evaluating the acceptability of the constructed soil liner. The hydraulic conductivity of a soil is dependent on the viscosity and density of the permeant liquid. Most MSWLF leachates have physical properties similar to those of water and, therefore, water is appropriate as a fluid in such testing of the compacted soil liner and source materials. The effective porosity of the soil is a function of size, shape, and area of the conduits through which the liquid flows. Thus, the hydraulic conductivity of a partially saturated soil will be less than the hydraulic conductivity of the same soil when saturated due to a reduction of flow area from air entrapment. Hydraulic conductivity testing should, therefore, be conducted on samples that are fully saturated.

EPA has promulgated Method 9100 in publication SW-846 (Test Methods for Evaluating Solid Waste) to measure hydraulic conductivity of soil samples. Other methods are U.S. Army Corps of Engineers Engineering Manual 1110-2-1906 (COE, 1970) and the newly published "Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter" (ASTM D-5084). To verify full saturation of the sample, this latter method may be performed with back pressure saturation and electronic pore pressure measurement.

Soil Properties –

Soils typically possess certain ranges of physical characteristics including gradation and plasticity which affect their ability to achieve a hydraulic conductivity of 1×10^{-7} cm/sec. Testing methods used to characterize proposed liner soils should include grain size distribution (ASTM D-422), Atterberg limits (ASTM D-4318), and compaction curves depicting moisture and density relationships using the standard or modified Proctor (ASTM D-698 or ASTM D-1557), whichever is appropriate for the compaction equipment used.

Liner soils usually have at least 20 percent fines (fine silt-and clay-sized particles). Some soils with less than 20 percent fines may be worked to obtain hydraulic conductivities below 1×10^{-7} cm/sec, but these soils require greater control of construction practices and conditions.

Soil plasticity index (PI), which is determined from the Atterberg limits (defined by the liquid limit minus the plastic limit), should generally be greater than 10 percent. Soils with very high PI, (greater than 30 to 40 percent), are very cohesive and sticky and become difficult to work with in the field. When high PI soils are too dry during placement, they tend to form hard clumps (clods) that are difficult to break down during compaction. Preferential flow paths may be created around the clods allowing leachate can migrate at a relatively rapid rate.

[illegible] particles or rock fragments should be less than three inches in diameter so as not to affect the overall hydraulic performance of the soil (USEPA, 1989a).

The maximum density of soil will occur at the optimum water content, but this point generally does not correspond to the point at which minimum hydraulic conductivity is achieved. Depending on the specific soil characteristics, compaction equipment, and compactive effort, the hydraulic conductivity criterion may be achieved at moisture values of 1 to 7 percent wet of (above) optimum moisture content.

Although the soil may contain all the correct properties for successful construction of a liner, the soil liner may not meet the hydraulic conductivity criterion, if the construction practices are not appropriate and carefully controlled.

Amended Soils –

Soil additives, such as bentonite or other clay materials, may be used to decrease the hydraulic conductivity of native soils (USEPA, 1988b).

Bentonite may be obtained in dry, powdered forms and are relatively easy to blend with on-site soils. Bentonite is a clay mineral (sodium-montmorillonite) which, upon addition of water (hydration), expands by absorbing water within the mineral matrix. This property allows relatively small amounts (5 to 10 percent) to be added to a noncohesive soil (sand) to make it more cohesive (USEPA, 1988b). Thorough mixing of additives to cohesive soils (clay) is difficult and may lead to inconsistent results in complying with the hydraulic conductivity criterion.

The most common additive used to amend soils is sodium bentonite. One drawback with using sodium bentonite is its vulnerability to attack by chemicals and waste leachates (USEPA,1989a).

Calcium bentonite, although more permeable than sodium bentonite, also has been used for soil blends. Approximately twice as much calcium bentonite typically is needed to achieve a hydraulic conductivity comparable to that of sodium bentonite.

Soil/bentonite mixtures generally require central plant mixing by means of a pugmill, cement mixer, or other mixing equipment where water can be added during the process. Water, bentonite content, and particle size distribution must be controlled during mixing and placement, which is easier to attain at a central plant. Spreading of the soil/bentonite mixture may be accomplished in the same manner as natural soil liners by using scrapers, graders, dozers, or a continuous asphalt paving machine (USEPA, 1988a).

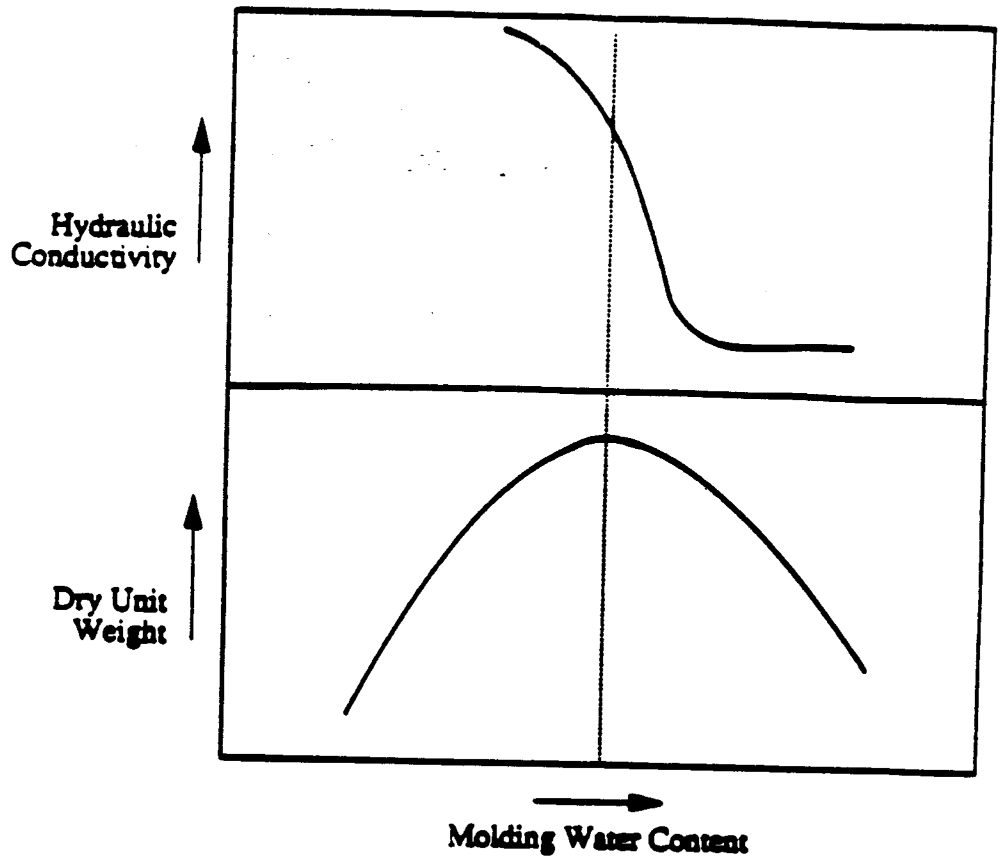
Materials other than bentonite, including lime, cement, and other clay minerals such as atapulgite, may be used as soil additives (USEPA, 1989a). For more information concerning soil admixtures, the reader is referred to the technical resource document on the design and construction of clay liners (USEPA, 1988a).

Testing

Prior to construction of a soil liner, the relationship among water content, density, and hydraulic conductivity for that particular soil should be established. Figure 4-5 shows the influence of molding water content (moisture content of the soil at the time of compaction) on hydraulic conductivity of the soil. The lower half of the diagram is a compaction curve and shows the relationship between dry unit weight, or dry density of the soil, and water content of the soil. A water content called the optimum moisture content of the soil is related to a peak value of dry density known as maximum dry density. Maximum density is achieved at the optimum moisture content.

The lowest hydraulic conductivity of compacted clay soil usually occurs when the soil is compacted at a moisture content slightly higher than the optimum moisture content, generally in the range of 1 to 7 percent (USEPA, 1989a). When compacting clay, water content and compactive effort are the two factors that should be controlled to meet the maximum hydraulic conductivity criterion.

It is impractical to specify and construct a clay liner to a specific moisture content and a specific compaction (e.g., 5 percent wet of optimum and 95 percent modified Proctor). Moisture content can be difficult to control in the field during construction and it may be more appropriate to specify a range of moisture contents and corresponding soil densities (percent compaction) that are considered appropriate to achieve the required hydraulic conductivity. Daniel and Benson (USEPA, 1990) propose water content and density criteria for the construction of clay liners in which the moisture-density criteria ranges are established based on hydraulic conductivity test results. This type of approach is recommended because of the flexibility and guidance it provides



Source: U.S. EPA, 1989.

Note: The optimum moisture content occurs at the point at which maximum density is achieved. The lowest hydraulic conductivity generally occurs at water contents higher than optimum.

FIGURE 4-5
Hydraulic Conductivity and Dry Unit Weight as a Function of Molding Water Content

to the construction contractor during soil placement. This approach is exemplified in Figure 4-6. The amount of soil testing to define these construction parameters is dependent on the degree of natural variability of the source material.

Quality assurance and quality control of soil liner materials involve both laboratory and field testing. Quality control tests are performed to ascertain compaction requirements and moisture contents of material delivered to the site. Field tests for quality assurance provide an opportunity to check representative areas of the liner for conformance to compaction specifications including density and moisture content. Quality assurance laboratory testing is usually conducted on field samples for determination of hydraulic conductivity of the in-place liner. Laboratory testing allows full saturation of the soil samples with the ability to simulate the effects of large overburden stress on the soil which cannot be done conveniently in the field (USEPA, 1989a).

Differences between laboratory and field conditions (e.g., uniformity of material, control of water content, compactive effort, compaction equipment) may make it unlikely that minimum hydraulic conductivity values measured in the laboratory on remolded, pre-construction borrow source samples are the same as the values achieved during actual liner construction. Laboratory testing does not account for operational problems which may result in desiccation, cracking, poor bonding of lifts, and inconsistent degree of compaction on sidewalls (USEPA, 1988b).

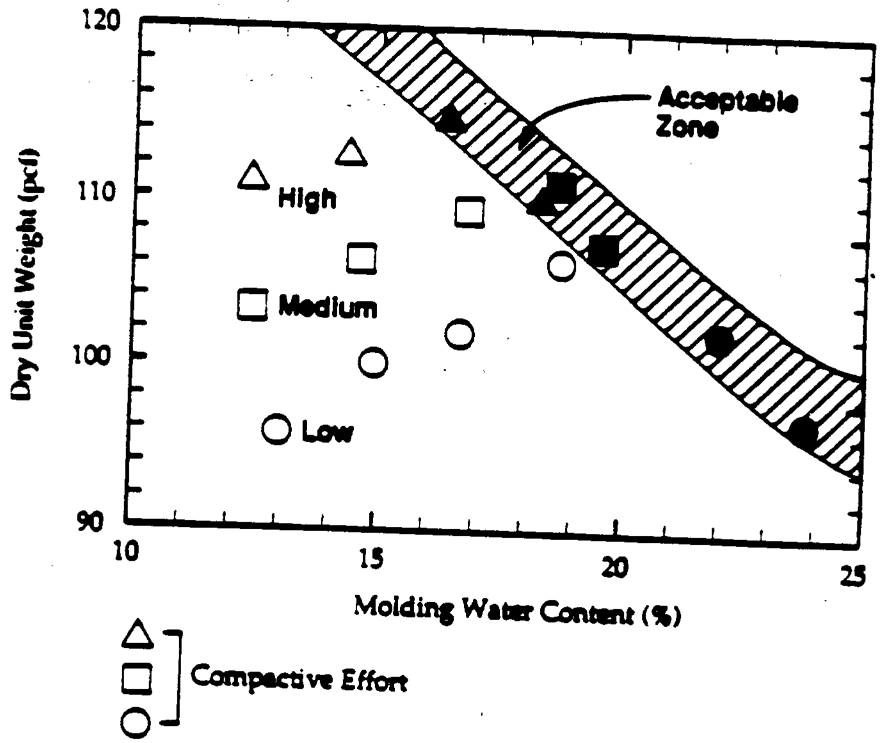
Some relationships between field and laboratory hydraulic conductivity testing have been investigated by USEPA using field case studies (USEPA, 1990c).

In situ, or field, hydraulic conductivity testing operates on the assumption that by testing larger masses of soil in the field one can obtain more realistic results. There are actually four kinds of in situ hydraulic conductivity tests: borehole tests, porous probes, infiltrometer tests, and underdrain tests. To conduct a borehole test one simply drills a hole in the soil, fills the hole with water, and measures the rate at which water percolates into the borehole.

The second type of test involves driving or pushing a porous probe into the soil and pouring water through the probe into the soil. With this method, however, the advantage of testing directly in the field is somewhat offset by the limitations of testing such a small volume of soil.

A third method of testing involves a device called an infiltrometer. This device is embedded into the surface of the soil liner such that the rate of flow of a liquid into the liner can be measured. The two types of infiltrometers popularly used are open and sealed. Open rings are less desirable because with conductivity of 10^{-7} cm/sec, it is difficult to separate a 0.002 inches per day drop in water level of the pond from evaporation and other losses.

With sealed rings, however, very low rates of flow can be measured. Single-ring infiltrometers allow lateral flow beneath the ring, complicating the interpretation of test results. Single rings are also susceptible to the effects of temperature



Compaction Data for a Silty Clay (from Mitchell et al., 1965). Solid symbols represent specimens with a hydraulic conductivity $\leq 1 \times 10^{-7}$ cm/s and open symbols represent specimens with hydraulic conductivity $> 1 \times 10^{-7}$ cm/s.

Source: CERI 90-50 (USEPA, 1990)

FIGURE 4-6
Compaction Data for Silty Clay

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variation; as the water heats up, the whole system expands and as it cools down, the whole system contracts. This situation could lead to erroneous measurements when the rate of flow is small.

The sealed double-ring infiltrometer has proven the most successful and is the one used currently. The outer ring forces the infiltration from the inner ring to be more or less one dimensional. Covering the inner ring with water insulates it substantially from temperature variation.

Underdrains, the fourth type of in situ test, are the most accurate in situ permeability testing device because they measure exactly what migrates from the bottom of the liner. Underdrains are slow in generating good data for low permeability liners because of the length of time required to accumulate measurable flow. Also, underdrains must be installed during construction, so there are fewer in operation than there are other kinds of testing devices.

Soil Liner Construction --

Standard compaction procedures are usually employed when constructing soil liners. The following factors influence the degree and quality of compaction:

- Lift thickness;
- Full scale or segmented placement;
- Number of equipment passes;
- Scarification between lifts; and
- Soil water content.

The method used to compact the soil is an important factor in achieving the required minimum hydraulic conductivity. Higher degrees of compactive effort increase soil density and lower the soil hydraulic conductivity for a given water content. Laboratory compaction test methods do not necessarily provide a direct correlation to the amount of compaction that can be achieved during construction.

Heavy compaction equipment (greater than 25,000 lbs or 11,300 kg) is typically used when building the soil liner to maximize compactive effort (USEPA, 1989a). The preferred field compaction equipment is a roller with long feet that fully penetrate a loose lift of soil and provide higher compaction, while kneading the clay particles together. The shape and depth of the feet are important; narrow, rod-like feet with a minimum length of about seven inches provide the best results. A progressive change from the rod-like feet to a broader foot may be necessary in some soils after initial compaction, to allow the roller to walk out of the compacted soil. The sheepsfoot feet also aid in breaking up dry clods (See "Soil Properties"). Mechanical road reclaimers, the equipment used to strip and re-pave asphalt, can be extremely effective in reducing soil clod size prior to compaction, and in scarifying soil surfaces between lifts. Other equipment that have been used to compact soil include discs and rototillers.

To achieve adequate compaction, the lift thickness (usually five to nine inches) may be decreased, or the number of passes over the lift may be increased. Generally, compaction equipment must pass over the soil liner five to twenty times to attain the compaction needed to comply with the minimum hydraulic conductivity criterion (USEPA, 1989a).

Efforts made to reduce clod size during excavation and placement of the soil for the liner should improve chances for achieving low hydraulic conductivity in several ways. Keeping clods to smaller sizes in the soil liner material will facilitate a more uniform water content. Macropores between clod remnants can result in unacceptably high field hydraulic conductivity.

Opinions differ on acceptable clod sizes in the uncompacted soil. Some suggest a maximum of one to three inches in diameter, or no larger than one-half the lift thickness. The main objective is to remold all clods in the compaction process to keep hydraulic conductivity values consistent throughout the soil liner (USEPA, 1988a).

Geomembranes

Geomembranes are relatively thin sheets of flexible thermoplastic or thermoset polymeric materials that are manufactured and prefabricated at a factory and transported to the site. Because of their inherent impermeability, use of geomembranes in landfill construction has increased. The design of the side slope (friction between natural soils and geosynthetics) is very critical and requires careful review.

Material Types and Thicknesses

Geomembranes are made of one or more polymers along with a variety of other ingredients such as carbon black, pigments, fillers, plasticizers, processing aids, crosslinking chemicals, anti-degradants, and biocides. The polymers used to manufacture geomembranes include a wide range of rubbers and plastics differing in properties such as chemical resistance, and basic composition (USEPA, 1983 and USEPA, 1988e). The polymeric materials may be categorized as follows:

- Thermoplastics such as polyvinyl chloride (PVC);
- Crystalline thermoplastics such as high density polyethylene (HDPE), very low density polyethylene (VLDPE), and linear low density polyethylene (LLDPE); and
- Thermoplastic elastomers such as chlorinated polyethylene (CPE) and chlorosulfonated polyethylene (CSPE).

The polymeric materials used most frequently as geomembranes are PVC, CSPE, CPE, and HDPE. The thickness of geomembranes ranges from 20 to 120 mils (USEPA, 1983 and USEPA, 1988e). The recommended minimum thickness for all geomembranes is 30 mils, with the exception of HDPE, which must be at least 60 mils to allow proper seam welding. Some geomembranes can be manufactured by a calendaring process with fabric reinforcement called scrim to provide additional tensile strength and dimensional stability.

Chemical and Physical Stress Resistance

The design of the landfill should consider stresses imposed on the liner by the design configuration. These stresses include the following:

- Differential settlement in the foundation soils;
- Strain requirements at the anchor trench; and
- Strain requirements over long, steep side slopes.

Extensive literature has been developed by manufacturers and independent researchers on the physical properties of liners. Geosynthetic design equations are presented in several publications including Kastman (1984), Koerner (1986), and USEPA (1988e).

The chemical resistance of a geomembrane to leachate has traditionally been considered a critical issue for Subtitle C (Hazardous Waste) facilities where highly concentrated solvents may be encountered. Chemical resistance testing of geomembranes may not be required for strictly municipal solid waste because EPA's data base has shown that MSWLF leachate is not aggressive to these types of materials. Testing for chemical resistance may be warranted considering the waste type, volumes, characteristics, and amounts of small quantity generator waste or other industrial waste present in the waste stream. The following guidance is provided in the event such testing is of interest to the owner or operator.

EPA's Method 9090 in SW-846 is the established test procedure used to evaluate leachate degradation of geomembranes when exposed to hazardous waste leachate. In the procedure, the geomembrane is immersed in the site-specific chemical environment for at least 120 days at two different temperatures. Physical and mechanical properties of the tested material are then compared to those of the original material every thirty days. A software system entitled Flexible Liner Evaluation Expert (FLEX), which is designed to assist in the hazardous waste permitting process, may aid in interpreting EPA Method 9090 test data (USEPA, 1989a). A detailed discussion of both Method 9090 and FLEX is available from EPA.

It is imperative that a geomembrane liner maintain its integrity during exposure to short-term and long-term mechanical stresses. Short-term mechanical stresses include equipment traffic during the installation of a liner system, as well as thermal expansion and shrinkage of the geomembrane during the construction and operation of the MSWLF. Long-term mechanical stresses result from the placement of waste on top of the liner system and from subsequent differential settlement of the subgrade (USEPA, 1988a).

Long-term success of the liner requires adequate friction between the components of a liner system, particularly the soil subgrade and the geomembrane, so that slippage or sloughing does not occur on the slopes of the unit. Specifically, the foundation slopes and the subgrade materials must be considered in design equations to evaluate:

- The ability of a geomembrane to support its own weight on the side slopes;

- The ability of a geomembrane to withstand down-dragging during and after waste placement;

- The best anchorage configuration for the geomembrane; and

- The stability of a soil cover on top of a geomembrane.

These requirements may affect the choice of geomembrane material, including polymer type, fabric reinforcement, thickness and texture (e.g., smooth or textured for HDPE) (USEPA, 1988a).

Design specifications should indicate the type of raw polymer and manufactured sheet to be used as well as the requirements for delivery, storage, installation, and sampling of the geomembrane. Material properties can be obtained from manufacturers supplied average physical property values published in Geotechnical Fabrics Report, which is updated annually. Tensile properties of the geomembrane must be sufficient to satisfy the stresses anticipated during the service life of the geomembrane. Specific raw polymer and manufactured sheet specifications and test procedures include (USEPA, 1988e and Koerner, 1990):

Raw Polymer Specifications

- Density (ASTM D-1505)
- Melt index (ASTM D-1238)
- Carbon black (ASTM D-1603)
- Thermogravimetric analysis (TGA) or differential scanning calorimetry (DSC)

Manufactured Sheet Specifications

- Thickness (ASTM D-1593)
- Tensile properties (ASTM D-638)
- Tear resistance (ASTM D-1004)
- Carbon black content (ASTM D-1603)
- Carbon black dispersion (ASTM D-3015)
- Dimensional stability (ASTM D-1204)
- Stress crack resistance (ASTM D-1693)

Geomembranes made from different polymers and by different manufacturers have different physical characteristics that can affect the design of a liner system. The manufacturers' literature should be coupled with the knowledge that each manufacturer may use more than one polymer or resin type for each grade of geomembrane and that the material specifications may be generalized to represent several grades of material. Material specifications should specify the percentage of acceptable non-virgin resins used in the manufacturing of the geomembrane.

Installation

Installation specifications should cover installation procedures specific to the properties of the liner installed. The coefficient of thermal expansion of the geomembrane sheet can affect its installation and its service performance. The geomembrane should lie flat on the underlying soil depending on the ambient temperature. However, shrinkage and expansion of the sheeting, due to changes in temperature during installation, may result in excessive wrinkling or tension in the geomembrane. Wrinkles on the geomembrane surface will affect the uniformity of the soil-geomembrane interface and leakage through imperfections. Excessive tautness of the geomembrane may affect its ability to resist rupture from localized stresses on the seams or at the toe of slopes where bridging over the subgrade may occur during installation. In addition to thermal expansion and contraction of the geomembrane, residual stresses from manufacture remain in some geomembranes and can cause non-uniform expansion and contraction during construction. The geomembrane selection and installation may require provision of slack in the specifications to account for anticipated dimensional changes resulting from thermal expansion and contraction (USEPA, 1988a).

Technical specifications for geomembranes should also include information for protection of the material during shipping, storage and handling, quality control certifications required from the manufacturer or fabricator (if panels are constructed), and quality control testing by the contractor, installer, or a construction quality assurance (CQA) agent. Installation procedures addressed by the technical specifications include a geomembrane layout plan, deployment of the geomembrane at the construction site, seam preparation, seaming methods, seaming temperature constraints, and sealing of the geomembrane to appurtenances, both adjoining and penetrating the liner. The performance of inspection activities, including both non-destructive and destructive quality control field testing of the sheets and seams during installation of the geomembrane, should be addressed in the technical specifications. Construction quality assurance is addressed in an EPA guidance document (USEPA, 1988a).

The geomembrane sheeting is shipped in rolls or panels from the suppliers, manufacturers, or fabricators to the construction site. Each roll or panel may be labeled according to its position on the geomembrane layout plan to facilitate installation. Damage that has occurred during shipping can be identified by inspection upon delivery (USEPA, 1988a).

Proper storage of the rolls or panels prior to installation is important to the final performance of the geomembrane. Some geomembrane materials may be sensitive to ultraviolet exposure and should not be stored in direct sunlight prior to installation. Others such as CSPE and CPE are sensitive to moisture and heat and can partially crosslink or block (stick together) under improper storage conditions before installation. Adhesives or welding materials, which are used to join geomembrane panels, also should be stored appropriately (USEPA, 1988a).

Visual inspection and acceptance of the soil liner subgrade should be conducted prior to placing the geomembrane. The surface of the subgrade should meet design specifications with regard to a lack of protruding objects, grades, and thickness. Once these inspections are conducted and complete, the geomembrane may be installed on top of the soil liner. If necessary, means to protect the subgrade from precipitation and erosion, and to prevent desiccation, moisture loss, and erosion from the soil liner prior to geomembrane placement should be employed. Such methods may include placing a plastic tarp on top of completed portions of the soil liner (USEPA, 1988a).

Deployment, or placement, of the geomembrane panels or rolls should be described in the geomembrane layout plan. Rolls of sheeting, such as HDPE, generally can be deployed by placing a shaft through the core of the roll which is supported and deployed by heavy equipment such as a front-end loader or a winch. Panels composed of extremely flexible liner such as PVC are usually folded on pallets and require workers to manually unfold and place the geomembrane. Placement of the geomembrane goes hand-in-hand with the seaming process; only the amount of sheeting that can be seamed during a shift or work day should be deployed at any one time (USEPA, 1988a). Panels should be weighted with sand bags if wind uplift of the membrane or excessive movement from thermal expansion is a potential problem.

Once deployment of a section of the geomembrane is complete and each section has been visually inspected for imperfections and tested to ensure specified thickness, seaming of the geomembrane may begin. Quality control/quality assurance monitoring of the seaming process should be implemented to detect inferior seams. Seams may be manufactured both in the factory and the field. Factory seams are made in a controlled environment and are generally of high quality, but the entire seam length (100 percent) should still be tested (USEPA, 1988a).

Consistent quality in fabricating field seams is important, and conditions that may affect seaming should be monitored and controlled during installation. Inspection in accordance with a construction quality assurance plan can be used to document the integrity of field seams. The factors affecting the seaming process include the (USEPA, 1988a):

- Ambient temperature at which the seams are made;
- Relative humidity;
- Control of panel lift up by wind;
- Effect that clouds have on the geomembrane temperature;
- Water content of the subsurface beneath the geomembrane;
- Supporting surface on which the seaming is bonded;
- Skill of the seaming crew;
- Quality and consistency of the chemical or welding material;
- Proper preparation of the liner surfaces to be joined; and
- Cleanliness of the seam interface (e.g., the amount of airborne dust and debris present).

Several bonding systems are available depending on the type of geomembrane for the construction of both factory and field seams. Bonding methods include solvents, heat seals, heat guns, dielectric seaming, extrusion welding, and hot wedge techniques. To ensure the integrity of the seams, a given geomembrane should be seamed using the bonding system recommended by the manufacturer (USEPA, 1988a). EPA has developed a field seaming manual for all types of geomembranes (U.S. EPA, 1991).

Thermal methods of seaming require cleanliness of the bonding surfaces, heat, pressure, and dwell time to produce high quality seams. The requirements for adhesive systems are the same as thermal systems, except that the adhesive takes the place of the heat. Sealing the geomembrane to appurtenances and penetrating structures should be performed in accordance with detailed drawings included in the design plans and approved specifications.

An anchor trench along the perimeter of the cell is generally used to secure the membrane during construction (to prevent sloughing or slipping down the interior side slopes). Run out calculations (Koerner, 1986) are available to determine the depth of burial at the trench necessary to hold a specified length of membrane, or combination of membrane and geofabric or geotextile. The force holding the membrane should not exceed the tensile strength of the material. After the geomembrane is in service, it is preferable to allow the membrane to slip or give in the trench, rather than tear if forces larger than the tensile strength of the membrane are inadvertently developed. During construction, the geomembrane should be anchored according to the detailed drawings provided in the design plans and specifications (USEPA, 1988a).

Geomembranes that are subject to damage from exposure to weather and work activities should be covered with a layer of soil as soon as possible after quality assurance activities associated with geomembrane testing are completed. Soil should be placed without driving construction vehicles directly on the geomembrane. Light ground pressure bulldozers may be used to push material out in front over the liner, but the operator must not attempt to push a large pile of soil forward in a continuous manner over the membrane. Such methods can cause localized wrinkles to develop and overturn in the direction of movement. Overturned wrinkles create sharp creases and localized stresses in the geomembrane which could lead to premature failure. Instead, the operator should continually place smaller amounts of soil or drainage material working outward over the toe of the previously placed material. Alternatively, large backhoes can be used to place soil out over the geomembrane which can later be spread with a bull dozer or similar equipment. Although such methods may sound tedious and slow, in the long run they will be faster and more cost effective than placing too much material too fast and having to remobilize the liner installer to repair damaged sections of the geomembrane. The CQA activities during construction should also include monitoring the contractor's activities on top of the liner to avoid damage to installed and accepted geomembranes.

Leachate Collection Systems

Leachate refers to liquid that has passed through or emerged from solid waste and contains dissolved, suspended, or immiscible materials removed from the solid waste. At MSWLFs, leachate is typically aqueous with limited, if any, immiscible fluids or dissolved solvents. The primary function of the leachate collection system is to collect and convey leachate out of the landfill and to control the height of the leachate above the liner. The leachate collection system (LCS) should be designed to meet the regulatory performance standard of maintaining less than 30 cm (12 inches) of leachate, or "head," above the liner. Flow of leachate through imperfections in the liner system increases with an increase in leachate head above the liner. Maintaining a low leachate level above the liner helps to improve the performance of the composite liner.

Leachate is generally collected from the landfill through sand drainage layers, synthetic drainage nets, or granular drainage layers with perforated plastic collection pipes, and removed through sumps or gravity drain carrier pipes. Each LCS consists of the following components (USEPA, 1988a):

- A low-permeability base (in this case a composite liner);
- A high-permeability drainage layer constructed of either natural granular materials (sand and gravel) or synthetic drainage material (e.g., geonet). The drainage layer is placed directly on the flexible membrane liner, or on protective bedding layer (e.g., geofabric) directly overlying the liner;
- Perforated leachate collection pipes within the high-permeability drainage layer to collect leachate and carry it rapidly to a sump or collection header pipe;
- A protective filter material surrounding the pipes, if necessary, to prevent physical clogging of the pipes or perforations;
- A protective filter layer over the high permeability drainage material which prevents physical clogging of the material by fine grained material; and
- Leachate collection sumps or header pipe system where leachate can be removed.

The design, construction, and operation of the LCS should maintain a maximum height of leachate above the composite liner of 30 cm (12 in). SW-869 (USEPA, 1982) provides design guidance for calculating the maximum leachate depth over a liner for granular drainage systems materials. The leachate head in the layer is a function of the liquid impingement rate, bottom slope, pipe spacing, and drainage layer hydraulic conductivity. The impingement rate is estimated using a complex liquid routing procedure. If the maximum leachate depth exceeds 30 cm for the system, except for short-term occurrences, the design should be modified to improve its efficiency by increasing grade, decreasing pipe spacing or increasing the hydraulic conductivity (transmissivity) of the layer (USEPA, 1988a).

Grading of Low-Permeability Base

The typical bottom liner slope is two percent at all points in each system. A slope is necessary for effective gravity drainage through the entire operating and post-closure period. Settlement estimates of the foundation soils should set this two-percent grade as a post-settlement design objective (USEPA, 1988a).

High-Permeability Drainage Layer

The high-permeability drainage layer is placed directly over the liner or its protective bedding layer at a slope of at least two percent (the same slope necessary for the composite liner). Often the selection of a drainage material is based on the on-site availability of natural granular materials. In some regions of the country, hauling costs may be very high for sand and gravel, or appropriate materials may be unavailable and the designer may elect to use geosynthetic drainage nets (geonets) or synthetic drainage materials as an alternative. Frequently, geonets are substituted for granular materials on steep sidewalls since maintaining sand on the slope during construction and operation of the landfill is more difficult (USEPA, 1988a).

Soil Drainage Layers

If the drainage layer of the leachate collection system is constructed of granular soil materials, (e.g., sand and gravel), then it should be demonstrated that this granular drainage layer has sufficient bearing strength to support expected loads. This demonstration will be very similar to that required for the foundations and soil liner (USEPA, 1988a).

If the landfill is designed on moderately to steeply (15%) sloping grades, the landfill design should include calculations demonstrating that the selected granular drainage materials will be stable on the most critical (e.g., usually the steepest slope) in the design. The calculations and assumptions should be shown, especially the friction angle between the geomembrane and soil, and if possible, supported by laboratory and/or field testing (USEPA, 1988a).

Generally, gravel soil with a group designation of GW or GP on the Unified Soils Classification Chart can be expected to have a hydraulic conductivity of greater than 0.01 cm/sec, while sands identified as SW or SP can be expected to have a coefficient of permeability greater than 0.001 cm/sec. The regulated performance drains water that enters the drainage layer to prevent 30 cm (12 in) or more accumulation on top of the liner over the active life of the MSWLF unit LCS. The design of an LCS typically uses a drainage material with a hydraulic conductivity of 1×10^{-2} cm/sec. Alternatively, if a geonet is used, the design is based on the transmissivity of the geonet.

If a filter layer (soil or geosynthetic) is constructed on top of a drainage layer to protect it from clogging, and the LCS is designed and operated to avoid drastic changes in the oxidation reduction potential of the leachate (thereby avoiding formation of precipitates within the LCS), then there is no conceptual basis to anticipate that conductivity will decrease over time. Where conductivity is expected to decrease over time, the change in impingement rate should also be evaluated over the same time period since reduced impingement rate and conductivity may still comply with the 30 cm criterion.

Unless alternative provisions are made to control incident precipitation and resulting surface runoff, the impingement rate during the operating period of the MSWLF unit is usually at least an order of magnitude greater than the impingement rate after final closure. The critical design condition for meeting the 30 cm (12 in) criterion can therefore be expected during the operating life. The designer may evaluate the sensitivity of a design to meet the 30 cm (12 in) criterion as a result of changes in impingement rates, hydraulic conductivity, pipe spacing, and grades. Such sensitivity analysis may indicate which element of the design should be emphasized during construction quality monitoring or whether the design can be altered to more cost-effectively comply with the 30 cm (12 in) criterion.

The soil material used for the drainage layer should be investigated at the borrow pit prior to use at the landfill. Typical borrow pit characterization testing would include laboratory hydraulic conductivity and grain size distribution. If grain size distribution information from the borrow pit characterization program can be correlated to the hydraulic conductivity data, then the grain size test, which can be conducted in a short time in the field, may be a useful construction quality control parameter. Compliance with this parameter would then be indicative that the hydraulic conductivity design criterion was achieved in the constructed drainage layer. This information could be incorporated into construction documents after the borrow pit has been characterized. If a correlation cannot be made between hydraulic conductivity and grain size distribution, then construction documents may rely on direct field or laboratory measurements to demonstrate that the hydraulic conductivity design criterion was met in the drainage layer.

Granular materials are generally placed using conventional earthmoving equipment, including trucks, scrapers, bulldozers, and front-end loaders. If the materials are being placed over a geomembrane or geotextile, then they should be placed without driving vehicles directly over the geosynthetic material (USEPA, 1988a).

Coarse granular drainage materials, unlike low-permeability soils, can be placed dry and need not be heavily compacted. To minimize settlement following material placement, the granular material may be compacted with a vibratory roller. The final thickness of the drainage layer should be checked by optical survey measurements or by direct test pit measurements (USEPA, 1988a).

Geosynthetic Drainage Nets

Geosynthetic drainage nets (geonets) may be substituted for the granular layers of the LCRs on the bottom and sidewalls of the landfill cells. Geonets require less space than perforated pipe or gravel and also promote rapid transmission of liquids. They do, however, require geotextile filters above them and can experience problems with creep and intrusion. Long-term operating and performance experience of geonets is limited because the material and its application are relatively new (USEPA, 1989a).

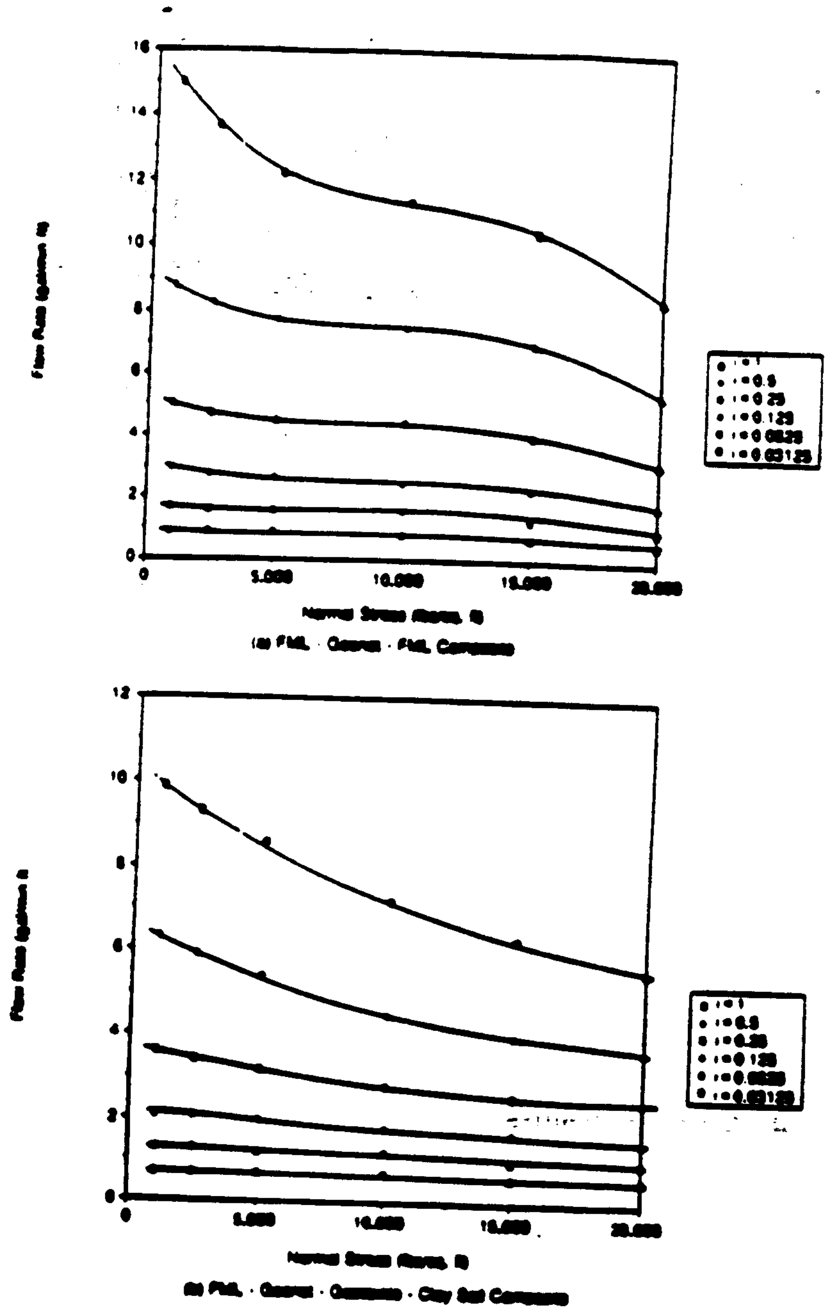
If a geonet is used in place of a granular drainage layer, it must provide the same level of performance (maintaining less than 30 cm of leachate head above the liner). An explanation of the calculation used to compute the capacity of a geonet may be found in USEPA (1987a). The transmissivity of a geonet can be reduced entirely by intrusion of the soil. A protective geotextile between the soil and geonet will help alleviate this concern. If laboratory transmissivity tests are performed, they should be done under conditions, loads, and configurations that closely replicate the actual field conditions. It is important that the transmissivity value used in the leachate collection system design calculations be selected based upon those loaded conditions (USEPA, 1988a).

The flow rate or transmissivity of geonets may be evaluated by ASTM D-4716. This flow rate may then be compared to design-by-function equations presented in USEPA (1989a). In the ASTM D-4716 flow test, the proposed collector cross section should be modeled as closely as possible to actual field conditions. (USEPA, 1989a)

Figure 4-7 shows the flow rate "signatures" of a geonet between two geomembranes (upper curves) and the same geonet between a layer of clay soil and a geomembrane (lower curves). The differences between the two sets of curves represent intrusion of the geotextile/clay into the apertures of the geonet. The curves are used to obtain a flow rate for the particular geonet being designed (USEPA, 1989a). Equations to determine the design flow rate or transmissivity are also presented in USEPA (1989a), Giroud (1982), Carroll (1987), Koerner (1990), and FHWA (1987).

Generally, geonets perform well and result in high factors of safety or performance design ratios, unless creep becomes a problem or if adjacent materials intrude into apertures (USEPA, 1989a). For geonets, the most critical specifications are concerned with the ability to transmit fluids under load. The specifications should include a minimum transmissivity under expected landfill operating (dynamic) or completion (static) loads. The specifications for thickness and type of material should be identified on the drawings or in the materials section of the specifications, and should be consistent with the design calculations (USEPA, 1988a).

Geonets are often used on the sidewalls of landfills because of their stability and ease of installation. They should be placed with the top ends in a secure anchor



Source: U.S. EPA, 1989.

FIGURE 4-7

Flow Rate Curves for Geonets in Two Composite Liner Configurations

trench with the strongest longitudinal length extending down the slope. They should be installed with no seams on the side slopes. If seams are used on the side slopes, they should be evaluated by the ASTM D-4716 test method for hydraulic flow capability. The geonets need not be seamed to each other on the slopes, only tied at the edges, butted, or overlapped. They should be placed in a loose condition, not stretched or placed in a configuration where they are bearing their own weight in tension. The construction specifications should contain appropriate installation requirements described above or by the requirements of the geonet manufacturer. All geonets need to be protected by a filter layer or geotextile to prevent clogging (USEPA, 1988a).

The friction factors against sliding for geotextiles, geonets, and geomembranes often can be demonstrated using manufacturers data because these materials do not exhibit the range of characteristics as seen in soil materials. However, it is important that the designer perform the actual tests using site materials and that the sliding stability calculations accurately represent the actual design configuration, site conditions, and the specified material characteristics (USEPA, 1988a).

Leachate Collection Pipes

All components of the leachate collection system must have sufficient strength to support the weight of the overlying waste, cover system, and post-closure loadings, as well as stresses from operating equipment. The component that is most vulnerable to strength failure is the drainage layer piping. Leachate collection system piping can fail by excessive deflection which may lead to buckling or collapse (USEPA, 1988a). Pipe strength calculations should include resistance to wall crushing, pipe deflection, and critical buckling pressure. Design equations for most pipe types and design information can be obtained from most major pipe manufacturers. For more information regarding pipe structural strength, refer to USEPA (1988a).

Perforated drainage pipes have been documented to provide good long-term performance. These have been shown to transmit fluids rapidly and maintain good service lives. They do, however, require a minimum vertical dimension of the drainage layer and may be susceptible to particulate clogging, biological clogging, and creep (deflection). Proper maintenance and design of pipe systems can mitigate these effects and provide systems that function properly. Acceptable pipe deflections should be evaluated for the pipe material to be used (USEPA, 1989a).

The design of perforated collection pipes should consider the following factors:

- The required flow using known percolation impingement rates and pipe spacing;
- Pipe size using required flow and maximum slope; and
- The structural strength of the pipe.

The pipe spacing may be determined by the Mound Model. In the Mound Model (see Figure 4-8), the maximum height of fluid between two parallel perforated drainage pipes is equal to (USEPA, 1989a):

$$h_{max} = \frac{L\sqrt{c}}{2} \left[\left(\left(\tan^2 a \right)/2 \right) + 1 - \left(\left(\tan a \right)/c \right) \left(\tan^2 a \right) + c \right]^{1/2}]$$

where $c = q/k$
k = permeability
q = inflow rate
a = slope

The two unknowns in the equation are:

L = distance between the pipes;
c = amount of leachate.

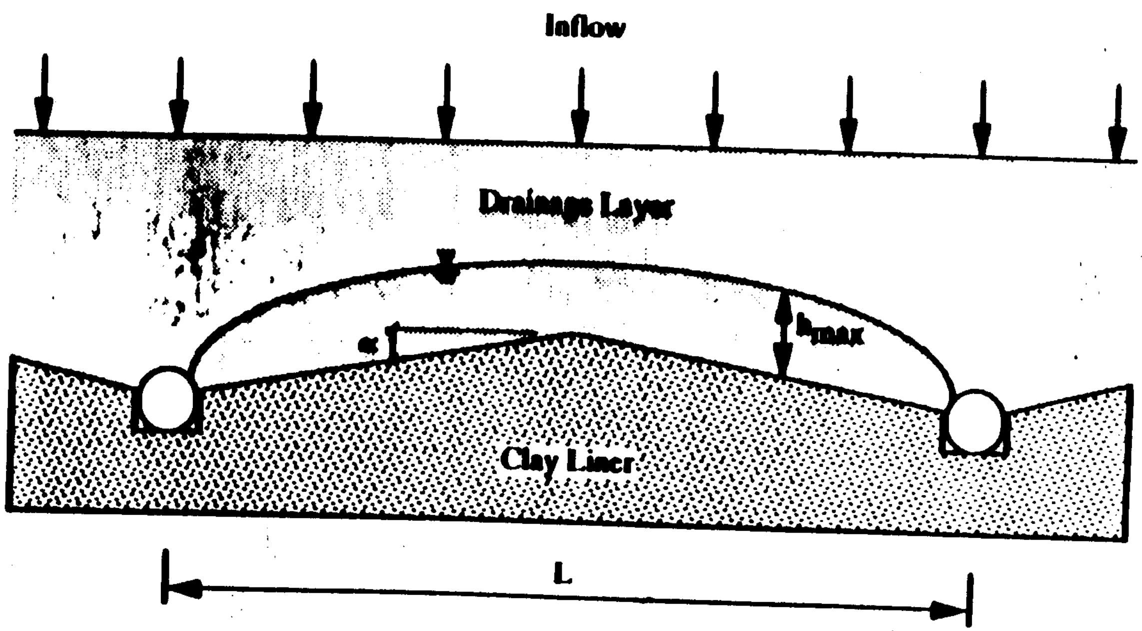
Using a maximum allowable head, h_{max}, of 30 cm (12 in), the equation is usually solved for "L" (USEPA, 1989a).

One method for determining the value of "c" is by using the Water Balance Method described in USEPA (1989a). The computer program Hydrologic Evaluation Landfill Performance (HELP) Model can also be used to estimate "c." The HELP Model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of landfills. The model uses climatologic, soil, and landfill design data and incorporates a solution technique that accounts for the effects of surface storage, run-off, infiltration, percolation, soil-moisture storage, evapotranspiration, and lateral drainage. The program estimates run-off drainage and leachate that are expected to result from a wide variety of landfill conditions, including open, partially open, and closed landfill cells. The model also may be used to estimate the depth of leachate above the bottom liner of the landfill. The results may be used to compare designs or to aid in the design of leachate collection systems (USEPA, 1988a).

Once the percolation and pipe spacing are known, the design flow rate can be obtained using the curve in Figure 4-9. The amount of leachate percolation at the particular site is located on the x-axis. The required flow rate is the point at which this value intersects with the pipe spacing value determined from the Mound Model. Using this value of flow rate and the bottom slope of the site, the required diameter for the pipe can be determined (see Figure 4-10). Finally, the graphs in Figures 4-11 and 4-12 show two ways to determine whether the strength of the pipe is adequate for landfill design. In Figure 4-11 the vertical soil pressure is located on the y-axis. The density of the backfill material around the pipe is not governed by strength, so it will deform under pressure rather than break. Ten percent is the absolute limiting deflection value for plastic pipe. Using Figure 4-11, the applied pressure on the pipe is located and traced to the trench geometry, and then the pipe deflection value is checked for its adequacy (USEPA, 1989a).

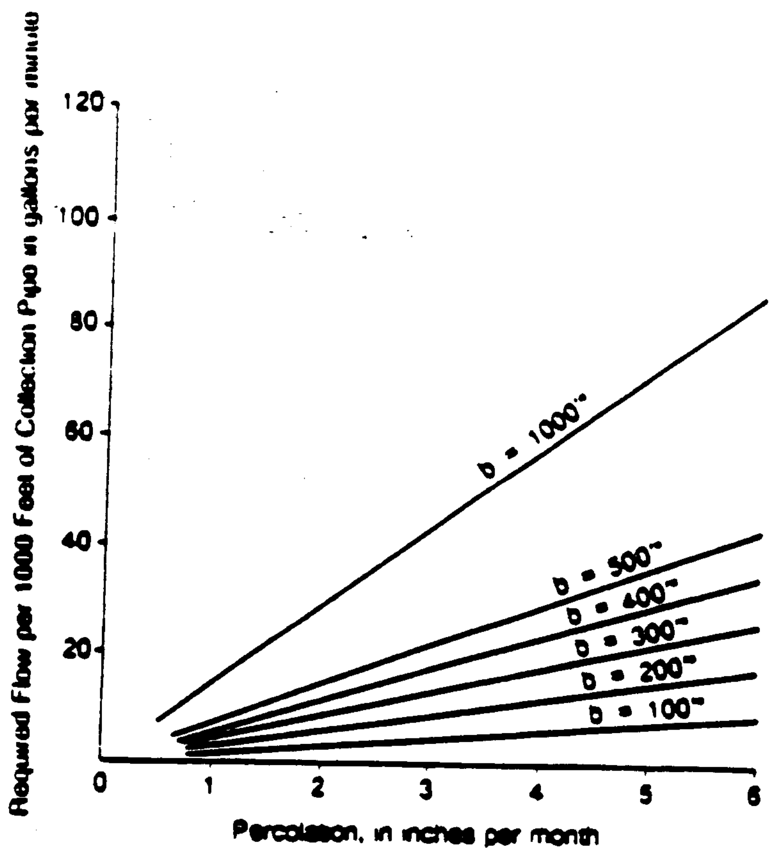
The LCS specifications should include the (USEPA, 1988a):

- Type of piping material;
- Diameter and wall thickness;
- Size and distribution of slots and perforations;



Source: U.S. EPA, 1989.

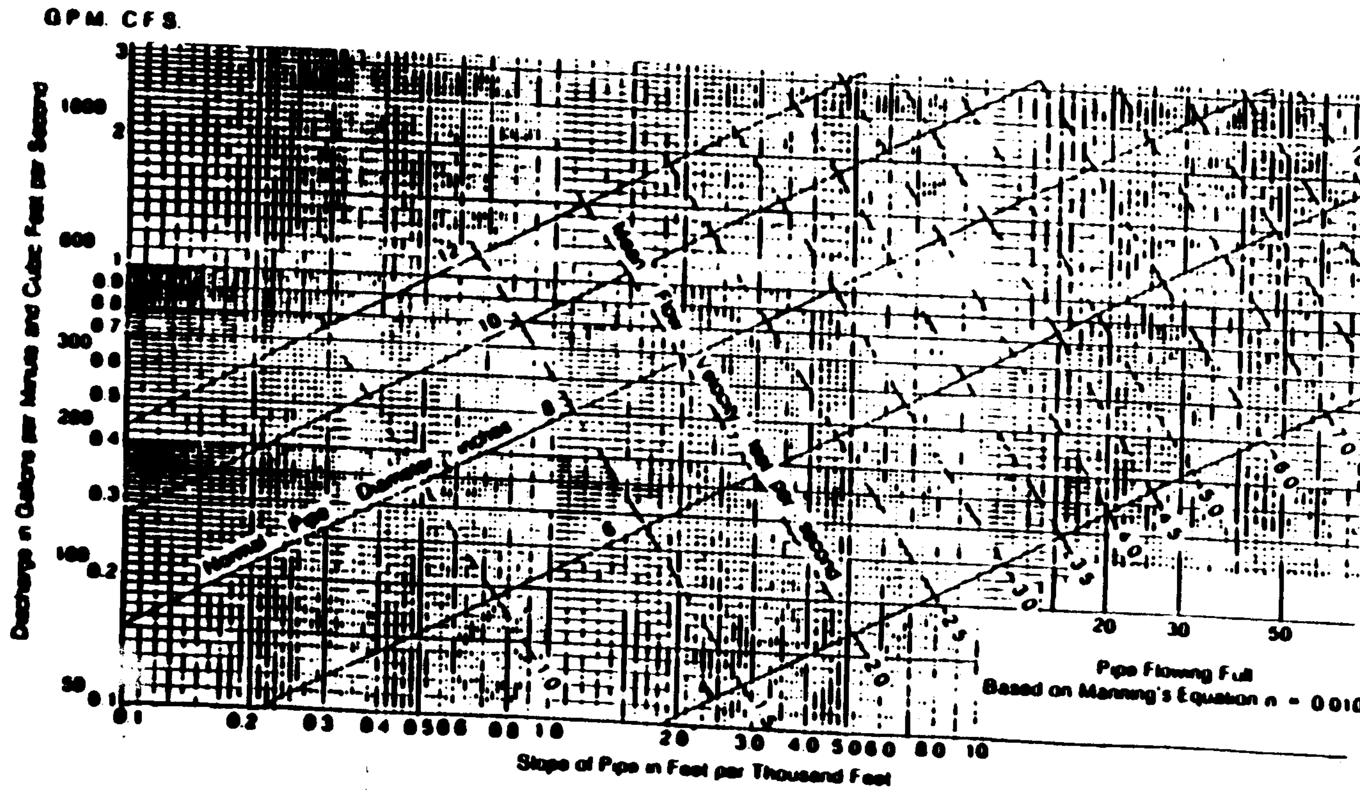
FIGURE 4-8
Definition of Terms for
Mound Model Flow Rat[illegible]culations



*Where b = width of area contributing to leachate collection pipe

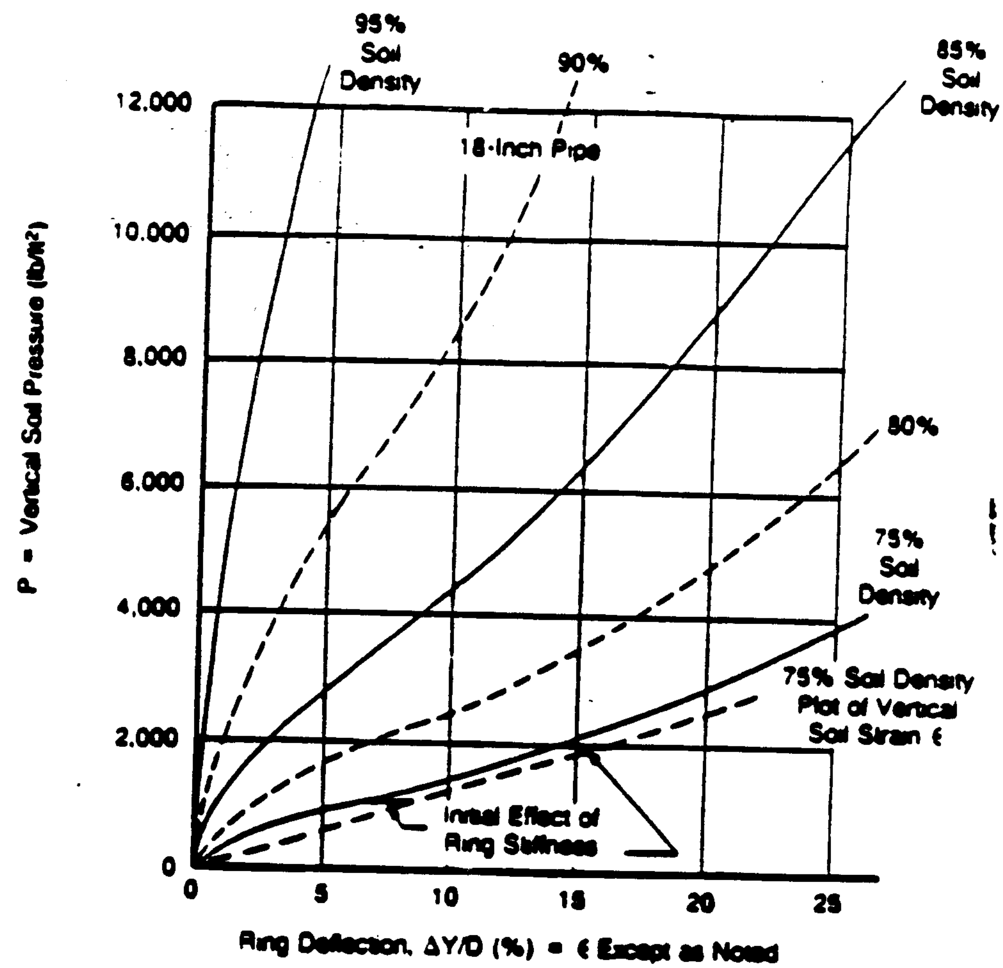
Source: U.S. EPA,1989.

FIGURE 4-9
Required Capacity of Leachate Collection Pipe



Source U.S. EPA, 1989

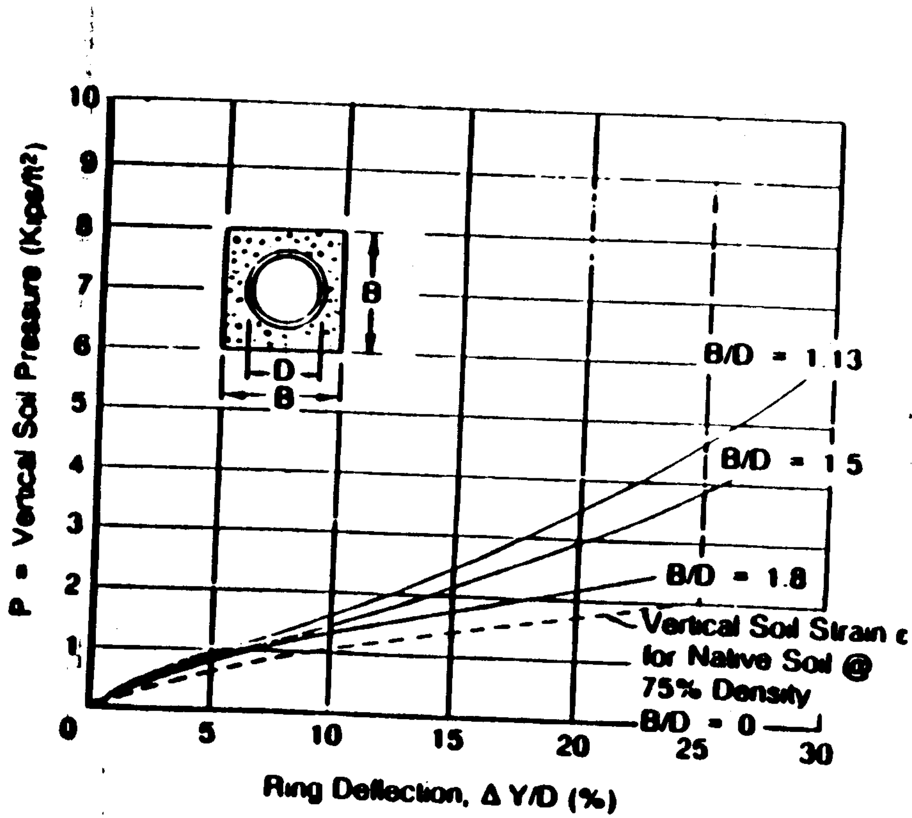
FIGURE 4-10
Leachate Collection P… izing Chart



Source: U.S. EPA, 1988.

FIGURE 4-11

Vertical Ring Deflection Versus Vertical Soil Pressure for 18-inch Corrugated Polyethylene in High Pressure Soil Cell



Source: U.S. EPA, 1989.

FIGURE 4-12

Example of the Effect of Trench Geometry and Pipe Sizing on Ring Deflection

- Type of coatings (if any) used in the pipe manufacturing; and

- Type of pipe bedding material used to support the pipes.

The construction drawings and specifications should clearly indicate the type of bedding to be used under the pipes and the dimensions of any trenches. The specifications should indicate how the pipe lengths are joined. The drawings should show how the pipes are placed with respect to the perforations. To maintain the lowest possible leachate head, there should be perforations near the pipe invert, but not directly at the invert. The pipe invert itself should be solid to allow for efficient pipe flow at low volumes (USEPA, 1988a).

When drainage pipe systems are embedded in filter and drainage layers, no unplugged ends should be allowed. The filter materials in contact with the pipes should be appropriately sized to prevent migration of the material into the pipe. The filter media, drainage layer, and pipe network specified should be compatible and represent an integrated design.

Protection of Leachate Collection Pipes

The long term performance of the LCS is dependent on design to protect pipes from physical clogging (sedimentation) by the granular drainage materials. Use of a graded material or a filter fabric system around the pipes is most effective if accompanied by proper sizing of pipe perforations. The Army Corps of Engineers (GCA Corporation, 1983) has established design criteria, using graded filters, to prevent physical clogging of leachate drainage layers and piping by soil sediment deposits. Clogging of the pipes and drainage layers of the leachate collection system can occur through several other mechanisms, including chemical and biological fouling (USEPA, 1988a). LCS should be designed with cleanout access capable for reaching all parts of the collection system with standard pipe cleaning equipment.

When geotextiles (filter fabrics) are used in place of graded filters, the protective filter may be only about one millimeter in thickness. Holes, tears, or gaps in the fabric should not be accepted in the constructed LCS. Geotextiles wrapped directly around perforated pipe must be carefully designed to protect against long term clogging. Most current designs avoid direct pipe wrapping by the geotextile. Sand or gravel is placed around the pipe, then an envelope of a geotextile filter is placed around the sand or gravel. The advantages to using geotextiles in place of granular filters are uniformity, increase in useable landfill volume, ease of installation, and possibly, cost. Geotextiles are often competitive with graded filters, given the costs of graded aggregate and its installation. One of the most important advantages to geotextiles is quality control during construction. The properties of geotextiles will remain practically constant (independent of construction practices), whereas graded filters can become segregated during placement (USEPA, 1988a).

Chemical clogging can occur when dissolved species in the leachate precipitate in the piping. Clogging can be minimized by periodically flushing pipes or by providing a sufficiently steep slope in the system to allow for high flow velocities for self-cleansing. These velocities are dependent on the diameter of the precipitate particles and on their specific gravity. ASCE (1969) discusses these relationships. Generally, flow velocities should be in the range of one or two feet per second to allow for self-cleansing of the piping (USEPA, 1988a).

Biological clogging due to algae and bacterial growth can be a serious problem in MSWLF landfills. There are no universally effective methods of preventing such biological growth. Since organic materials will be present in the landfill, there will be a potential for biological clogging The system design should include features which allow for pipe system cleanings. The components of the cleaning system should include (USEPA, 1988a):

- A minimum of six-inch diameter pipes to facilitate cleaning;
- Access located at major pipe intersections or bends to allow for inspections and cleaning; and
- Valves, ports, or other appurtenances to introduce biocides and/or cleaning solutions.

In its discussion of drainage layer protection, the following section includes further information concerning protection of pipes using filter layers .

Protection of the High-Permeability Drainage Layer

The openings in drainage materials, whether holes in pipes, voids in gravel, or apertures in geonets, must be protected against clogging by accumulation of fine (silt-sized) materials. An intermediate material, between the waste and drainage layer, having smaller openings than those of the drainage material, can be used as filter. Sand may be used as filter material, but has the disadvantage of taking up vertical space (USEPA, 1989a).

The use of geotextiles as filters avoids these problems. The open spaces in the fabric allow liquid flow while simultaneously preventing upstream fine particles from fouling the drain. Geotextiles save vertical space, are easy to install, and have the added advantage of remaining stationary under load. As with sand filters, however, clogging can occur. Geotextiles also can be used as cushioning materials above and/or below geomembranes (USEPA, 1989a).

Soil Filter Layers

There are three parts to an analysis of a sand filter that will be placed above drainage material. The first determines whether or not the filter allows adequate flow of liquids through it. The second evaluates whether the void spaces are small enough to prevent solids from being lost from the upstream materials. The third part estimates the long-term clogging behavior of the filter (USEPA, 1989a).

The particle-size distribution of the drainage system and the particle-size distribution of the invading (or upstream) soils are required in the design of granular soil (sand filter) materials. The filter material should have its large and small size particles intermediate between the two extremes. Relationships for adequate flow and retention are:

- Adequate Flow:
  $d_{85f} > (3 \text{ to } 5) d_{15d.s.}$

- Adequate Retention:
  $d_{15f} < (3 \text{ to } 5) d_{85w.f.}$

There are no quantitative methods to assess soil filter clogging, although empirical guidelines are found in geotechnical engineering references.

The specifications for granular filter layers surrounding perforated pipes and protecting the drainage layer from clogging are based on a well-defined particle size distribution. The orientation and configuration of filter layers relative to other LCS components should be shown on all drawings and described, with ranges of particle sizes, in the materials section of the specifications (USEPA, 1988a).

Thickness is an important placement criterion for granular filter material. Generally, the granular filter materials will be placed around perforated pipes by hand, forming an "envelope." The dimensions of the envelope should be clearly stated on the drawings or in the specifications. This envelope can be placed at the same time as the granular drainage layer, but it is important that the filter envelope protect all areas of the pipe where the clogging potential exists. The plans and specifications should indicate the extent of the envelope. The construction quality control program should document that the envelope was installed according to the plans and specifications (USEPA, 1988a).

A granular filter layer is generally placed using the same earthmoving equipment as the granular drainage layer. The final thickness should be checked by optical survey or direct test pit measurement (USEPA, 1988a).

This filter layer is the uppermost layer in the leachate collection system. A landfill design option includes a buffer layer, 12 inches thick (30 cm) or more, to protect the filter layer and drainage layer from damage due to traffic. This final layer can be general fill, as long as it is no finer than the soil used in the filter layer (USEPA, 1988a). However, if the layer has a low permeability, it will affect leachate recirculation attempts.

Geotextile Filter Layers --

Geotextile filter design parallels sand filter design with some modifications (USEPA, 1989a). Adequate flow is assessed by comparing the material (allowable) permittivity to the design imposed permittivity. Permittivity is measured by ASTM D-4491 test method. The design permittivity utilizes an adapted form of

Darcy's law. The resulting comparison yields a design ratio, or factor of safety, that is the focus of the design (USEPA, 1989a):

$$DR = \phi_{allow}/\phi_{reqd}$$

where:

ϕ_{allow} = permittivity from ASTM D-4491

$\phi_{reqd} = q/a \frac{1}{h_{max}}$

q/a = inflow rate per unit area

h_{max} = 12 inches

The second part of the geotextile filter design is determining the opening size necessary for retaining the upstream soil or particulates in the leachate. It is well established that the 95% opening size is related to particles to be retained in the following type of relationship (USEPA, 1989a).

$$O_{95} < fct\ (d_{50}, CU, DR)$$

where:

O_{95} = 95% opening size of geotextile

d_{50} = 50% size of upstream particles

CU = Uniformity of the upstream particle size

DR = Relative density of the upstream particles

The O_{95} size of a geotextile in the equation is the opening size at which 5 percent of a given value should be less than the particle size characteristics of the invading materials. In the test for the O_{95} size of the geotextile, a sieve with a very coarse mesh in the bottom is used as a support. The geotextile is placed on top of the mesh and is bonded to the inside so that the glass beads used in the test cannot escape around the edges of the geotextile filter. The particle-size distribution of retained glass beads is compared to the allowable value using any of a number of existing formulas (USEPA, 1989a).

The third consideration in geotextile design is long-term clogging. The test method that may be adopted by ASTM is called the Gradient Ratio Test. In the test, the hydraulic gradient of 1 inch of soil plus the underlying geotextile is compared with the hydraulic gradient of 2 inches of soil. If the gradient ratio is greater than 3, the geotextile will probably clog. An alternative to this procedure is a long-term flow test that is also performed in a laboratory. The test models a soil-to-fabric system at the anticipated hydraulic gradient. The flow rate through the system is monitored. A long-term flow rate will gradually decrease until it stops altogether (USEPA, 1989a).

The primary function of a geotextile is to prevent the migration of fines into the leachate pipes while allowing the passage of leachate. The most important specifications are those of hydraulic conductivity and retention. The hydraulic conductivity of the geotextile generally should be at least ten times the soil it is retaining. An evaluation of the retention ability for loose soils is based on the average particle size of the soil and the apparent opening size (AOS) of the geotextile. The maximum apparent opening size, sometimes called equivalent opening size, is determined by the size of the soil that will be retained; a geotextile is then selected to meet that specification.

The material specifications should contain a range of AOS values for the geotextile, and these AOS values should match those used in the design calculations (USEPA, 1988a).

One of the advantages of geotextiles is their light weight and ease of placement. The geotextiles are brought to the site, unrolled, and held down with sandbags until they are covered with a protective layer. They are often overlapped, not seamed; however, on slopes or in other configurations, they may be sewn (USEPA, 1988a).

As in granular filter layers, it is important that the design drawings be very clear in their designation of geotextile placement so that no potential route of pipe or drainage layer clogging is left unprotected. If geotextiles are used on a slope, they should be secured in an anchor trench similar to those for geomembranes or geonets (USEPA, 1988a).

Leachate Removal System

Low-volume sumps, located in a recess at the low point(s) within the leachate collection drainage layer, provide one mean for leachate removal from the MSWLF unit. In the past, low volume sumps have been constructed successfully from reinforced concrete pipe on a concrete footing and supported above the geomembrane on a steel plate to protect the geomembrane from puncture. More recently, prefabricated polyethylene structures have become available. These structures may be suitable to replace the concrete components of the sump and also have the advantage of a significant reduction in weight.

These sumps typically house a submersible pump which is positioned close to the sump floor to pump the leachate and to maintain a 30 cm (12 in) maximum leachate depth. Low-volume sumps, however, can present operational problems. Since they may run dry frequently, there is an increased probability of the submersible pumps burning out. For this reason, some landfill operators prefer to have sumps placed at depths between 1.0 and 1.5 meters instead of 30 cm, even though the leachate level in a high volume sump will be greater than 30 cm (USEPA, 1989a). Alternatively, the sump may be designed with float valves and a backup pump to control initiation and shut-off of the pumping sequence and to have the capability of alternating between the two pumps. The second pump also may be used in conjunction with the primary pump during periods of high flow (e.g., following storm events) and as a backup if the primary pump fails to function. A visible alarm warning light, to indicate pump failure to the operator, may also be installed.

Pumps used to remove leachate from the sumps should be sized to ensure removal of leachate at the expected rate of generation. These pumps also should have a sufficient operating head to lift the leachate to the required height from the sump to the access port. Portable vacuum pumps can be used. They can be moved in sequence from one leachate sump to another. The type of pump specified and the leachate sump access pipes should be compatible and should consider performance needs under operating and closure conditions. (USEPA, 1988a).

Alternative methods of leachate removal include internal standpipes and pipe penetrations through the geomembrane that allow leachate removal by gravity flow to either a leachate pond or exterior pump station. If a leachate removal standpipe is used, it should be extended through the entire landfill from liner to cover and then through the cover itself. It should be maintained for the entire post-closure care period of 30 years or longer (USEPA, 1989a). If a gravity drainage pipe that requires geomembrane penetration is used, a high degree of care should be exercised in both the design and construction of the penetration. The penetration should be designed and constructed in a manner that allows nondestructive quality control testing of 100 percent of the seal between the pipe and the geomembrane. If not properly constructed and fabricated, geomembrane penetrations can become a source of leakage through the geomembrane.

Other Design Considerations

The stability of the individual leachate collection system components placed on geomembrane covered slopes should be considered. A method for calculating the factor of safety (FS) against sliding for soils placed on a sloped geomembrane surface is provided in Koerner (1990). The method considers the forces acting on the system, including the slope length, the slope angle, and the friction angle between the geomembrane and its cover soil. Generally, the slope angle is known and is specified on the design drawings. A minimum FS is then selected. From the slope angle and the FS, a minimum allowable friction angle is determined, and the various components of the liner system are selected based on this minimum friction angle. If the design evaluation results in an unacceptably low FS, then either the sidewall slope or the materials should be changed to produce an adequate design (USEPA, 1988a). For short slopes in a landfill, the FS can be as low as 1.1 to 1.2 if the slope will be unsupported (i.e., no waste will be filled against it) for only a short time, and if any failures that do occur can be repaired fairly easily. Longer slopes may require higher factors of safety due to the potential of sliding material to tear the geomembrane along the slope or near the toe of slope.

Additional Considerations

The following section discusses quality/assurance and quality control considerations for composite liner and leachate collection system components.

Soil Liner Quality Assurance/Quality Control

A quality assurance/quality control program has two principal components. The first is the Construction Materials Quality Control, which is designed to ascertain that materials used meet specifications. The second component is the Construction Quality Assurance Program, which is designed to ascertain that the constructed facility meets the requirements described in the plans and specifications.

Quality control testing performed on materials used in construction of the landfill includes source testing and construction testing. Source testing defines material properties that govern material placement. Source testing commonly includes moisture content, soil density, Atterberg limits, grain size, and laboratory hydraulic conductivity. Construction testing ensures that landfill construction has been performed in accordance with the plans and technical specifications. Construction testing generally includes soil moisture content, density tests, lift thickness tests, and hydraulic conductivity tests.

The method of determining compliance with the maximum hydraulic conductivity criterion should be specified in the QA/QC plan. Some methods have included use of the criterion as a maximum value that never should be exceeded, while other methods have used statistical techniques to estimate the true mean. The sample collection program should be designed to work with the method compliance determination. Selection of sample collection points should be made on a random basis.

Thin wall sampling tubes generally are used to collect compacted clay samples for laboratory hydraulic conductivity testing. It is important to minimize disturbance of the sample being collected. Tubes pushed into the soil by a backhoe may yield disturbed samples. A recommended procedure for sample collection is to use the backhoe bucket as a stationary support and then push the tube into the clay with a jack positioned between the clay and the tube. The sample hole should be filled with bentonite, or a bentonite clay mixture, and compacted using short lifts of material.

If nuclear methods are used for moisture and density measurements, it is recommended that alternative methods also be used less frequently to verify the accuracy of the faster nuclear methods. Additional information on testing procedures can be found in USEPA (1988b) and USEPA (1990a).

Quality assurance testing for soil liners includes the same testing requirements as specified above for control testing. Generally, the tests are performed less frequently and are performed by an individual or entity independent of the contractor. Activities of the construction quality assurance (CQA) officer are essential to document quality of construction. The CQA officer's responsibilities, and that of the CQA's staff members, may include:

- Communicating with the contractor;
- Interpreting and clarifying project drawings and specifications with the designer, owner, and contractor;
- Recommending acceptance or rejection by the owner/operator of work completed by the construction contractor;
- Submitting blind samples (e.g., duplicates and blanks) for analysis by the contractor's testing staff or one or more independent laboratories, as applicable;
- Notifying owner or operator of construction quality problems not resolve 1-site in a timely manner;

- Observing the testing equipment, personnel, and procedures used by the construction contractor to check for detrimentally significant changes over time;

- Reviewing the construction contractor's quality control recording, maintenance, summary and interpretations of test data for accuracy and appropriateness; and

- Reporting to the owner/operator on monitoring results.

Soil Liner Pilot Construction (Test Fill)

A pilot construction or test fill is a small-scale test pad which can be used to verify that the soil, equipment, and construction procedures can produce a liner that performs according to the construction drawings and specifications. An owner or operator may want to consider the option of constructing a Test Fill prior to construction of the liner. A test pad is useful not only in teaching people how to build a soil liner, it also can function as a construction quality assurance tool. If the variables used to build a test pad that achieves a $1x10^{-7}$ cm/sec hydraulic conductivity are followed exactly, then the completed full size liner should meet the regulatory requirements (U.S. EPA, 1989a). A test fill may be a cost-effective method for the contractor to evaluate the construction methods and borrow source. Specific factors that can be examined/tested during construction of a test fill include (USEPA, 1988b):

- Preparation and compaction of foundation material to the required bearing strength;

- Methods of controlling uniformity of the soil material;

- Compactive effort (e.g., number of passes) to achieve required soil density and hydraulic conductivity;

- Lift thickness and placement procedures to achieve uniformity of density throughout a lift and the absence of apparent boundary effects between lifts or between placements in the same lift;

- Procedures for protecting against desiccation cracking or other site- and season-specific failure mechanisms for the finished liner or intermediate lifts;

- Measuring the hydraulic conductivity on the test fill in the field and collecting samples of field-compacted soil for laboratory testing;

- Test procedures for controlling the quality of construction;

- Ability of different types of soil to meet hydraulic conductivity requirements in the field; and

- Skill and competence of the construction team including equipment operators and quality control specialists.

Geomembrane Quality Assurance/ Quality Control Testing

As in the construction of soil liners, installation of geomembrane liners should be in conformance with a quality assurance/quality control plan. Tests performed to evaluate the integrity of geomembrane seams are generally considered to be either "destructive" or "non-destructive."

Destructive Testing

Quality control testing of geomembranes generally includes peel and shear testing of scrap test weld sections prior to commencing seaming activities and at periodic intervals throughout the day. Additionally, destructive peel and shear field tests are performed on samples from the installed seams.

Quality assurance testing generally requires that an independent laboratory perform peel and shear tests of samples from installed seams. The samples may be collected randomly or in areas of suspect quality. HDPE seams are generally tested at intervals equivalent to one sample per every 300 to 400 feet of installed seam for extrusion welds, and every 500 feet for fusion welded seams. Extrusion seams on HDPE require grinding prior to welding which can greatly diminish parent material strengths if excessive grinding occurs. Detailed discussion of polyethylene welding protocol can be found in USEPA (1989b). For dual hot wedge seams in HDPE, both the inner and outer seam may be subjected to destructive shear tests at the independent laboratory. Destructive samples of installed seam welds are generally cut into several pieces and distributed for the following purposes to:

- The installer to perform construction quality control field testing;
- The owner/operator to retain and appropriately catalog or archive; and
- An independent laboratory for peel and shear testing.

If the test results for a seam sample do not pass the acceptance/rejection criteria, then samples are cut from the same field seam on both sides of the rejected sample location. Samples are collected and tested until the areal limits of the low quality seam are defined. Corrective measures are necessary to repair the length of seam that has not passed the acceptance/rejection criteria. In many cases, this involves seaming a cap over the length of the rejected seam or reseaming the affected area (USEPA, 1988a). In situations where the seaming crews continually fail testing, they may have to be retrained.

Non-destructive Testing

Non-destructive test methods are conducted in the field on an in-place geomembrane. These test methods determine the integrity of the geomembrane field seams. Non-destructive test methods include the probe test, air lance, vacuum box, ultrasonic pulse echo, ultrasonic impedance plane, electrical spark test, pressurized dual seam, electrical resistivity, and hydrostatic tests. Detailed discussion of these test methods may be found in USEPA (1989b). Seam sections that fail appropriate, non-destructive tests must be carefully delineated, patched or reseamed, and retested. Large patches or reseamed areas should be subjected to destructive test procedures for quality assurance purposes. The specifications should clearly describe the degree to which non-destructive and destructive test methods will be used in evaluating failed portions of non-destructive seam tests.

Geomembrane Construction Quality Assurance Activities

The responsibilities of the construction quality assurance (CQA) personnel for the installation of the geomembrane are generally the same as the responsibilities for the construction of a soil liner with the following additions:

- Observation of liner storage area and liners in storage, and handling of the liner as the panels are positioned in the cell;
- Observation of seam overlap, seam preparation prior to seaming, and material underlying the liner;
- Observation of destructive testing conducted on scrap test welds prior to seaming;
- Observation of destructive seam sampling, submission of the samples to an independent testing laboratory, and review of results for conformance to specifications;
- Observation of all seams and panels for defects due to manufacturing and/or handling and placement;
- Observation of all pipe penetration boots and welds in the liner;
- Preparation of reports indicating sampling conducted and sampling results, locations of destructive samples, locations of patches, locations of seams constructed, and any problems encountered; and,
- Preparation of record drawings of the liner installation, in some cases.

The last responsibility is frequently assigned to the contractor, the owner's representative, or the engineer.

Leachate Collection System Construction Quality Assurance

The purpose of leachate collection system CQA is to document that the system construction is in accordance with the design specifications. Prior to construction, all materials should be inspected to confirm that they meet the construction plans and specifications. These include (USEPA, 1988a):

- Geonets;
- Geotextiles;
- Pipe size, materials, and perforations;
- Granular material gradation and prefabricated structures (sumps, manholes, etc.);
- Mechanical, electrical, and monitoring equipment; and
- Concrete forms and reinforcement.

The leachate collection system foundation (geomembrane or low permeability soil liner) should be inspected and surveyed upon its completion to ensure that it has proper grading and is free of debris and liquids (USEPA, 1988a).

During construction, the following activities, as appropriate, should be observed and documented (USEPA, 1988a):

- Pipe bedding placement including quality, thickness, and areal coverage;
- Granular filter layer placement including material quality and thickness;
- Pipe installation including location, configuration, grades, joints, filter layer placement, and final flushing;
- Granular drainage layer placement including protection of underlying liners, thickness, overlap with filter fabrics and geonets if applicable, and weather conditions;
- Geonet placement including layout, overlap, and protection from clogging by granular material carried by wind or runoff during construction;
- Geotextile/geofabric placement including coverage and overlap;
- Sumps and structure installation; and
- Mechanical and electrical equipment installation including testing.

In addition to field observations, actual field and laboratory testing may be performed to document that the materials meet the design specifications. These activities should be documented and should include the following (USEPA, 1988a):

- Geonet and geotextile sampling and testing;
- Granular drainage and filter layer sampling and testing for grain size distribution; and
- Testing of pipes for leaks, obstructions, and alignments.

Upon completion of construction, each component should be inspected to identify any damage that may have occurred during its installation, or during construction of another component (e.g., pipe crushing during placement of granular drainage layer). Any damage that does occur should be repaired, and these corrective measures should be documented in the CQA records (USEPA, 1988a).

4.4 RELEVANT POINT OF COMPLIANCE 40 CFR §258.40(d)

4.4.1 Statement of Regulation

(d) The relevant point of compliance specified by the Director of an approved State shall be no more than 150 meters from the waste management unit boundary and shall be located on land

owned by the owner of the MSWLF unit. In determining the relevant point of compliance, the State Director shall consider at least the following factors:

(1) The hydrogeologic characteristics of the facility and surrounding land;

(2) The volume and physical and chemical characteristics of the leachate;

(3) The quantity, quality, and direction of flow of ground water;

(4) The proximity and withdrawal rate of the ground-water users;

(5) The availability of alternative drinking water supplies;

(6) The existing quality of the ground water, including other sources of contamination and their cumulative impacts on the ground water and whether the ground water is currently used or reasonably expected to be used for drinking water;

(7) Public health, safety, and welfare effects; and

(8) Practicable capability of the owner or operator.

4.4.2 Applicability

The provision for a relevant point of compliance is to assist an owner or operator in designing and monitoring the effectiveness of a alternate liner design under §258.40(a)(1). The owner or operator of a MSWLF in an approved State can locate the relevant point of compliance a maximum of 150 meters from the waste management unit boundary. The proposed location must be on property owned by the MSWLF unit owner or operator.

In unapproved States, the waste management unit boundary is the relevant point of compliance. The waste management unit boundary is defined as the vertical surface located at the hydraulically downgradient limit of the unit. This vertical surface extends down into and through the entire thickness of the uppermost aquifer.

4.4.3 Technical Considerations

The Director should consider at least eight factors in establishing the alternative boundary. The factors provide information needed to determine if the alternative boundary is sufficiently protective of human health and the environment and if the relevant point of compliance is adequate to measure the performance of the disposal unit.

Site Hydrogeology

The first factor to be considered when determining the relevant point of compliance is site hydrogeology. Known characteristics of site hydrogeology can be identified to determine what other information may need to be collected to set the relevant point of compliance. The site data should be sufficient to determine both the well and the lateral spacing required to detect leakage to the uppermost aquifer. This information should be sufficient to estimate the width and depth of a plume that may migrate from the MSWLF unit. The assessment of the fate and transport of constituents from the landfill was discussed previously in Section 4.2. Hydrogeologic information required for a site is presented in greater detail in Section 5.6.3.

Leachate Volume and Physical Characteristics

Leachate volume and quality are needed to make a determination of the "detectability" of leakage from the facility at the relevant point of compliance. The net concentration at any given point during the transport of solutes and immiscible liquids from the unit by ground water is a function of constituent type, initial constituent concentration and leakage rate. The assessment of fate and transport was discussed in Section 4.3. Leachate volume assessment was discussed in Sections 4.2 and 4.3.

Quality, Quantity and Direction of Groundwater Flow

The hydrogeologic data collected should provide information to assess the flow direction and the volume of flow. Background ground-water quality data should be used to determine baseline concentrations of the monitoring constituents. This information will be required as input to determine whether contaminants from the landfill will be detectable at the proposed relevant point of compliance.

Groundwater Users

The goal of the relevant point of compliance is to ensure early detection of contamination of the uppermost aquifer. The distance also should allow sufficient time for corrective measures to be implemented prior to the spread of contamination to private or public water supply wells. The Director of an approved State should consider the practicable capability of the owner or operator of the unit to respond to a problem that might cause public or environmental harm.

Existing users of ground-water immediately downgradient from the facility should be identified on a map. Users located within a distance where constituents might be expected to migrate during the active life and post-closure care period of the facility should be identified.

Alternative Drinking Water Supplies

The State Director should consider the availability of alternate drinking water supplies in the event of a ground-water contamination problem. If the uppermost aquifer is the sole water supply source available, all reasonable efforts should be made to locate the relevant point of compliance as close as possible to the actual waste management unit boundary.

Existing Ground-Water Quality

The existing ground-water quality, both upgradient and downgradient of the MSWLF, should be determined prior to establishing the relevant point of compliance.

The resource value of groundwater should be considered when determining landfill design, groundwater monitoring, and corrective action requirements. The rule allows approved States to approve less stringent landfill designs based on the ground-water quality, in conjunction with other factors. The performance standard for landfill design requires that landfills be designed to meet drinking water standards at a relevant point of compliance. Points for approved States to consider are whether the ground-water is currently used, or reasonably expected to be used, as a drinking water source when setting a relevant point of compliance. If the ground-water is not reasonably expected to be used for drinking water, the State may wish to establish the relevant point of compliance farther from the landfill and as a result, employ a less stringent landfill design. To assess potential effects for both the relevant point of compliance and down-gradient ground-water, the Director should consider all aspects of ground-water quality.

Public Health, Welfare, Safety

The Director will consider the potential overall effect on public health, welfare, and safety of the proposed relevant point of compliance. Consideration should include:

- Distance to the nearest ground-water user or potentially affected surface water;
- The response time (in relation to the proposed relevant point of compliance) required to identify and remediate or otherwise contain ground-water that may become impacted and potentially affect downgradient water supplies; and
- Risk that detection may not be representative of worst case condition of the ground water.

Practicable Capability of the Owner or Operator

As the location of the relevant point of compliance moves farther from the waste management unit boundary, the volume of water requiring treatment should the ground-water be contaminated, will increase. One or more of the following conditions that could affect the owner's or operator's practicable capability (technical and financial) to resolve the problem may be:

- Increased area of impact, increasing remedial costs, scope of remedial investigation, and site characterization;
- Increased response time due to higher costs and increased technical scope of selected remedial method;
- A reduction of treatment technologies removal efficiency ; and
- Increased difficulty in ground water extraction or containment if these technologies are chosen.

The Director may require some indication of financial capability of the owner or operator to maintain a longer and more costly remedial program due to the longer detection time frame associated with a relevant point of compliance located away from the waste management unit boundary. Additional information on remedial actions for ground water is provided in the guidance for Subpart E.

4.5 PETITION PROCESS
40 CFR §258.40(e)

4.5.1 Statement of Regulation

(e) If EPA does not promulgate a rule establishing the procedures and requirements for State compliance with RCRA Section 4005(c)(1)(B) by October 9, 1993, owners and operators in unapproved States may utilize a design meeting the performance standard in §258.40(a)(1) if the following conditions are met:

(1) The State determines the design meets the performance standard in §258.40(a)(1);

(2) The State petitions EPA to review its determination; and

(3) EPA approves the State determination or does not disapprove the determination within 30 days.

[Note to Subpart D: 40 CFR Part 239 is reserved to establish the procedures and requirements for State compliance with RCRA Section 4005(c)(1)(B).]

4.5.1 Applicability

If EPA does not promulgate procedures and requirements for state approval by October 9, 1993, owners and operators of MSWLFs located in unapproved States may use an alternative design under certain circumstances.

Owners or operators of MSWLF units should contact the municipal solid waste regulatory department in their state to determine if their state is approved by the USEPA.

4.6 FURTHER INFORMATION

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5.0
SUBPART E
GROUND-WATER MONITORING AND CORRECTIVE ACTION

5.1 INTRODUCTION

The Criteria establish ground-water monitoring and corrective action requirements for all existing and new MSWLFs except where the Director of an approved State suspends the requirements because there is no potential for migration of leachate constituents from the facility. The Criteria include requirements for location, design, and installation of ground-water monitoring systems and set standards for ground-water sampling and analysis. Furthermore, specific statistical methods and decision criteria are provided for identifying a significant change in ground-water quality. If a significant change in ground-water quality occurs, the Criteria require an assessment of the nature and extent of contamination followed by an evaluation and implementation of remedial measures. The ground-water monitoring and corrective action requirements are discussed in the sections that follow.

5.2 APPLICABILITY
40 CFR §258.50 (a) & (b)

5.2.1 Statement of Regulation

(a) The requirements in this Part apply to MSWLF units, except as provided in paragraph (b) of this section.

(b) Ground-water monitoring requirements under §258.51 through §258.55 of this Part may be suspended by the Director of an approved State for a MSWLF unit if the owner or operator can demonstrate that there is no potential for migration of hazardous constituents from that MSWLF unit to the uppermost aquifer (as defined in §258.2) during the active life of the unit and the post-closure care period. This demonstration must be certified by a qualified ground-water scientist and approved by the Director of an approved State, and must be based upon:

(1) Site-specific field collected measurements, sampling, and analysis of physical, chemical, and biological processes affecting contaminant fate and transport, and

(2) Contaminant fate and transport predictions that maximize contaminant migration and consider impacts on human health and environment.

5.2.2 Applicability

The ground-water monitoring requirements are applicable to all existing MSWLFs, lateral expansions, and new MSWLFs that receive waste after October 9, 1993. The requirements for ground-water monitoring may be suspended, provided the owner or operator can successfully demonstrate either:

1) That the MSWLF unit qualifies for the exemption for small landfills under 40 CFR §258.1 (f); or

2) That no potential exists for migration of hazardous constituents from the MSWLF unit to the uppermost aquifer during the active life of the unit, including closure or post-closure periods.

The no-migration demonstration must be based upon site specific information relevant to the fate and transport of any hazardous constituents which may be expected to be released from the unit. The predictions of fate and transport must identify the maximum anticipated concentrations of constituents migrating to ground water so that a protective assessment of potential effects to human health and the environment can be made. The demonstration would exempt the MSWLF unit from requirements of §§258.51 through 258.55 which include installation of ground-water monitoring systems, and sampling and analysis for both detection and assessment monitoring constituents.

5.2.3 Technical Considerations

All MSWLF units that receive waste after the effective date of Part 258 must comply with the ground-water monitoring requirements. There are two exemptions from the requirements:

1) The small landfill exemption (see Section A); or

2) The "no potential for migration" exemption.

Small Landfill Exemption

Technical considerations for determining the applicability of the small landfill exemption is presented in Chapter 1.0 (Subpart A) of this document.

Exemption from Ground-water Monitoring Requirements

For MSWLFs that do not qualify for the small landfill exemption, a suspension of the ground-water monitoring requirements of 40 CFR §258.51 through §258.55 is available only in approved States. To receive this exemption, the owner or operator must demonstrate that there is no potential for hazardous constituent migration to the uppermost aquifer throughout the operating, closure, and post-closure periods of the unit. The demonstration must be certified by a qualified ground-water scientist and be based on site-specific field measurements and sampling and analyses of the physical, chemical, and biological processes affecting hazardous constituent fate and transport. The demonstration must be supported by site-specific data and predictions that maximize contaminant migration. Site-specific information must include at a minimum, information relevant to evaluate or interpret the influence of the following processes which may affect contaminant transport:

Physical Processes:

- Aquifer Characteristics including hydraulic conductivities, hydraulic gradients, effective porosity, aquifer thickness, identification of saturated and unsaturated conditions, stratigraphy, degree of fracturing and secondary porosity of soils and bedrock, spatial variability of aquifer parameters, ground-water discharge and ground-water recharge areas;

- Waste Characteristics including quantity, type, and origin (e.g., commercial, industrial, small quantity generators of unregulated hazardous wastes);

- Climatic Conditions including annual precipitation, leachate generation estimates, and effects on leachate quality;

- Leachate Characteristics including leachate composition, density, the presence of immiscible constituents, Eh, and pH;

- Engineered Controls including liners, cover systems, and aquifer alterations (e.g., lowering water table) may be evaluated under design and failure conditions to estimate long-term residual performance and any resulting enhancement of natural conditions.

Chemical Processes:

- Attenuation of contaminants in the subsurface including adsorption/desorption reactions, ion exchange, (organic content of soil and soil water pH), and consideration of possible reactions causing chemical transformation or chelation;

Biological Processes:

- Microbiological Degradation which may attenuate target compounds or cause transformations of compounds during substrate utilization, forming more toxic chemical species.

The rule was written for owners or operators who do not qualify for the small community exemption. A discussion on these and other processes which affect contaminant fate and solute transport is presented in the alternative design section of Chapter 5.0.

When owners or operators prepare a "no-migration" demonstration they must use predictions that maximize contaminant migration both from the unit and through the subsurface media. Assumptions about variables affecting transport should be biased toward over-estimating transport and anticipated concentrations. On the whole, such biased assumptions should be consistent with known site conditions and should represent a realistic condition. Assumptions and site specific data that are used in the fate and transport predictions should conform with transport principles and processes including adherence to mass-balance and chemical equilibria limitations. Within these physicochemical limitations, assumptions should be biased toward the objective of assessing the maximum potential impact on human health and the environment. Evaluation of site-specific data and assumptions to consider may include some of the following approaches:

- Use of the upper bound of known aquifer parameters and conditions which will maximize contaminant transport (e.g., hydraulic conductivity, effective porosity, horizontal and vertical gradients) rather than average values;

- Use of the lower range of known aquifer conditions and parameters which tend to attenuate or retard contaminant transport (e.g., dispersivities, decay coefficients, cation exchange capacities, organic carbon contents, and recharge conditions) rather than average values; and

- Consideration of cumulative impacts to water quality including both existing water quality data and cumulative health risks posed by hazardous constituents likely to migrate from the MSWLF unit and other potential or known sources.

Guidance on selection and use of mathematical approaches for evaluating contaminant or solute transport is provided in Chapter 5.0 under discussion of alternative design and relevant point of compliance assessment.

5.3 COMPLIANCE SCHEDULE 40 CFR § 258.50 (c)

5.3.1 Statement of Regulation

(c) Owners and operators of MSWLF units must comply with the ground-water monitoring requirements of this part according to the following schedule unless an alternative schedule is specified under paragraph (d):

(1) Existing MSWLF units and lateral expansions less than one mile from a drinking water intake (surface or subsurface) must be in compliance with the ground-water monitoring requirements specified in §§258.51 - 258.55 by October 9, 1994;

(2) Existing MSWLF units and lateral expansions greater than one mile but less than two miles from a drinking water intake (surface or subsurface) must be in compliance with the ground-water monitoring requirements specified in §§258.51 - 258.55 by October 9, 1995;

(3) Existing MSWLF units and lateral expansions greater than two miles from a drinking water intake (surface or subsurface) must be in compliance with the ground-water monitoring requirements specified in §§258.51 - 258.55 by October 9, 1996.

(4) New MSWLF units must be in compliance with the ground-water monitoring requirements specified in §§258.51 - 258.55 before waste can be placed in the unit.

5.3.2 Applicability

The rule establishes a self-implementing schedule for owners or operators in unapproved States. This schedule is dependent on the distance of the MSWLF unit from drinking water sources. Being in compliance with this schedule requires that an appropriate number of monitoring wells have been installed at proper locations (§258.51) and the detection monitoring program has been initiated (§§258.53 and 258.54) prior to the specified deadlines. Approved States may specify an alternative schedule under §258.50 (d) which is discussed in Section 5.4.

Existing units and lateral expansions less than one mile from a drinking water intake must be in compliance with the ground-water monitoring requirements by October 9, 1994. If the units are greater than one mile but less than two miles from a drinking water intake they must be in compliance by October 9, 1995. Those units located more than two miles from a drinking water intake must be in compliance by October 9, 1996. A drinking water intake includes water supplied to a user from either a surface water or ground-water source.

New MSWLF units, defined as units that have not received waste prior to October 9, 1993, must be in compliance with these requirements before receiving waste regardless of the proximity to a water supply intake.

5.3.3 Technical Considerations

For most facilities, these requirements will become applicable three to five years after the effective date of the rule. This period should provide sufficient time for the owner or operator to conduct site investigation and characterization studies to comply with the requirements of 40 CFR §258.51 through §258.55. For those facilities closest to drinking water intakes, the period provides two to three years to collect ground-water quality information to assess seasonal variations. This period should be sufficient to establish a database on which to evaluate seasonal variations for most sites except for those where the ground-water flow rate is very slow.

5.4 ALTERNATIVE COMPLIANCE SCHEDULES 40 CFR 258.50 (d)(e) & (g)

5.4.1 Statement of Regulation

(d) The Director of an approved State may specify an alternative schedule for the owners or operators of existing MSWLF units and lateral expansions to comply with the ground-water monitoring requirements specified in §§258.51 - 258.55. This schedule must ensure that 50 percent of all existing MSWLF units are in compliance by October 9, 1994 and all existing MSWLF units are in compliance by October 9, 1996. In setting the compliance schedule, the Director of an approved State must consider potential risks posed by the unit to human health and the environment. The following factors should be considered in determining potential risk:

(1) Proximity of human and environmental receptors;

(2) Design of the MSWLF unit;

(3) Age of the MSWLF unit;

(4) The size of the MSWLF unit;

(5) Types and quantities of wastes disposed, including sewage sludge; and

(6) Resource value of the underlying aquifer, including:

(i) Current and future uses;

(ii) Proximity and withdrawal rate of users; and

(iii) Ground-water quality and quantity.

(e) Once established at a MSWLF unit, ground-water monitoring shall be conducted throughout the active life and post-closure care period of that MSWLF unit as specified in §258.61.

(f) (See Section 5.5 for technical guidance on qualifications of a ground-water scientist.)

(g) The Director of an approved State may establish alternative schedules for demonstrating compliance with §258.51(d)(2), pertaining to notification of placement of certification in operating record; § 258.54(c)(1), pertaining to notification that statistically significant increase (SSI) notice is in operating record; § 258.54(c)(2) and (3), pertaining to an assessment monitoring program; § 258.55(b), pertaining to sampling and analyzing Appendix II constituents; §258.55(d)(1), pertaining to placement of notice (Appendix II constituents detected) in record and notification of notice in record; § 258.55(d)(2), pertaining to sampling for Appendix I and II; , § 258.55(g), pertaining to notification (and placement of notice in record) of SSI above ground-water protection standard; § 258.55(g)(1)(iv) and § 258.56(a), pertaining to assessment of corrective measures; § 258.57(a), pertaining to selection of remedy and notification of placement in record; § 258.58(c)(4), pertaining to notification of placement in record (alternative corrective action measures); and § 258.58(f), pertaining to notification of placement in record (certification of remedy completed).

5.4.2 Applicability

Alternative schedules for compliance with the ground-water monitoring requirements apply to existing units and lateral expansions in approved States only. An alternate schedule may be granted by the Director of an approved State. To grant alternative monitoring compliance schedules, the Director of an approved State must evaluate site-specific information on a case-by-case basis. Each case should be evaluated relative to other sites to ensure that fifty percent of all existing MSWLF units are in compliance by October 9, 1994 and that all units are in compliance by October 9, 1996.

Site-specific information, that the owner or operator must submit to the Director of an approved State for consideration, will be used to assess the relative risks posed by different waste management units and w[illegible] allow priorities to be developed at the State level. This site-specific information should enable the Director to assess potential risk (proximity to receptors, proximity and withdrawal rate of ground-water users, waste quantity, type, containment design and age) to the uppermost aquifer. The resource value of the aquifer to be monitored (ground-water quality and quantity, present and future uses, and withdrawal rate of ground-water users) must also be considered. The level of use of a particular aquifer (e.g., public water supply well fields versus single family domestic users) may influence the rate and direction of flow within the aquifer.

Once ground-water monitoring has been initiated, it must continue throughout the active life, closure, and post-closure care periods. The post-closure period may last up to thirty years or more after the MSWLF unit has received final cover.

In addition to establishing alternative schedules for compliance with ground-water monitoring requirements, the Director may also establish alternative schedules for certain sampling and analysis requirements of §§258.54 and 258.55, as well as corrective action requirements of §§258.56, 258.57, and 258.58.

5.4.3 Technical Considerations

The rule allows approved States flexibility in establishing alternate schedules. In setting an alternative schedule, the State will consider potential impacts to human health and the environment. Additionally, the flexibility will allow the State to establish lower priorities for small communities. Approved States have the option to address immediately MSWLFs that have environmental problems.

To establish alternative schedules for initiating ground-water monitoring at existing MSWLF units, the Director may consider information summarizing the age and design of existing facilities. The environmental performance of these facilities may also be dependent upon the rock and soil types underlying the landfill units. Based on design and age, in conjunction with a knowledge of the wastes disposed, the Director should be able to qualitatively assess or rank facilities based on their risk to local ground-water resources. Due to possible limitations in regional availability of engineering and scientific professionals, and companies specializing in well installation, some areas in the country may not have adequate resources to perform the site investigations necessary to install wells at all MSWLF locations within the compliance schedule. The Director, therefore, may approve alternative schedules for some facilities so long as all existing facilities are in compliance within five years from the publication date of Part 258.

5.5 QUALIFICATIONS 40 CFR 258.50 (f)

5.5.1 Statement of Regulation

(f) For the purposes of this Subpart, a <u>qualified ground-water scientist</u> is a scientist or engineer who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in ground-water hydrology and related fields

Compliance Schedule for Existing Units and Lateral Expansions

Distance From Water Supply Intake	Time to Comply From October 9, 1993
One mile or less	3 Years
More than one mile but less than two miles	4 Years
More than two miles	5 Years

Summary of Notification Requirements

Section	Description
§258.51(d)(2)	14 day notification period after well installation certification by GWS*
§258.54(c)(1)	14 day notification period after finding of statistical increase from background of detection parameter(s)
§258.54(c)(2)	90 day period for implementing assessment monitoring after finding of statistical increase (see above)
§258.55(d)(1)	14 day notification period after detection of Appendix II constituents
§258.56(a)	90 day period to initiate corrective measures assessment after finding of exceedance of Appendix II GSPS**
§258.57(a)	14 day notification period after selection of corrective measures
§258.58(c)(4)	14 day notification period prior to implementing alternative measures
§258.58(f)	14 day notification period after remedy has been completed and certified by GWS

as may be demonstrated by State registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgements regarding ground-water monitoring, contaminant fate and transport, and corrective action.

5.5.2 Applicability

The qualifications of a ground-water scientist are defined to ensure that professionals of appropriate capability and judgement are consulted when required by the Criteria. The ground-water scientist must possess the fundamental education and experience necessary to evaluate ground-water flow, ground-water monitoring systems, and ground-water monitoring techniques and methods. A ground-water scientist must understand and be able to apply methods to solve solute transport problems and evaluate ground-water remedial technologies. Education may include undergraduate or graduate studies in hydrogeology, ground-water hydrology, engineering hydrology, water resource engineering, geotechnical engineering, geology, ground-water modeling/ground-water computer modeling, and other aspects of the natural sciences. The individual's education must be through an institution and need not be supported by other outside certifications unless required at the State level. Some States may have certification programs for ground-water scientists, however, there are none nationally recognized.

5.5.3 Technical Considerations

A qualified ground-water scientist must certify work performed pursuant to the following provisions of the ground-water monitoring and corrective action requirements:

- No potential for migration demonstration (§258.50(b));
- Number, spacing, and depths of monitoring systems (§258.51(d));
- Determination that contamination was caused by another source or that statistically significant increase resulted from an error in sampling, analysis, or evaluation (§§258.54 (c)(3) and 258.55 (g)(2));
- Determination that compliance with a remedy requirement is not technically practicable (§258.58(c)(1)); and
- Completion of remedy (§258.58(f)).

Certifications are required in both approved and unapproved states. In the case of unapproved states, the owner or operator must determine that the professional qualifications of the ground-water specialist are in accordance with the regulatory definition. In general, a certification is a signed document which transmits some finding (e.g., that

Certifications by ground-water scientists are required for the following five provisions of the ground-water monitoring and corrective action requirements:

Provision	Section
1) No potential migration demonstration	§258.50(b)
2) Number, depth and spacing of monitoring system	§258.51(d)
3) Determination that contamination which led to a statistical increase in detection monitoring was caused by error or another source	§258.54(c) §258.55(g)(2)
4) Determination that compliance cannot be achieved	§258.58(c)(1)
5) Completion of a remedy	§258.58(f)

monitoring wells were installed according to acceptable practices and standards at locations and depths appropriate for a given facility). The certification must be placed in the operating records of the facility and the State Director must be notified that the demonstration has been made. Specific details of these certifications will be addressed in the order in which they appear in this guidance document.

Most State environmental regulatory agencies have ground-water scientists on staff. The owner or operator of a MSWLF is not necessarily required to obtain certification from an independent (e.g., consulting) ground-water scientist and may, if agreed to by the Director in an approved State, obtain approval by the Director in lieu of certification by an outside individual.

5.6 GROUND-WATER MONITORING SYSTEMS 40 CFR §258.51 (a)(b)(d)

5.6.1 Statement of Regulation

(a) A ground-water monitoring system must be installed that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield ground-water samples from the uppermost aquifer (as defined in §258.2) that:

(1) Represent the quality of background ground water that has not been affected by leakage from a unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the waste management area where:

(i) Hydrogeologic conditions do not allow the owner operator to determine what wells are hydraulically upgradient; or

(ii) Sampling at other wells will provide an indication of background ground water quality that is as representative or more representative than that provided by the upgradient wells; and

(2) Represent the quality of ground water passing the relevant point of compliance specified by the Director of an approved State under §258.40(d) or at the waste management unit boundary in unapproved States. The downgradient monitoring system must be installed at the relevant point of compliance specified by the Director of an approved State under §258.40(d) or at the waste management unit boundary in unapproved states that ensure detection of ground-water contamination in the uppermost aquifer. When physical obstacles preclude installation of ground-water monitoring wells at the relevant point of compliance at existing units, the down-gradient monitoring system may be installed at the closest practicable distance hydraulically down-gradient from the relevant point of compliance or specified by the Director of an approved State under §258.40 that ensure detection of ground-water contamination in the uppermost aquifer.

(b) The Director of an approved State may approve a multi-unit ground-water monitoring system instead of separate ground-water monitoring systems for each MSWLF unit when the facility has several units, provided the multi-unit ground-water monitoring system meets the requirement of §258.51(a) and will be as protective of human health and the environment as individual monitoring systems for each MSWLF unit, based on the following factors:

(1) Number, spacing, and orientation of the MSWLF units;

(2) Hydrogeologic setting;

(3) Site history;

(4) Engineering design of the MSWLF units; and

(5) Type of waste accepted at the MSWLF units.

(c) (See Section 5.7 for technical guidance on monitoring well design and construction.)

(d) The number, spacing, and depths of monitoring systems shall be:

(1) Determined based upon site-specific technical information that must include thorough characterization of:

(i) Aquifer thickness, ground-water flow rate, ground-water flow direction including seasonal and temporal fluctuations in ground-water flow; and

(ii) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the

uppermost aquifer; including, but not limited to: thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

(2) Certified by a qualified ground-water scientist or approved by the Director of an approved State. Within 14 days of this certification, the owner or operator must notify the State Director that the certification has been placed in the operating record.

5.6.2 Applicability

The requirements for establishing a ground-water monitoring system pursuant to §258.51 are applicable to all new facilities, existing facilities, and lateral expansions of existing facilities according to the schedules identified in 40 CFR §258.50. A ground-water monitoring system consists of monitoring wells located both hydraulically upgradient and downgradient of the MSWLF unit. The wells must be installed to provide representative ground-water samples from the uppermost aquifer. The ground-water monitoring network must be capable of characterizing changes in the quality of ground-water passing the relevant point of compliance. A sufficient number of monitoring wells must be located downgradient of the unit and be screened at depths in the uppermost aquifer to ensure contaminant detection. Generally, upgradient wells are used to determine background ground-water quality.

The downgradient wells must be located at the relevant point of compliance specified by the Director of an approved State, or at the waste management unit boundary in unapproved States. If existing physical structures obstruct well placement, the downgradient monitoring system should be placed as close to that boundary as possible. The use of an alternative boundary for the point of compliance is discussed in Chapter 4.0. Wells located at the relevant point of compliance must be capable of detecting contamination in the uppermost aquifer.

In approved States, each individual waste management unit is not required to have a separate ground-water monitoring system. A multi-unit ground-water monitoring system may be installed at the facility as long as the number and depths of wells are appropriate for the site conditions. MSWLF units in unapproved States must have a monitoring system for each unit.

A qualified ground-water scientist must certify that the number, spacing, and depths of the monitoring wells are appropriate for the MSWLF. This certification must be placed in the operating record. The State Director must be notified within 14 days that the certification was placed in the operating record.

5.6.3 Technical Considerations

The objective of a ground-water monitoring system is to maximize the likelihood of intercepting ground water that has been contaminated by leachate from the MSWLF. Early contaminant detection is important to allow sufficient time for a remedial response measure to be developed and implemented before sensitive receptors are significantly affected. To accomplish this objective, the monitoring wells should be located to sample ground-water from the uppermost aquifer at the closest practicable distance to the waste management unit boundary. An alternative distance, which is protective of human health and the environment, may be granted by the Director of an approved State. Information on setting the relevant point of compliance for ground-water monitoring is provided in Chapter 4.0 (Design Criteria). Since the monitoring program is intended to operate through the post-closure period, the location, design, and installation of monitoring wells should address both existing conditions and anticipated facility development and changes in the ground-water flow regime.

Uppermost Aquifer

Monitoring well placement must be adequate to provide representative samples from the uppermost aquifer. The uppermost aquifer is defined in §258.2 as "the geologic formation nearest to the natural ground surface that is an aquifer, as well as, lower aquifers that are hydraulically interconnected with this aquifer within the facility property boundary." These lower aquifers may be separated physically from the upper aquifer by less permeable strata (having a lower hydraulic conductivity) which are generally termed aquitards. An aquitard is a less permeable geologic unit or series of closely layered units (e.g., silt, clay, or shale) which in itself will not yield significant quantities of water, but will transmit water through its thickness. Aquitards may include thicker stratigraphic sequences of clays, shales and dense, unfractured, crystalline rocks (Freeze and Cherry, 1979).

To be considered part of the uppermost aquifer, a lower zone of saturation must be hydraulically connected to the uppermost aquifer within the facility property boundary. Generally, the degree of communication between aquifers is evaluated by ground-water pumping tests.

Determination of Background Ground-Water Quality

The goal of monitoring well placement is to provide representative samples of water quality both upgradient and downgradient of the landfill. In this manner, changes in the quality of ground-water passing under the landfill can be determined. The natural chemical composition of ground water essentially is controlled by the mineral composition of the geologic unit comprising the aquifer. As ground water moves from one geologic unit to another, its chemical composition changes. To reduce the probability of detecting naturally occurring differences in ground-water quality between upgradient and downgradient locations, water quality should only be compared between geologic units of similar composition.

Complex hydrogeology can be difficult to describe. As a result, the rule allows the owner or operator flexibility in determining where to locate wells that will be used to establish background water quality.

If the facility is new, ground-water samples collected prior to disposal of waste can determine baseline water quality for both upgradient and downgradient locations. The sampling should be conducted to account for both seasonal and spatial variability in ground-water quality.

Determining background ground-water quality by sampling wells that are not hydraulically upgradient may be necessary where hydrogeologic conditions do not allow the owner or operator to determine which wells are hydraulically upgradient. Additionally, background ground-water quality may be determined by sampling at wells that can be established to provide ground water as representative or more representative than that provided by upgradient wells. These conditions include the following:

- The facility is located above an aquifer in which ground-water flow directions change seasonally;
- The facility is located near production wells;
- Upgradient ground-water quality is affected by a source of contamination;
- The proposed or existing landfill overlies a ground-water divide or local source of recharge;
- Strata present at downgradient locations are absent at upgradient locations;
- Karst terrain or fault zones modify flow;
- Nearby surface water [illegible]uences ground-water flow direction[illegible] [illegible].g., river floodplains);
- Waste management areas are located close to a property boundary that is upgradient to the facility; and
- Waste management facilities contain significant amounts of contaminants with densities greater than water.

Multi-Unit Monitoring Systems

For facilities that have more than one MSWLF unit, the rule gives the owner or operator the option of using multi-unit monitoring systems. A multi-unit monitoring system does not have wells at individual MSWLF boundaries. Instead, an imaginary line is drawn around all of the units at the facility. This line would constitute the relevant point of compliance. The option to establish a multi-unit monitoring system is restricted to facilities located in approved States. A multi-unit system must be approved by the Director of an approved State after consideration has been given to the:

- Number, spacing, and orientation of the MSWLF units;
- Hydrogeologic setting;
- Site history;
- Engineering design of the MSWLF units; and
- Type of wastes accepted at the facility.

The purpose of a multi-unit system is to reduce the overlap of monitoring wells that can provide the same information. The conceptual design of the multi-unit system should consider the use and management of the facility with respect to anticipated unit locations. By reducing duplicity, monitoring costs can be reduced from sampling and analysis. In some cases it may be possible to justify a reduction in the number of wells if the waste management units are aligned along the same flow path in the ground-water system.

The multi-unit monitoring system must provide a level of protectiveness to human health and the environment that is comparable to a separate unit monitoring system. The multi-unit system should allow an adequate response time after detection of contamination in order to develop and implement corrective action before sensitive receptors are significantly impacted.

Hydrogeological Investigations

Adequate well placement is dependent on collecting and evaluating hydrological information that can be used to form a conceptual model. The goal of a hydrogeological investigation is to acquire site-specific data concerning:

- The lateral and vertical extent of the uppermost aquifer;
- The lateral and vertical extent of the upper and lower confining units/layers;
- The geology at the owner/operator's facility (e.g, stratigraphy, lithology, structural setting); and
- The chemical properties of the uppermost aquifer and its confining layers relative to local ground-water chemistry and wastes managed at the facility.

Ground-water flow data, including:

- The vertical and horizontal directions of ground-water flow in the uppermost aquifer;
- The vertical and horizontal components of the hydraulic gradient in the uppermost and lower aquifer;
- The hydraulic conductivities of the materials that comprise the uppermost aquifer and its confining units/layers; and
- The average linear horizontal velocity of ground-water flow in the uppermost aquifer.

Prior to initiating a field investigation, the owner or operator should review all available information on the site. This preliminary investigation must include a review of the following information, as available:

- Waste management history of the site, including:
  - Chronological history of the site including descriptions of wastes managed on-site;
  - Summary of documented releases;
  - Structural integrity of the MSWLF unit and physical controls on waste mitigation;
- A literature review, including:
  - Research reports performed in the area of the site;

- Journal articles;

- Studies and reports from local, regional, and State offices (geology surveys, water boards, environmental agencies, etc.);

- Studies from Federal offices such as USGS or USEPA.

• Information from file searches, including:

  - Reports of previous investigations at the site;

  - Geological and environmental assessment data from State and Federal project reports.

The aforementioned documentation is by no means a complete listing of data necessary to conduct a preliminary investigation. There are many other sources of documentation that may be available for review during the preliminary investigation.

The geology of the site is characterized after completion of the preliminary investigation.

Borehole Program

All hydrogeological investigations include a borehole program. A borehole program is necessary to define site hydrogeology and the small-scale geology of the area beneath the site. The program usually requires more than one iteration. The objective of the initial boreholes is to further define the conceptual model derived from research data.

The borehole program should be designed as follows:

• The initial number of borings and their spacing is based on the information obtained during the preliminary investigation;

• Additional borings must be installed as needed to provide more information about the site; and

• Samples must be collected at changes in litholo[illegible] boreholes that will be completed [illegible] monitoring wells, at least one sample must be collected from the interval that will be the screened interval.

Geophysical techniques, either surface or downhole, can be used to plan and supplement the subsurface borehole program. Downhole techniques include electric logging, sonic logging, and nuclear logging. Surface geophysical techniques include seismic profiling, electromagnetic profiling, and resistivity profiling.

The data obtained from the borehole program should enable the owner or operator to identify:

• Lithology, soil types, and stratigraphy;

• Zones of potentially high hydraulic conductivity;

• The presence of a confining formation(s) or layer(s);

• Unpredicted geologic features such as fault zones, cross-cutting structures, pinch out zones, etc.;

- Continuity of petrographic features such as sorting, grain size distribution, cementation, etc.; and

- Potentiometric surface or water table.

Upon completion of the initial borehole program, the data is interpreted and data gaps identified. The data is used to prepare:

- Structural and stratigraphic maps and cross sections;

- Potentiometric surface and water table maps;

- Topographic maps; and

- Ground-water quality maps.

In addition to maps, a hydrogeological report is prepared. The report should contain, at a minimum:

- A description of field activities;

- Drilling and/or well construction logs;

- Analytical data;

- A discussion and interpretation of the data; and

- Recommendations to address data gaps.

The final output of the site characterization phase of the hydrogeological investigation is a conceptual model. The conceptual model is the integrated picture of the hydrogeologic system and the waste management setting. The final conceptual model must be a site-specific description of the vadose zone, the uppermost aquifer, and its confining units. The model should contain all of the information necessary to design a ground-water monitoring system.

Monitoring Well Installation

The placement and screening of wells in a monitoring network is based on the results of the site characterization. Typically, the monitoring wells installed initially will not be sufficient for achieving the performance objectives of a detection monitoring network.

Since there is no required minimum number of monitoring wells at a facility, it may be necessary to install additional monitoring wells. These wells will be located to provide additional information necessary for characterizing ground-water contamination and/or to meet the regulatory requirements.

Horizontal Placement

The spacing of monitoring well locations needs to be sufficient to detect releases from the landfill. For facilities located above a relatively uniform aquifer (homogeneous and isotropic), the well spacings can be based on general aquifer characteristics and potential contaminant fate and transport characteristics. As aquifer heterogeneity increases, the distribution and number of preferential flow paths may also increase, resulting in the well placement and locations of the screened interval being determined by the location and type of natural and man-made pathways of contaminant migration.

Figure 5-1 illustrates several examples of more complex stratigraphy which would require multiple vertical monitoring intervals.

The number of monitoring wells needed to adequately monitor the uppermost aquifer downgradient of the MSWLF is dependent on the geology and waste constituents at the site. Based on these considerations, all preferential flow paths should be identified and monitored. The upgradient wells should be sufficient in number to monitor the corresponding geologic units located and monitored downgradient.

In summary, lateral spacing of monitoring wells is controlled by site-specific characteristics such as those described above. If the facility covers a large area, more monitoring wells will be needed. In general, the more samples collected, the more accurate the estimate of the mean and variance of ground-water quality will be.

Additional information on monitoring well placement, water quality, and monitoring case histories may be found in USEPA, (1987) and USEPA, (1988) and USEPA-SW-846, (1990), and USEPA, (1991).

Well Screened Intervals and Vertical Placement of Screens

The objective of a monitoring well is to sample discrete flow zones in an aquifer. The thickness of each stratum as well as the overall thickness of all the strata that comprise the uppermost aquifer are important in evaluating the depth interval at which to install the monitoring well screen. Thick aquifers with several highly permeable preferential flow paths may require several screened intervals or multiple wells at one location (well cluster). In the site characterization process, these preferential flow paths, including fractured zones and faults, need to be identified for proper screened interval selection. The screened interval is usually not less than 5 feet and in general should not exceed 10 feet in length (USEPA-SW-846, 1990). A screened interval of excessive length could lead to contaminant dilution within the well by uncontaminated water from another zone. Dilution effects will not only affect the statistical analysis of ground-water monitoring data but may also lead to non-detection of constituents that otherwise would have been detected. It is usually not necessary to screen the entire aquifer thickness. The screen placement requirements can be determined by assessing the waste characteristics and the hydrogeology (e.g., stratigraphy, lithology and vertical component of the gradient).

The characteristics of the leachates to be detected should be anticipated based on waste disposal and operational practices. It is possible, particularly at older facilities that received commercial or industrial wastes, that a non-aqueous component in the leachate may be released in detectable quantities to the aquifer. Monitoring for dense non-aqueous phase liquids (D-NAPLs) should occur just above the boundary with less permeable strata (aquitards or confining layers). Monitoring for light non-aqueous phase liquids (L-NAPLs) should occur

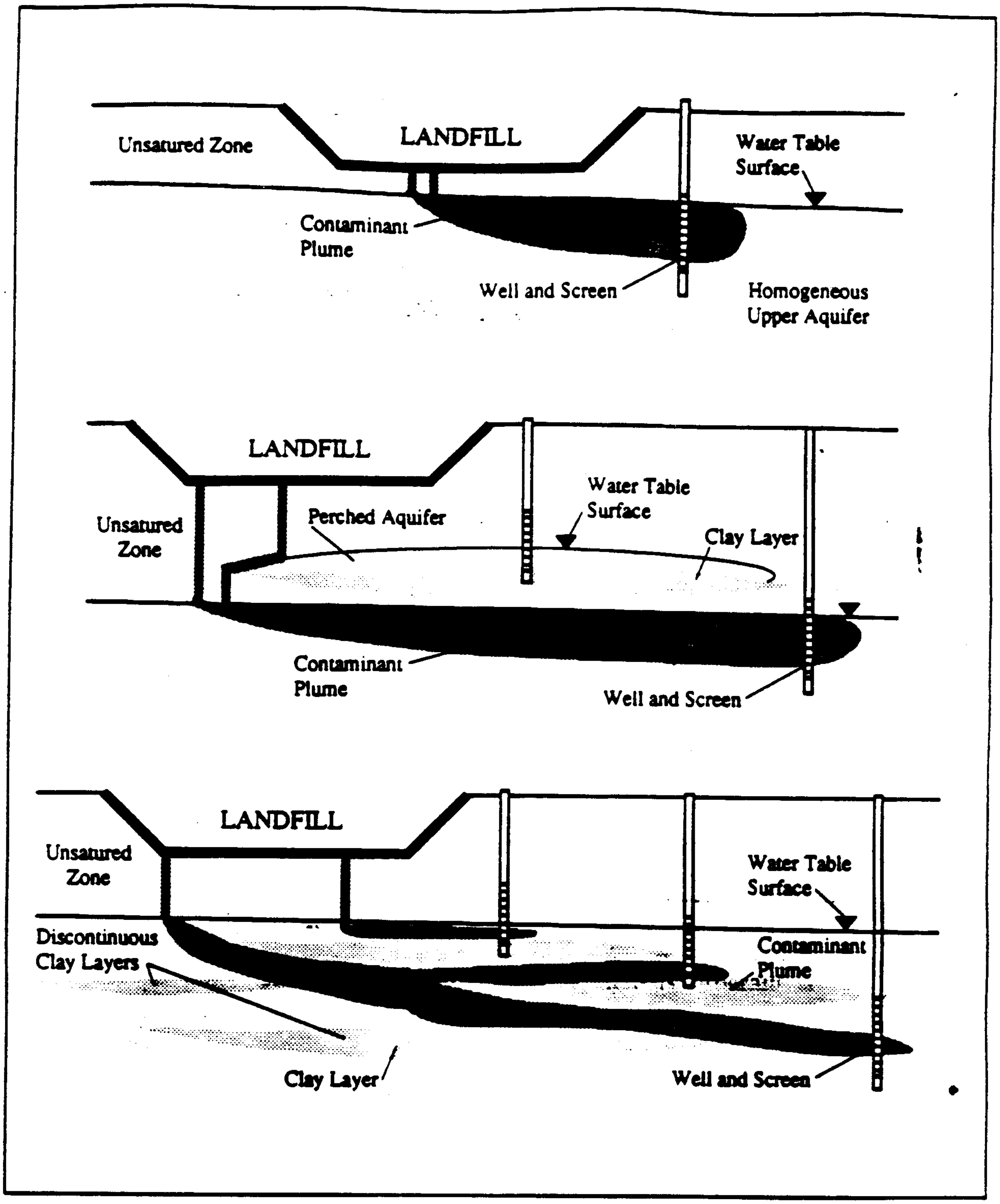

FIGURE 5-1
Examples of Monitoring Well Placement

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along the water surface/capillary zone interface. At existing sites, the existence of D- or L-NAPLs should be addressed in selecting strata to be monitored.

Vertical Placement

The proper selection of the vertical sampling interval is necessary to ensure that the monitoring system is capable of detecting a release from the MSWLF unit. The vertical position and lengths of well intakes are functions of:

- Hydrogeologic factors that determine the distribution of, and fluid/vapor phase transport within, potential pathways of contaminant migration to and within the uppermost aquifer; and
- The chemical and physical characteristics of contaminants that control their transport and distribution in the subsurface.

Shorter screens may be necessary to detect contaminants concentrated at particular depths. A contaminant may be concentrated at a particular depth because of its physical/chemical properties and/or because of hydrologic properties. Heterogeneous formations require shorter well screens to allow sampling of discrete portions of the formation.

When more than one suspected zone of contamination exists at a single location, a well cluster should be installed. Multiple wells (cluster) are necessary for a single location when:

- A single well cannot adequately intercept and monitor the vertical extent of a potential pathway of contamination; or
- There is more than one potential pathway of contaminant migration in the subsurface; or
- There is a thick saturated zone and immiscible contaminants are, or may be present.

If the ground-water table has a high degree of seasonal fluctuation, either a longer screened interval is required or separate, discreet intervals may be used at a single well location.

Once the ground-water table surface has been identified over the site (either by wells or piezometers) the water table elevations may be contoured with respect to a true datum (mean sea level) to produce a map showing the equipotential lines (lines of equal head) at the site. Ground-water flow will be approximately normal to the equipotential lines. A minimum of three water level elevations are required to define flow direction. An example equipotential map showing flow direction is provided in Figure 5-2. A discussion of the basic principles of flow net construction is provided in Freeze and Cherry (1979). The water level elevation map should be contoured at intervals that allow an accurate and detailed representation of ground-water flow directions. For some sites with relatively flat water tables, the interval may be as little as 0.1 feet, while at other sites, the interval may be as large as 2 feet.

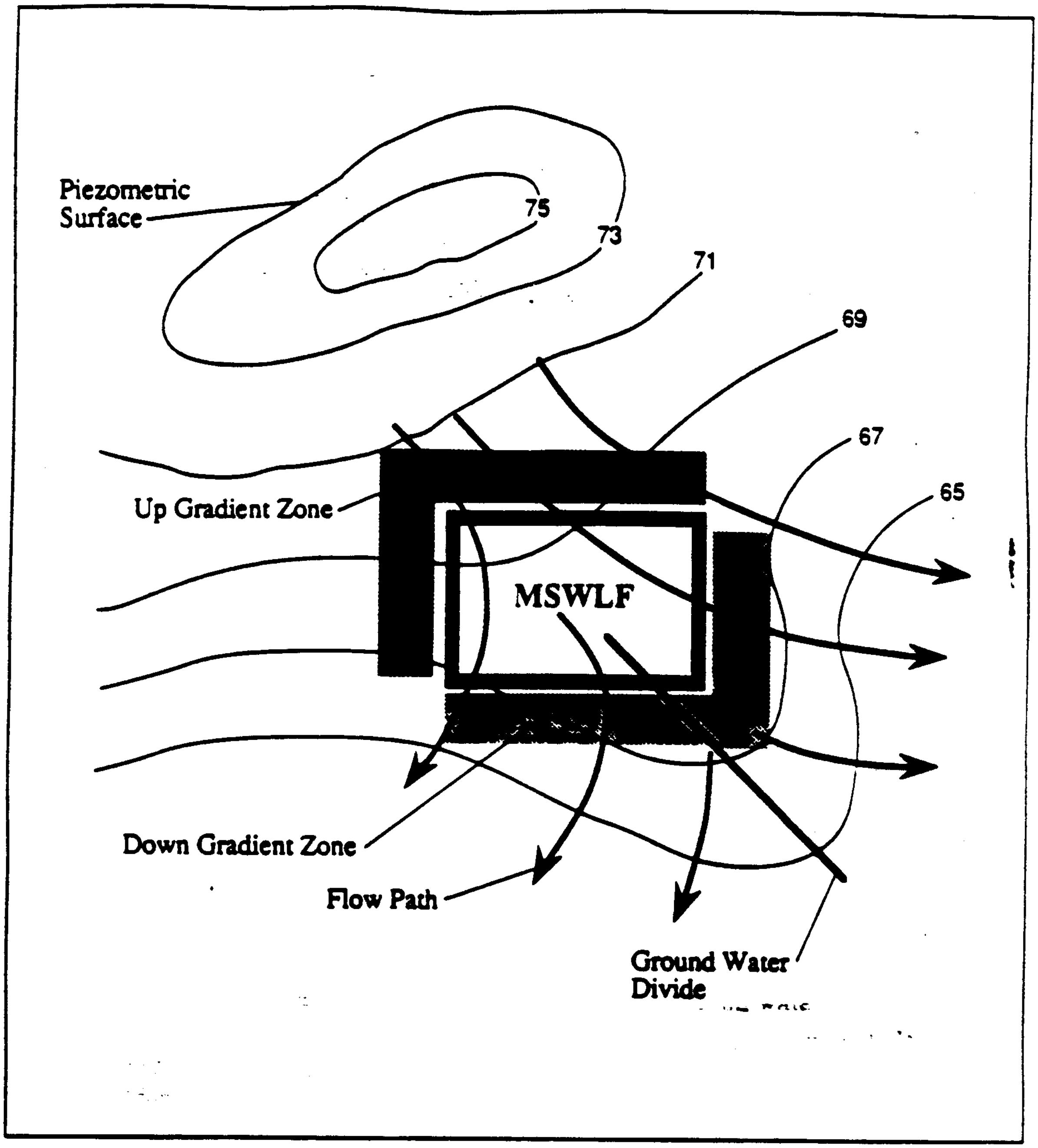


FIGURE 5-2
Upgradient and Downgradient Designations for Idealized MSWLF

5.7 GROUND-WATER MONITORING WELL DESIGN AND CONSTRUCTION 40 CFR §258.51 (c)

5.7.1 Statement of Regulation

(c) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of ground-water samples. The annular space (i.e., the space between the bore hole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the ground water.

(1) The owner or operator must notify the State Director that the design, installation, development, and decommission of any monitoring wells, piezometers and other measurement, sampling, and analytical devices documentation has been placed in the operating record; and

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to design specifications throughout the life of the monitoring program.

§258.52 [Reserved].

5.7.2 Applicability

The requirements for monitoring well design, installation, and maintenance are applicable to all wells installed at existing units, lateral expansions, and new MSWLF units. The design, installation, and decommissioning of any monitoring well must be documented in the operating record of the facility and certified by a qualified ground-water scientist. Documentation is required for piezometers, sampling devices, and water level measurement instruments used in the monitoring program. Directors in approved States must be notified within 14 days that the certification has been placed in the operating record.

The monitoring wells must be cased to protect the integrity of the borehole. The design and construction of the well directly affects the quality and representativeness of the samples collected. The well casing must have a screened or perforated interval to allow entrance of water into the well casing. The annular space between the well casing and the formation wall must be packed with a granular material to inhibit migration of formation material into the well. The well screen must have openings sized according to the packing material used. The interval above and below the filter pack must be sealed to provide a discrete sampling interval.

All monitoring wells, piezometers, sampling and analytical devices must be maintained in a manner that ensures their continued performance according to design specifications over the life of the monitoring program.

5.7.3 Technical Considerations

The design, installation, and maintenance of monitoring wells will affect the consistency and accuracy of samples collected. The design must be based on site-specific information. The formation material (lithology and grain size distribution) will determine the selection of proper packing materials and the stratigraphy will determine the screened length for the interval to be monitored. Installation practices should be specified and overseen, to ensure that the monitoring well is installed as designed and will perform as intended. This section will provide a discussion of the factors that must be considered when designing monitoring wells. However, it should be noted that there are no "typical" monitoring well designs because each well must be tailored to suit the hydrogeological setting, the contaminants to be monitored, and other site-specific factors.

Close attention to proper selection of packing materials and well development procedures for wells installed in tight soils (e.g., clays and silty glacial tills) is important to minimize sample turbidity from suspended and colloidal geologic solids.

Monitoring Well Design

__Well Casing__

The monitoring well casing provides access from the surface to the zone to be monitored. The casing, associated seals, and grout protect the integrity of the borehole and minimize the hydraulic communication between zones.

Choosing the proper casing material for ground-water monitoring wells must be done with great care. Materials that are not compatible with subsurface conditions can cause false or misleading detections or non-detections of analytes. Selecting the proper well casing materials is dependent on the following factors:

1) The geologic environment;

2) The natural geochemical environment;

3) Anticipated well depth;

4) Types and concentrations of suspected contaminants; and

5) The design life of the well.

The most frequently evaluated characteristics of casing materials are strength and chemical resistance/interference. The casing must be made of a material strong enough to last for the life of the well.

Tensile strength is needed primarily during well installation when the casing is lowered into the hole. The joint strength will determine how long of a section can be suspended from the surface in an air-filled borehole.

Collapse strength is the second important factor to be considered. Collapse strength is the capability of a casing to resist collapse by any and all external loads to which it is subjected both during and after installation. A casing is most susceptible to collapse during installation before placement of the filter pack or annular seal materials around the casing. Once a casing is installed and supported, collapse is seldom a concern. Several steps that can be taken to avoid casing collapse are:

1) Drilling a straight, clean borehole;

2) Uniformly distributing filter pack materials at a slow, even rate; and

3) Avoiding use of quick-setting (high temperature) cements for thermoplastic casings installation.

Compressive strength of the casing is the greatest compressive stress that a substance can bear without deformation. Casing failure due to a compressive strength limitation generally is not an important factor in a properly installed well. This type of failure results from soil friction on unsupported casing.

The chemical resistance/interference characteristics must be evaluated before selecting monitoring well materials. Metallic casing materials are more subject to corrosion, while thermoplastic casing materials are more susceptible to chemical degradation. The geochemistry of the formation water influences the degree to which these processes occur. If ground-water chemistry affects the structural integrity of the casing, then the samples taken from the well are likely to be affected.

Materials used for monitoring well casing must not exhibit a tendency to sorb or leach chemical constituents from, or into, water sampled from the well. If a casing material sorbs constituent from ground-water, those constituents may either not be present (false negative) or be present at a reduced level. Chemical constituents also can be leached from the casing materials by aggressive aqueous solutions. These constituents may be detected in samples taken from the well. The results may indicate contamination (false positive) that is due to the casing rather than the formation water. Casing materials must be selected with care to avoid degradation of the well and to avoid erroneous results.

There are many different types of joints used to hold sections of casing together. The most common types of joints for thermoplastic casing are mechanical joints (threaded) or joints that require solvent cementing. In ground-water monitoring wells, mechanical joining by threaded connections should always be used. Solvent cements should <u>never</u> be used to join casing in ground-water monitoring wells. Tests have shown that solvent cements can contaminate ground-water samples for longer than two years after installation.

Casing materials for ground-water monitoring wells can be divided into three categories:

1) Fluropolymer materials such as polytetrafluroethelyne (PTFE), tetrafluroethylene (TFE), etc;

2) Metallic materials including carbon steel, galvanized steel, and stainless steel; and

3) Thermoplastic materials such as polyvinylchloride (PVC) and acrylonitrile butadiene styrene (ABS).

Each material may have properties which limit its use under specific conditions. Detailed discussion of material properties of these products with regard to suitability for use in monitoring wells construction is provided in Chapter Eleven of SW-846 (USEPA, 1990).

The diameter of the well casing is generally selected to accommodate downhole equipment. Additional casing criteria include:

- Drilling or well installation method used;
- Anticipated depth of the well and associated strength requirements;
- Anticipated method of well development;
- Volume of water to be purged prior to sampling;
- Rate of recovery of the well after purging; and
- Anticipated aquifer testing.

Filter Pack Design

The primary filter pack material should be a chemically inert material, well rounded, and with a high coefficient of uniformity. Filter pack material should be composed of high purity silica sands (e.g., industrial grade quartz sand) or glass beads. The use of other materials such as local, naturally occurring clean sand is discouraged unless it can be shown that the material is inert (e.g., low cation exchange capacity), coarse-grained, permeable, and uniform in grain size. The filter pack should extend at least two feet above the screened interval in the well.

Although design techniques for selecting filter pack size vary, all use the filter pack ratio to establish size differential between formation materials and filter pack materials. Generally, this ratio refers to either the average (50 percent retained) grain size of the formation material or to the 70 percent retained size of the formation material. Barcelona et al. recommend using a uniform filter pack grain size that is three to five times the size of the 50 percent retained size of the formation material (USEPA, 1990).

Well Screen Design

The screened interval, through which water flows into the monitoring well, should be selected with consideration to seasonal fluctuations in water table elevation in the uppermost aquifer and identification of the interval that requires monitoring. Interval selection and related topics are discussed in previous guidance on selecting well locations.

The screen size should be selected according to the grain size and gradation of the primary filter pack and the formation to be monitored. The well screen slot size should be designed to exclude 60 percent of the formation materials and retain from 85 percent to 100 percent of the primary filter pack (USEPA, 1990). The well screen must be a factory manufactured product to ensure adequate control over slot sizes and material strength. Field slotted screens are not acceptable. Unless D-NAPLs are expected to be encountered, the well may contain a short additional length of casing below the screen to act as a sump to trap sediment in the well.

Well clusters, or nests, should be installed when more than one zone needs to be sampled at any one location. If multiple well screens are installed in one well, the areas between the screened intervals must be sealed to avoid hydraulic communication between two zones in the aquifer. Vertical cross connection between different zones or different aquifers interfere with the quality of the collected samples and provides a pathway for vertical transport of contaminants.

Annular Sealant

Proper sealing of the well annulus is required to prevent contamination of samples and ground-water. The materials used for sealing must be chemically inert with the highest anticipated concentration of chemical constituents expected in ground-water at the facility. When the screened interval is in the saturated zone, a minimum of two feet of certified sodium bentonite pellets should be placed immediately over the filter pack. Pellets are preferred in a saturated zone, because they will penetrate the water column to create an effective seal. Pellets also will not hydrate and bridge as easily as coarse grit bentonite. A cement bentonite grout should be used as the annular sealant above the bentonite and below the frost line. When the annular seal must be installed in the unsaturated zone, neat cement or shrinkage-compensated neat cement mixtures should be used. Bentonite is not recommended as an annular sealant in the unsaturated zone because the moisture available is insufficient to fully hydrate bentonite.

Surface Completion

Monitoring wells commonly are completed either as above-ground completions or as flush-to-ground completions. The purpose of both types is to prevent infiltration of surface runoff into the well annulus and to prevent accidental damage or vandalism. Completing a monitoring well involves installing the following components:

- Surface seal;
- Protective casing;
- Ventilation hole;
- Drain hole;
- Cap and lock; and
- Guard posts.

A surface seal is installed on top of the grout seal and extends vertically up the well annulus to the land surface. To protect against frost heave, the seal should extend at least one foot below the frost line. The composition of the surface seal should always be neat cement. In an above ground-completion the surface seal should form at least a two-foot wide, four-inch thick apron.

A locking, protective casing must be installed around the well casing to ensure that the well can be maintained throughout the life of the monitoring program. The casing should be anchored at least one foot below the frost line in the surface seal. A one quarter inch hole should be installed in the casing to allow the escape of any gases that may accumulate in the well. A drain hole should be installed in the protective casing to prevent water from accumulating and possibly freezing around the casing. A cap must be placed on the protective casing and a lock must be installed on the cap to provide security.

To guard against accidental damage to the well from facility traffic, concrete or steel guards should be installed on the edge of the apron.

Figure 5-3 depicts the components of a typical monitoring well installation. Additional information on well design and installation may be found in Driscoll (1987) and USEPA (1991).

5.8 GROUND-WATER SAMPLING AND ANALYSIS REQUIREMENTS 40 CFR §258.53

5.8.1 Statement of Regulation

(a) The ground-water monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of ground-water quality at the background and downgradient wells installed in compliance with §258.51(a) of this Part. The owner or operator must notify the State Director that the sampling and analysis program documentation has been placed in the operating record and the program must include procedures and techniques for:

(1) Sample collection;

(2) Sample preservation and shipment;

(3) Analytical procedures;

(4) Chain of custody control; and

(5) Quality assurance and quality control.

(b) The ground-water monitoring program must include sampling and analytical methods that are appropriate for ground-water sampling and that accurately measure hazardous constituents and other monitoring parameters in ground-water samples. Ground-water samples shall not be field-filtered prior to laboratory analysis.

(c) The sampling procedures and frequency must be protective of human health and the environment.

(d) Ground-water elevations must be measured in each well immediately prior to purging, each time ground water is sampled. The owner or operator must determine the rate and direction of ground-water flow each time ground water is sampled. Ground-water elevations in wells which monitor the same waste management area must be measured within a period of time short enough to avoid temporal variations in ground-water flow which could preclude accurate determination of ground-water flow rate and direction.

(e) The owner or operator must establish background ground-water quality in a hydraulically upgradient or background well(s) for each of the monitoring parameters or constituents required in the particular ground-water monitoring program that applies to the MSWLF unit, as determined under §258.54(a), or §258.55(a) of this Part. Background

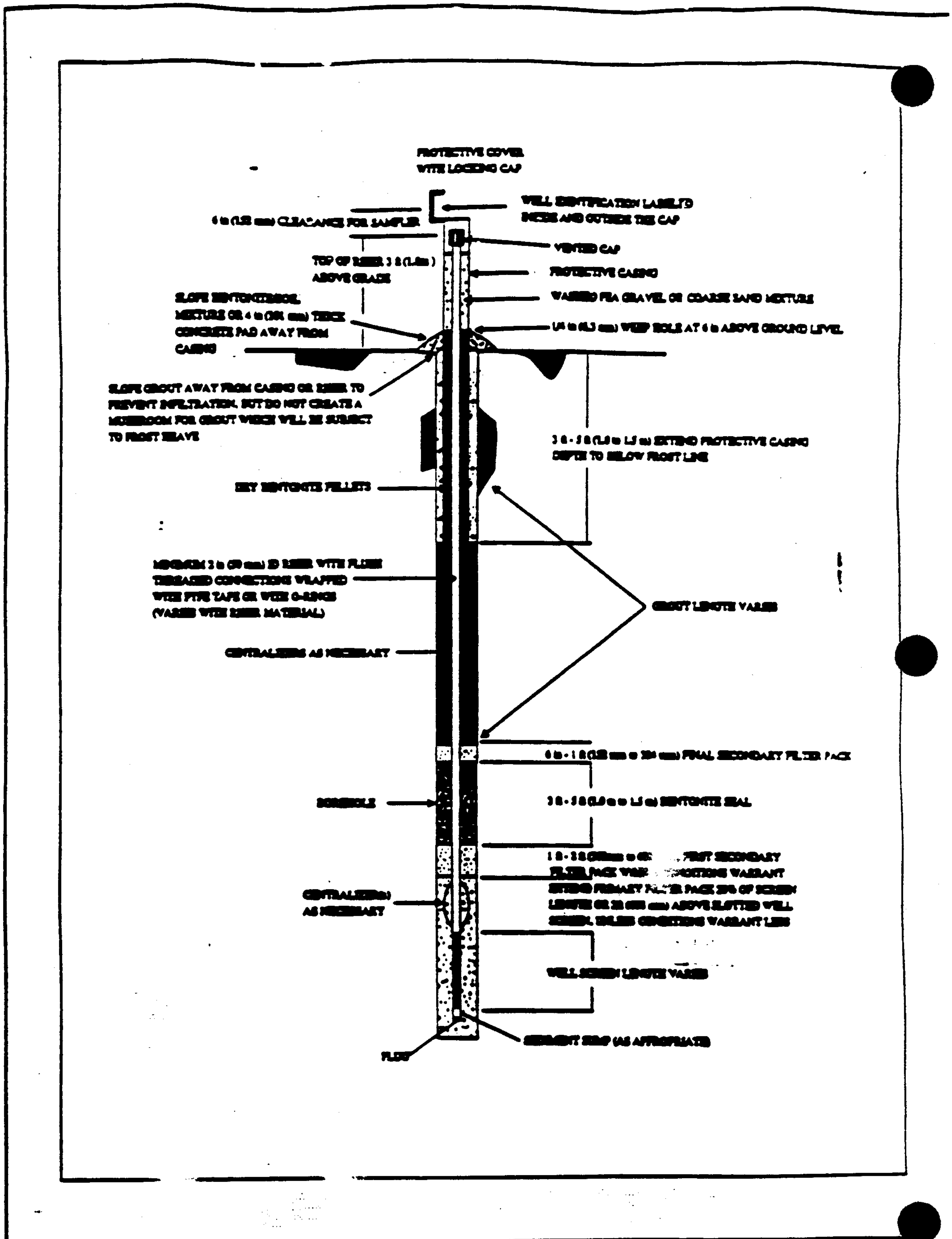


FIGURE 5-3
Monitoring Well Design - Single Cased Well

ground-water quality may be established at wells that are not located hydraulically upgradient from the MSWLF unit if it meets the requirements of §258.51(a)(1).

(f) The number of samples collected to establish ground-water quality data must be consistent with the appropriate statistical procedures determined pursuant to paragraph (g) of this section. The sampling procedures shall be those specified under §258.54(b) for detection monitoring, §258.55(b) and (d) for assessment monitoring, and §258.56(b) of corrective action.

5.8.2 Applicability

The requirements for sampling and analysis apply to all facilities required to conduct ground-water monitoring throughout the active life, closure, and post-closure periods of operation. The monitoring program must establish consistent and appropriate methods for sample collection, chain of custody, preservation, and analysis to ensure that results are representative of the water quality and will be comparable over time. Quality assurance and quality control measures for both field sampling and sample analysis must be implemented. The methods and procedures constituting the program must be placed in the operating record of the facility.

For the sampling and analysis program to be technically sound, the sampling procedures and analytical methods used should provide adequate accuracy, precision and detection limits for the analyte determinations. Sample analyses must be conducted on unfiltered samples. Prior to sampling, the static ground-water elevations in the wells must be measured to allow determination of direction of ground-water flow and estimates of rate of flow. The time interval between measurements at different wells must be minimized so that temporal changes in the ground-water table do not cause an incorrect determination of ground-water flow direction.

Background ground-water quality must be established at all upgradient or background wells. The background water quality may be determined from wells that are not upgradient of the MSWLF unit, provided that the wells yield representative ground-water samples.

The sampling program must be designed in accordance with the statistical method chosen by the owner or operator. The data objectives of the monitoring program, in terms of the number of samples collected and the frequency of collection, should be appropriate for the statistical method selected for data comparison.

5.8.3 Technical Considerations

The purpose of a ground-water sampling and analysis program is to establish a protocol that can be followed throughout the monitoring period of the site (operating, closure, and post-closure). The protocol is necessary so that data acquired can be compared over time and accurately represents ground-water quality. Sample collection, preservation, shipment, storage, and analyses should always be done in a consistent manner, even as monitoring staff change during the monitoring period.

The owner/operator's ground-water monitoring program should include a description of procedures for the following:

- Sample collection;
- Sample preservation and shipment;
- Analytical procedures;
- Chain of custody control; and
- Quality Assurance and Quality Control.

The ground-water monitoring program should be documented in the operating record of the facility.

The objectives of the monitoring program should clearly define the quality of the data required to detect significant changes in ground-water chemistry due to the operation of the solid waste disposal facility. These data quality objectives include:

- Accuracy and precision of methods used in the analysis of samples, including field measurements;
- Quality control and quality assurance procedures used to determine the validity of the results (e.g., use of blank samples, record keeping and data validation);
- Number and frequency of samples required to reach a certain degree of statistical confidence; and
- Location and number of monitoring wells used.

In general, the degree of statistical confidence increases with larger sample populations when describing the mean value for a particular constituent and when defining seasonal and longer term trends. Thus, a certain minimum number of samples must be collected to meet a specified degree of confidence in the strength of the statistical approach. In addition, the accuracy (exactness) and precision (reproducibility) of a particular measurement may effect the degree of confidence in the actual discrete concentration value used in the statistical comparison. These data quality topics will be discussed along with the general guidance that follows.

Sample Collection

__Frequency__

The frequency of sample collection under detection monitoring should be evaluated for each site based on hydrogeologic conditions and landfill design. At a minimum, the sampling frequency should be semi-annual. The background characterization should include four independent samples at each monitoring location during the first semi-annual event. More frequent sampling may be selected. For example, quarterly sampling may be conducted to evaluate seasonal effects on ground-water quality.

The frequency of sample collection during assessment monitoring activities will depend on the site-specific hydrogeologic and landfill design conditions being evaluated. The frequency of sampling is intended to obtain a data set that is independent of the previous set.

Guidance to estimate this minimum time to obtain independent samples is provided in "Statistical Analysis of Ground-water Monitoring Data at RCRA Facilities - Interim Final Guidance" (USEPA, 1989).

Measurements

The ground-water monitoring program must include provisions for measurement of static water level elevations in each well prior to purging the well for sampling. Static water level data is needed for interpretation of changes in the hydraulic conditions at the site. Analysis of the water levels are necessary to determine whether horizontal or vertical components of the hydraulic gradient have changed since initial site characterization.

Field measurements may include the following:

- Height of protective casing above ground surface (a quality control measurement to check on vertical displacement of the casing);

- Depth from protective casing to well riser (to check on relative displacement);

- Depth to standing water from top of riser (static water level);

- Total depth of well from top of riser (to verify condition of well); and

- Detection of immiscible layers, if present.

Measurements of the static water level and the depth to the well bottom can be made with a steel tape or an electronic water level meter. Accepted standard operating procedures call for the static water level to be accurately measured to within 0.01 foot (USEPA, 1986a). Some pressure transducers are believed to provide reproducible measurements on the order of 0.001 ft of water pressure. In general, steel tapes equipped with electronic sensors are considered accurate to the nearest 0.01 foot. Measurements of the ground-water elevations are used for determining horizontal and vertical ground-water gradients for estimation of flow rates and direction. These measurements should be made at all monitoring wells and well clusters in a time frame that avoids changes that may occur as a result of barometric pressure changes, significant infiltration events, or aquifer pumping.

The difference in the total depth of the well and the static water level is the height of standing water in the well riser. These measurements are needed to estimate the amount of water to be evacuated (purged) from the well prior to sample collection.

The ground-water monitoring program should include provisions for detecting immiscible fluids (i.e., L-NAPLs or "floaters" and D-NAPLs or "sinkers"), if the facility receives this type of waste. L-NAPLs are those relatively immiscible liquids which are less dense than the ground water that spread across the water table surface. D-NAPLs are those relatively immiscible liquids which are more dense than the ground water and tend to migrate vertically towards underlying confining layers. The detection of an immiscible layer may require specialized equipment and should be done before the well is evacuated for conventional sampling. The ground-water monitoring program should specify how the D-NAPLs and L-NAPLs will be detected. The program also should include a contingency plan describing procedures for sampling and analysis of these fluids. Guidance for detecting the presence of immiscible layers can be found in "RCRA Ground-water Monitoring Technical Enforcement Guidance Document", USEPA (1986a) and SW-846 Chapter Eleven (USEPA, 1990).

Well Evacuation

The water standing in a well prior to sampling may not be representative of in-situ ground-water quality. The chemistry of water stored in the well casing can be unrepresentative of the water in the aquifer due to atmospheric gas transfer and reactions within the well casing. Therefore, the standing water in the well must be removed prior to sampling to ensure that fresh formation water can be sampled. The ground-water monitoring program should document both the step-by-step procedures and criteria for evacuating wells as well as the equipment used to evacuate the wells.

The evacuation procedure should replace all stagnant water with fresh formation water. Generally, the standing water is removed from a point above the screen in the uppermost part of the water column to ensure fresh formation water will move upward and displace the standing water. Standard well evacuation practice involves evacuating a specified number of well volumes (the volume of standing water inside the well casing and filter pack) until field measurements (e.g., pH, temperature, and specific conductance) of the purge water stabilizes. The number of well volumes to be removed from a monitoring well prior to the collection of a water sample must be tailored to the hydraulic properties of the zone being monitored and to the hydraulic performance of the well. There is no set number of well volumes to be evacuated however, three to ten well volumes usually are sufficient. The well must be purged until field measurements verify stabilization of the water in the casing.

If a well is purged to dryness, sampling must be performed as soon as a sufficient volume of water has entered the well to enable collection of the samples.

Dissolved oxygen content and turbidity must be monitored during purging and preceding and subsequent to sampling. Additionally, pH, temperature, and specific conductance must be monitored at regular intervals during evacuation. Stabilization of these parameters indicates that the water being collected is representative of the formation water.

The purging program depends on the hydraulic yield characteristics of the well. Once such characteristics have been determined, the following generalized purging activities may be followed:

1) Calculate the volume of water in the well (volume in liters equals 0.154 times the square of the inside diameter of the well (in inches) times the height of the water (in feet)).

2) If the well screen is very large, making pumping from the top impractical, the inlet of the purging apparatus should be lowered to the approximate mid-point of the screened portion of the well.

3) If the well is situated in formations with low hydraulic conductivities, such as tills, clay, or unfractured rock, the purging of the well should be performed from near the top of the well screen. Purging at this level until 1 to 3 volumes have been purged will facilitate removal of standing water without creating a large artificial gradient in the well. Such a gradient may alter the oxidation-reduction potential of the aquifer near the well and may draw water from areas beyond the seasonal interval.

4) Monitor the in-situ parameters (dissolved oxygen content, turbidity, pH, temperature, and specific conductance) and measure the volume of ground-water being evacuated. Purging of the standing water is considered complete when a minimum of three well volumes have been purged and the field measured parameters stabilize, or when the well has been purged dry.

Wells should always be purged at rates below those used to develop the well. Low purge rates reduce the possibility of:

- Stripping VOCs from the water;
- Mobilizing solids that are immobile under natural flow conditions; and
- Disturbing accumulated corrosion or reaction products in the well.

Field Analysis

Several constituents or parameters that may be included in a ground-water monitoring program may be physically or chemically unstable and should be tested after well purging and before collection. Examples of unstable parameters include pH, redox (oxidation-reduction) potential, chlorine, dissolved oxygen, carbon dioxide, temperature, and specific conductance. If probes (e.g., pH electrode, specific ion electrode, specific conductance, thermistor) are used to measure any of the above properties, it is important that they be used on water samples taken after well evacuation and after any samples for chemical analysis have been collected, to reduce the potential for the probe(s) to contaminate a sample designated for laboratory analysis.

Monitoring probes must not be placed in shipping containers containing ground-water samples for laboratory analysis.

Any in-situ field monitoring equipment or field-test probes and kits should be calibrated at the beginning of each use, according to the manufacturers' specifications and consistent with methods in SW-846 (USEPA, 1986b).

Sample Withdrawal and Collection

The technique used to withdraw a ground-water sample from a well must be selected based on consideration of the parameters to be analyzed in the sample. To ensure the sample is representative of ground-water in the formation, it is important to keep physical or chemical alterations of the sample and its environment to a minimum. Selection of sampling materials and equipment is important to preserving sample integrity. The sampling equipment must be constructed of an inert material that will not alter analyte concentrations or react with, sorb, or desorb the analytes. Fluorocarbon resin (e.g., virgin teflon) or stainless steel sampling devices which can be easily disassembled for thorough decontamination are widely used. Commonly, sampling equipment is dedicated to each monitoring well. The following devices are some of the types commonly used for sampling ground-water:

- Positive displacement pumps (bladder pumps, helical rotor pumps, etc.);
- Suction lift pumps (e.g. peristaltic pumps); and
- Grab samplers (bailers and syringe devices).

In general, bailers should not be used to sample ground-water that will be analyzed for volatile organic compounds (VOCs) unless it is the only available method for sampling NAPLs. A significant loss of volatiles may occur when using bailers to sample ground-water.

Equipment with neoprene fittings, tygon tubing, silicon rubber bladders, neoprene impellers, polyethylene, and viton should not be used.

Bailers should be raised and lowered on non-reactive, non-sorbing cable (e.g., fluorocarbon resin-coated wire, single strand stainless steel wire). Materials and equipment for various ground-water monitoring applications are described in the "Ground-Water Handbook" (USEPA, 1987). Equipment and procedures should be used to keep sample agitation and contact with the atmosphere to a minimum during sample transfer.

When collecting samples where volatile constituents or gases are of interest using a positive gas displacement bladder pump, pumping rates should not exceed 100 milliliters/minute. Higher rates may increase the loss of volatile constituents and can cause fluctuation in pH and pH-sensitive analytes.

Once appropriate sampling equipment has been selected and operating procedures established, samples should be collected and containerized in the order of the volatilization sensitivity of the parameter. A preferred collection order for some common ground-water parameters follows (USEPA, 1986a):

1) Volatile Organics Compounds (VOCs);
2) Semi-volatile Organics Compounds (SVOCs);
3) Metals;
4) Cyanide;
5) Sulfate and Chloride;
6) Turbidity;
7) Nitrate and Ammonia; and
8) Radionucleides.

As an example, the flow chart shown in Figure 5-4 depicts a priority order for a generalized sample collection effort. Current accepted sample collection procedures call for samples to be collected and containerized according to the volatility of the target analytes.

The following steps should be followed by the samplers to obtain representative samples:

- Decontaminate all sampling equipment that will come in contact with the well casing and well water prior to use;
- Ensure that sampling equipment that has been decontaminated is not placed directly on the ground or other potentially contaminated surfaces prior to insertion into the well;
- Operate pneumatic bladder pumps in a continuous manner so that they do not produce samples that are aerated in the return tube or upon discharge;
- Ensure that check valves are designed and inspected to avoid fouling problems which can result in aeration of the sample;
- Lower sampling equipment (especially bailers) slowly to avoid degassing of the water upon impact; and
- Contents of a sampling device should be transferred to a sample container in a way that will minimize agitation and aeration.

The ground-water monitoring program documentation should include explicit procedures for disassembly and decontamination of sampling equipment before each use. If non-dedicated equipment is used, the decontamination procedures must be followed scrupulously. Improperly decontaminated equipment can affect samples in several ways. Residual contamination from the previous well may remain on equipment. Rinsing may not remove all of the detergents or solvents used during decontamination. Specific guidance is available in technical literature (e.g., USEPA, 1986a, Chapter Eleven). To keep sample cross-contamination to a minimum, sampling should proceed from upgradient background locations to downgradient locations which contain higher concentrations of contaminants. As contaminant concentrations increase, or NAPLs are encountered, then more rigorous decontamination procedures may be required. The sampling equipment should be allowed to dry in a dust-free environment before use.

Sample Containers

To avoid altering sample quality, the samples should be transferred from the sampling equipment directly into a prepared container. Proper sample containers for each constituent or common set of constituents are identified in SW-846 (USEPA, 1986b). Samples should never be composited in a common container in the field and then split. Sample containers should be specially cleaned for the constituents to be analyzed.

Sample containers should be cleaned based on the analyte of interest. Cleaning procedures are provided by USEPA (1986b). Sample containers that have

STEP	*PROCEDURE*	*ESSENTIAL ELEMENTS*
Well Inspection	Hydrologic Measurements	Water Level Measurements
Well Purging	Removal or Isolation of Stagnant Water	Representative Water Access
	Determination of Well-Purging Parameters (pH, Eh, $-\kappa$, Ω)*	Verification of Representative Water Sample Access
Sample Collection** Field Determinations*		Sample Collection by Appropriate Mechanism Minimal Sample Handling
	Volatile Organics, TOX	Head-Space Free Samples
	Dissolved Gases, TOC	Head-Space Free Samples
	Large Volume Samples for Organic Compound Determinations	Minimal Aeration
	Major Cations and Anions Metal Samples, Cyanide	Minimal Air Contact
	Assorted Sensitive Inorganic Species NO_2^-, NH_4^+, FE(II)	Adequate Rinsing against Contamination
Preservation Field Blanks Standards	(As needed for good QA/QC)	Minimal Air Contact, Preservation
Storage, Transport		Minimal Loss of Sample Integrity Prior to Analysis

* Denotes analytical determinations which should be made in the field.
**This is a suggested order for sampling, not all parameters are required by Part 258.

FIGURE 5-4
GENERALIZED W DIAGRAM OF GROUND-WATER SAMPLING STEPS

been cleaned according to these procedures can be procured commercially. Vendors provide a certification of cleanliness for a surcharge.

Sample Preservation and Shipment

The procedures for preserving and handling samples are nearly as important for ensuring the integrity of the samples as the collection device itself. Chapter Two of SW-846, Third Edition provides guidance on sample preservation procedures (USEPA,1986b). Detailed procedures for sample preservation must be provided in the QAPjP.

Preservation

During ground-water sampling, every attempt should be made to minimize changes in the chemistry of the samples. To assist in maintaining the natural chemistry of the samples, it is necessary to preserve the sample. Methods of sample preservation are relatively limited and are intended to retard chemical reactions such as hydrolysis or oxidation and to reduce the effects of sorption. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from light.

Holding times must be considered along with the preservation methods. Holding time refers to the period that begins when the sample is collected from the well and ends with its extraction or analysis.
Data from samples not analyzed within the recommended holding times should be considered suspect.

The owner or operator should identify the preservation methods, procedures, and techniques that will be used for transferring the samples to a laboratory. The owner or operator should refer to SW-846 (USEPA, 1986b) for the specific preservation method and holding times for each of the constituents in the samples.

Sample Storage and Shipment

Storage and transport conditions of ground-water samples are important elements of the sampling protocol to maintain sample quality. Samples should be cooled to 4°C as soon as possible after they are collected. These conditions should be maintained until samples are received at the laboratory. Sample containers are generally packed in picnic coolers or special containers for shipment. Polystyrene foam, vermiculite, and "bubble pack" are frequently used to pack sample bottles tightly so that no motion is possible, thereby preventing breakage. Ice is usually placed in double sealed plastic bags and added to the cooler. It should be noted that cold packs ("blue ice") also are acceptable. All related paperwork is sealed in a plastic bag and taped to the inside top of the cooler. The cooler top is then taped shut. Custody seals may be attached to the individual sample containers and are always attached on the outside of the cooler.

Transportation arrangements should be made that maintain proper storage conditions and provide for effective sample pick-up and receipt at the laboratory. Sampling plans should be coordinated with the laboratory so that sample receipt, storage, analysis, and custody arrangements can be provided.

Most analyses must be done within a specified period (holding time) from sample collection. Some holding times for Appendix I constituents are as short as 7 days. To provide the laboratory with operational flexibility in meeting these holding times, samples are usually shipped via overnight courier. Laboratory capacity or operating hours may influence sampling schedules. Coordination with laboratory staff during planning and sampling activities is important in maintaining sample and analysis quality.

Documentation that accompanies samples during shipment to the laboratory usually includes chain-of-custody (including a listing of all sample containers), analytical request schedule, and full identification of the origin of samples (including contact names, phone numbers, and addresses). Copies of all documents shipped with the samples should be retained by the sampler for confirmation that receipt of samples was complete. Such verification should occur upon receipt of samples at the laboratory and upon receipt of the report of analysis (ROA) from the laboratory. Documentation is described further in subsection 5.8.3.6.

Analytical Procedures

The requirements of 40 CFR Part 258 include detection and assessment monitoring activities. Under the detection monitoring activity, constituents listed in 40 CFR Part 258, Appendix I are to be analyzed. This list includes volatile organics and selected inorganic constituents. No specific analytical methods are cited in the regulations, but there is a requirement (40 CFR §258.53(h)(5)) that any practical quantitation limit (PQL) used in subsequent statistical analysis "be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility." Suggested test methods are listed in Appendix II of Part 258 for informational purposes only. Method 8240 (gas chromatography with packed column; mass spectrometry) and Method 8260 (capillary column) are typical scanning methods used for all Appendix I VOCs. The inorganic metals analyses can be performed using inductively coupled plasma atomic emission spectroscopy (ICP) Method 6010. These methods are presented in SW-846 (USEPA, 1986).

Since overnight delivery of samples to any laboratory in the continental United States is generally available to most facilities, the methods presented by the USEPA (1986) are believed to be readily available. These methods typically provide PQLs in the 1 to 50 μg/l range. The ground-water monitoring plan must specify the analytical method to be used.

To provide factual information on analytical performance, method blanks, matrix spikes, and laboratory duplicates are frequently included along with field samples. Surrogate recoveries are typically reported for volatile analyses, and the standard addition technique may be used to evaluate the accuracy of inorganic analyses. Specific laboratory analytical performance criteria were developed by USEPA for its Contract Laboratory Program. The ground-water monitoring program should include analytical performance criteria to define acceptable quality of laboratory results. Establishing data quality objectives (USEPA, 1986b) is an important element of the ground-water monitoring program.

Chain of Custody Record

To establish the documentation necessary to trace sample possession from time of collection, a chain-of-custody record should be filled out and should accompany every sample. The record should contain the following types of information:

- Sample number;
- Signature of collector;
- Date and time of collection;
- Media sampled (e.g., groundwater);
- Sample type (composite or grab);
- Identification of sampling location/well;
- Number of containers;
- Parameters requested for analysis;
- Signature of person involved in the chain of possession and times;
- Inclusive dates of possession with time in 24 hour notation.
- Internal temperature of shipping container when samples were sealed into the container for shipping;
- Internal temperature of container when opened at the laboratory; and
- Remarks section to identify potential hazards or to relay other information to the laboratory.

An adequate chain-of-custody program should allow for tracing the possession and for the handling of individual samples from the time of field collection through completion of laboratory analysis. An owner or operator's chain-of-custody program should include:

- Sample labels to prevent misidentification of samples;
- Sample seals to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory;
- Field notes to record information about each sample collected during the groundwater monitoring program;
- Chain-of-custody record to establish the documented sample possessions from the time of collection to analysis;
- Laboratory storage and analysis records, that are maintained at the laboratory and which record pertinent information about the sample.

Sample Labels

Sample identification should be marked clearly in waterproof ink on each sample container. To aid in labeling, the information should be written on each container prior to filling with a sample.

To prevent misidentifying samples, legible labels should be affixed to each sample container. The labels should be sufficiently durable to remain legible even when wet and should contain the following types of information:

- Sample identification number;
- Name and signature of the sampler;
- Date and time of collection;
- Sample location; and
- Parameters requested.

Sample Custody Seal

In cases where there is concern about sample tampering, a seal should be provided on the shipping container or individual sample bottle in a manner that breaks the seal if the sample is tampered.

Sample Analysis Request Sheet

A sample analysis request sheet should accompany the sample(s) on delivery to the laboratory and clearly identify which sample containers have been designated for each requested parameter and the preservation methods used. The record should include the following types of information:

- Name of person receiving the sample;
- Laboratory sample number (if different from field number);
- Date of sample receipt;
- Analyses to be performed (including desired analytical method and PQL); and
- Information that may be useful to the laboratory (e.g., type and quantity of preservatives added, unusual conditions).

Field Logbook

To provide a factual basis for evaluating the possibility of sample contamination during sampling activities, all sampling activities, measurements, and observations should be noted in a field log. Information should include visual appearance (e.g., color, turbidity, degassing, surface film), odor (type, strength) of samples and sample measurements and calibration results. Ambient conditions (temperature, humidity, wind, precipitation) and purging activities should also be recorded as an aid in evaluating sample analysis results. Samples of decontamination solutions and sampling equipment rinse water (sampling equipment blank) may be useful in documenting the effectiveness of sampling equipment decontamination procedures. Field notes generally document the following information:

- Identification of well;
- Well depth and other well measurements;
- Static water level and measurement technique;
- Presence and thickness of immiscible layers and detection method;

- Well yield (high or low) and well recovery after purging (slow or fast);
- Well purging procedure/ equipment;
- Purge volume and pumping rate;
- Time well was purged;
- Collection method for immiscible layers;
- Sample withdrawal procedure/ equipment;
- Date and time of collection;
- Well sampling sequence;
- Types of sample containers used and sample identification numbers;
- Sample preservation method;
- Parameters requested for analysis;
- Internal temperature of field and shipping containers;
- Field observations of sampling event;
- Name of sampler; and
- Climatic conditions including air temperature.

Laboratory Records

Once the sample has been received in the laboratory, the sample custodian and/or laboratory personnel should clearly document the processing steps that are applied to the sample. All sample preparation techniques (e.g., extraction) and instrumental methods should be identified in the laboratory records. Exceptional conditions (i.e., variances from prescribed procedures) such as the use of specific reagents (e.g., solvents, acids), temperatures, reaction times, and instrument settings, should be noted. The results of the analysis and identity of all quality control samples should be specifically identified for each batch of groundwater samples analyzed. Laboratory notes should include the time, date, and name of the person who performed each processing step.

Quality Assurance/Quality Control

One of the fundamental responsibilities of the owner or operator is the establishment of continuing programs to ensure the reliability and validity of field and analytical laboratory data gathered as part of the overall groundwater monitoring program. The owner or operator must explicitly describe the QA/QC program that will be used in the laboratory. Most owners or operators will use commercial laboratories to conduct analyses of groundwater samples. In these cases, it is the owner or operator's responsibility to ensure that the laboratory of choice is exercising an appropriate QA/QC program.

The owner or operator should provide for the use of standards, laboratory blanks, duplicates, and spiked samples for calibration and identification of potential matrix interferences, especially for metal determinants. The owner or operator should use adequate statistical procedures (e.g., QC charts) to monitor and document performance and to implement an effective program to resolve testing problems (e.g., instrument maintenance, operator training). Data from QC samples (e.g., blanks, spiked samples) should be used as a measure of performance or as an indicator of potential sources of cross-contamination, but should not be used by the laboratory to alter or correct analytical data. These data should be submitted with the groundwater monitoring sample results.

<u>Field Quality Assurance/Quality Control</u>

To verify the precision of sampling and analytical procedures, two types of QC blanks, trip blanks and equipment blanks, should be collected. The blanks should be collected at a frequency of 1 in 10 to 20 samples.

Each time a group of bottles is prepared for use in the field, one bottle of each type (e.g., glass, fluorocarbon resin, polyethylene) should be selected from the batch and filled with Type II reagent grade deionized water. These bottles should be transported to the sampling location and returned to the laboratory in a manner identical to the handling procedure used for the samples. These trip blanks should be subjected to the same analysis as the ground water.

Equipment rinsate blanks are collected to evaluate the effectiveness of the decontamination procedures. The sample is collected after a piece of sampling equipment has been decontaminated. Type II reagent grade deionized water is poured into (or on) the sampling device and is collected in a sample container. The sample should be handled in a manner identical to all other samples. The equipment rinsate blanks undergo the same analyses as ground water.

The following blanks should be prepared and analyzed for all of the required monitoring parameters:

- Trip Blank - In the laboratory, fill one of each type of sample bottle with Type II reagent grade water, transport the bottles to the site, handle like a sample, and return to the laboratory for analysis. One trip blank per sampling event is recommended.

- Equipment Rinsate Blank - To ensure that the non-dedicated sampling device has been effectively decontaminated (in the laboratory or field), fill the device with Type II reagent grade water or pump Type II reagent grade water through the device, transfer to sample bottle(s), and return to the laboratory for analysis. A minimum of one equipment blank for each day that ground-water monitoring wells are sampled is recommended.

Any contaminants found in the blanks could be attributed to 1) interaction between the sample and the container, 2) contaminated rinse water, or 3) a handling or laboratory procedure that alters the sample analysis results. The concentration levels of any contaminants found in the trip blank should not be subtracted from the ground-water data. The contaminant levels should be noted, and if the levels are within an order of magnitude when compared to the field sample results, the owner or operator should resample the ground water. The analytical results of the blanks should not be subtracted from the ground-water data. If contaminants are found in the blanks, the source of the contamination should be identified and corrective action, including resampling, should be initiated.

All field equipment that the owner or operator will use should be calibrated prior to field use and recalibrated in the field before measuring each sample. Other QA/QC practices, such as sampling equipment decontamination procedures and chain-of-custody procedures, should also be described.

Validation

The detection and reporting of leachate constituents by a laboratory does not necessarily mean the presence of the constituent is accurate or representative of water quality at the monitoring well. For example, acetone, toluene, 2-butanone, and methylene chloride are common sampling or laboratory contaminants (USEPA, 1988a) and are frequently but not always detected in method blanks. Typically, the laboratory results do not evaluate the significance of constituents found in quality control samples collected in the field (e.g., trip blanks, field duplicates, sampling equipment rinsate blanks, filtration blanks, preservative blanks). The laboratory report usually annotates constituents that were also detected in quality control samples (e.g., method blanks) prepared and analyzed by the laboratory. The laboratory report may or may not evaluate whether a reported result accurately represents the ground-water quality at the site.

Occasionally, the laboratory report includes results that do not comply with good laboratory practice or specific analytical performance criteria requirements (e.g., the USEPA Contract Laboratory Program Requirements). A comparison of laboratory performance to the requirements identified in the ground-water monitoring program should be conducted to establish the quality of the reported result.

To evaluate the quality of laboratory results, the USEPA has developed functional guidelines (USEPA, 1986a and b) for use with its CLP. These guidelines provide criteria which are used to evaluate analytical instrumentation, procedure, and reporting performance as well as to detect constituents in quality control samples.

In addition to the above data quality validation considerations, the consistency of the validated result with other information concerning that and other samples (i.e, QA/QC) and site conditions at the time of sampling should also be considered. These considerations should be addressed in the ground-water monitoring program. The detection of a constituent in a sample does not mean it is representative of the ground-water quality sampled. The result should be evaluated with respect to its appearance in background and other downgradient locations, consistent with hydrogeologic conditions, principles of chemical transport and fate, and landfill design and operations.

The validation procedures should be clearly stated in the ground-water monitoring program. These procedures should also include documentation. The result of the validation procedure should be an acceptable, or unacceptable classification of a specific result regarding its accuracy and representativeness. Occasionally, there is insufficient information to make such a classification and the result may be considered of provisional quality regarding whether it accurately represents ground-water quality. Classification of an acceptable or unacceptable result should be equally defensible. Classification of a result as provisional should provide for specific measures to establish its validity, if possible, and demonstrate how the result will be used in subsequent statistical analyses and evaluation of the monitoring results.

Documentation

The ground-water monitoring program required by §258.50 through §258.55 relies on documentation to demonstrate compliance. The operating record of the MSWLF should include a complete description of the program as well as periodic implementation reports.

At a minimum, the description of the ground-water monitoring program should include:

- Sampling and Analysis plan that details; sample parameters, sampling frequency, sample collection, preservation, and analytical methods to be used, shipping procedures, and chain-of-custody procedures;
- A Quality Assurance Project Plan (QAPjP);
- Monitoring well network of background and downgradient locations;
- Design, installation, development, and decommission of monitoring wells, piezometers, and other measurement, sampling, and analytical devices;
- Certified hydrogeologic description of site;
- Statistical methods to be used to evaluate ground-water monitoring data and demonstrated compliance with the performance standard;
- Approved demonstration that monitoring requirements are suspended (if applicable);
- Boring logs of sampling location for the groundwater monitoring program;
- Piezometer and well installation logs for the groundwater monitoring program.

5.9. STATISTICAL ANALYSIS 40 CFR §258.53 (g)-(i)

5.9.1 Statement of Regulation

(g) The owner or operator must specify in the operating record one of the following statistical methods to be used in evaluating groundwater monitoring data for each hazardous constituent. The statistical test chosen shall be conducted separately for each hazardous constituent in each well.

(1) A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of §258.53(h). The owner or operator must place a justification for this alternative in the operating record and notify the State Director of the use of this alternative test. The justification must demonstrate that the alternative method meets the performance standards of §258.53(h).

(h) Any statistical method chosen under §258.53(g) shall comply with the following performance standards, as appropriate:

(1) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or hazardous constituents. If the distribution of the chemical parameters or hazardous constituents is shown by the owner or operator to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.

(2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts.

(3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be

determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(4) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(5) The statistical method shall account for data below the limit of detection with one or more statistical procedures that are protective of human health and the environment. Any practical quantitation limit (PQL) that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.

(6) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

(i) The owner or operator must determine whether or not there is a statistically significant increase over background values for each parameter or constituent required in the particular groundwater monitoring program that applies to the MSWLF unit, as determined under §§258.54(a) or 258.55(a) of this part.

(1) In determining whether a statistically significant increase has occurred, the owner or operator must compare the groundwater quality of each parameter or constituent at each monitoring well designated pursuant to §258.51(a)(2) to the background value of that constituent, according to the statistical procedures and performance standards specified under paragraphs (g) and (h) of this section.

(2) Within a reasonable period of time after completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background at each monitoring well.

<u>5.9.2 Applicability</u>

The statistical analysis requirements are applicable to all existing units, new units, and lateral expansions of existing units that are required to conduct ground-water monitoring. The use of statistical procedures to evaluate monitoring data is to be used for the duration of the monitoring program inclusive of the post-closure care period.

The owner or operator must indicate in the operating record the statistical method that will be used in the analysis of ground-water monitoring results. The data objectives of the monitoring, in terms of the number of samples collected and the frequency of collection, must be consistent with the statistical method selected.

Several options for analysis of ground-water data are provided in the criteria. Other methods are not excluded if they can be shown to meet the performance standards. The approved methods include both parametric and non-parametric procedures which differ primarily in constraints placed by the statistical distribution of the data. Control chart, tolerance interval, and prediction interval approaches may also be applied.

The owner or operator must conduct the statistical comparisons between upgradient and downgradient wells after completion of each sampling event and receipt of validated data. The statistical procedure must conform to the performance standard of a Type I error level of no less than 0.01 for inter-well comparisons. Control chart, tolerance interval and prediction interval approaches must incorporate decision values which are protective of human health and the environment. Generally, this is meant to include a significance level of a least 0.05. Procedures to treat data below analytical method detection levels and seasonality effects must be incorporated prior to statistical analysis.

5.9.3 Technical Considerations

The rule requires facilities to evaluate ground-water monitoring data using a statistical method provided in §258.53(g) that meets the performance standard of §258.53(h). §258.53(g) contains a provision allowing for an alternative statistical method as long as the performance standards of §258.53(h) are met.

The requirements of §258.53(g) specify one of five statistical methods for evaluating ground-water monitoring data. One method should be specified for each constituent. While different methods may be selected for each constituent at new facilities, use of a method must be substantiated by demonstrating that the distribution of results obtained for that constituent is appropriate for that method (§258.53(h)). Selection of a specific method is described in the USEPA "Statistical Analysis of Ground-water Monitoring Data at RCRA Facilities - Interim Final Guidance" (USEPA, 1989). The methods include the following:

- Parametric analysis of variance (ANOVA);
- Rank based (non-parametric) ANOVA with multiple comparisons;
- Tolerance prediction interval;
- Control chart; and
- An alternative statistical method.

If an alternative method is used, then the State Director must be notified and a justification for its use must be placed in the operating record.

The statistical analysis methods chosen must meet performance standards specified under §258.53(h) including the following:

1) Applicability to actual distribution of the data;

2) Individual well comparisons to background ground-water quality or a

ground-water protection standard shall be done at a Type I error level no less than 0.01 or, if the multiple comparisons procedure is used, the experiment-wise error rate for each period shall be no less than 0.05;

3) If a control chart is used, the type of chart and associated parameter values shall be protective of human health and the environment;

4) The level of confidence and percentage of the population contained in an interval shall be protective of human health and the environment;

5) Account for data below the limit of detection (less than PQL) in a manner that is protective of human health and the environment; and, if necessary,

6) Account for seasonal and spatial variability and temporal correlation of the data.

These statistical analysis methods are to be used to determine whether a significant increase over background has occurred. A statistical analysis of monitoring data must occur after receiving validated results from each sampling and analysis event.

The statistical performance standards provide a means to limit the possibility of making false conclusions from the monitoring data. The specified error level of 0.01 for individual well comparisons for probability of Type I error (indication of contamination when it is not present, or false positive) essentially means that the analysis is predicting with 99 percent confidence that no significant increase in contaminant levels is evident. The corollary to this is that the there is only a 1 percent chance that a Type II error (failure to detect a significant increase in constituent concentration, or false negative) has occurred. Non-detected results must be treated in an appropriate manner or their influence on the statistical method may invalidate the statistical conclusion. Further discussion of non-detected results is found later in this section. In addition to the statistical guidance provided by USEPA (1989), the following references may be useful for selecting other methods (Dixon and Massey, 1969; Gibbons, 1976; Aitchison and Brown, 1957; and Gilbert, 1987).

Multiple Well Comparisons

The goal of monitoring well placement is to provide representative samples of water quality both upgradient and downgradient of the landfill. In this manner, changes in the quality of ground-water passing under the landfill can be determined. If more than two wells (upgradient and downgradient combined) are screened in the same stratigraphic unit then the appropriate comparison method is a multiple well comparison using analysis of variance or ANOVA. The analysis of variance test compares the average concentration among wells to determine if they are from the same continuous distribution. The ANOVA test includes both parametric and nonparametric procedures. Chemical data from ground-water tend to follow a log normal distribution (USEPA,1989) and such data usually need to be transformed prior to applying a parametric ANOVA procedure. By taking a log transformation, such data will generally be converted to a normal distribution. By applying a chi-squared procedure, probability plots or other normality tests on the residuals (errors) from the ANOVA procedure the normality of the transformed data can be determined. In addition, the variance of data from each well in the comparison must be approximately equivalent; this condition can be checked using Bartlett's test. Both Bartlett's test and four normality tests are presented in USEPA (1989).

If the transformed test data do not conform to the normality assumption, a nonparametric ANOVA procedure should be used. The nonparametric statistical procedures are not dependent on the mathematical properties of a specified distribution. The non-parametric equivalent to the parametric ANOVA is called the Kruskall-Wallis test which uses ranking methods to compare the data.

If the data display seasonality (consistent time dependent increases or decreases in parameter values), a two-way ANOVA procedure should be used. If the seasonality can be corrected, a one way ANOVA procedure may still be appropriate. Methods to treat seasonality are described in USEPA (1989).

ANOVA procedures determine whether different wells have significantly different concentrations of hazardous constituents. Contrasts are used to investigate where differences occur. ANOVA procedures are followed by multiple comparisons procedures that are used to discriminate between wells showing significant differences. This procedure must test the contrast between the mean value of each monitoring parameter for the background to the compliance well. Thus the Type I experiment wide error of the ANOVA test must be at a significance level of no less than 0.05 with a significance level of 0.01 for individual well comparisons. For limitations on multiple comparison tests when more than five compliance wells are used, refer to USEPA (1989).

If data show little variability between upgradient and downgradient wells, other methods, including tolerance intervals and prediction intervals, may be used in place of analysis of variance. These methods may be especially appropriate where the site geology is very homogeneous. Both methods are similar and consist of constructing confidence intervals about the mean of the background well data. The confidence interval should be one-sided since the objective of monitoring is to detect significant changes that are greater than the background mean. The confidence level should set to 95 percent. These methods are discussed also in USEPA (1989).

Individual Well Comparisons

Sites with complex geology may have stratigraphic units which are monitored by only one background and one downgradient well. Under these conditions the ANOVA procedure, which requires a minimum of three wells, may not be used. In these instances, other statistical methods would be required to compare background and compliance data.

A number of statistical procedures can be found in any basic statistic reference, for the comparison of means where variances are equal or where variances are unequal. The distribution assumptions of the method selected must be satisfied by the distribution of the data, and the confidence level should be no less than 95 percent for a Type I error. Methods selected for single well comparisons must be recorded and justified in the facility operating records.

Intra-well Comparisons

Intra-well comparisons, where data of one well is evaluated over time, are useful in evaluating trends in individual wells and for identifying seasonal effects in the data. The intra-well comparison methods do not constitute compliance with evaluating background data to compliance data. Some existing facilities may not have valid background data. Intra-well comparisons may represent the only valid comparison available. For example, a facility constructed on a hilltop with radial groundwater flow around the facility, may not have an upgradient well. If the geology is not similar nearby, it may not be able to clearly establish background ground-water quality from adjacent wells. A significant positive trend in the data from a downgradient monitoring well may provide sufficient evidence to conclude that the landfill unit is affecting the well. Such trends should be evident in several parameters since contaminant migration from a landfill will result in an influx of multiple constituents into the groundwater flow system. During initial rounds of groundwater monitoring, seasonal effects should not be misconstrued for either positive or negative trends. In the absence of a true background well, several monitoring events may be required to determine trends and seasonal fluctuations in groundwater quality.

Control charts may be used for intra-well comparisons but are only appropriate for uncontaminated wells. If a well is intercepting a release, then it is already in an out-of-control state which violates the principal assumption underlying control chart procedures. Time series analysis (plotting concentrations over time) is extremely useful for identifying trends in monitoring data. Such data may be adjusted for seasonality effects to aid in assessing the degree of change over time. Guidance for intra-well comparison techniques and limitations of the techniques are provided in USEPA (1989).

Treatment of Non-Detections

The treatment of data below the detection limit of the analytical method used is dependent upon the number or percentage of non-detections (NDs) and the statistical method employed. If a large proportion (greater than 50%) are present, a professional statistician should be consulted. USEPA (1989) provides general guidance on this topic which is briefly summarized here.

If the amount of data below detection is less than 15 percent, these data may be substituted with values of 1/2 of the reported method detection limit (MDL/2) or 1/2 the methods practical quantitation limit (PQL/2). If more than 15 percent of the data are Nds then nonparametric test procedures are recommended for evaluating the monitoring data. The nonparametric methods will treat the NDs values as ties; this procedure is less sensitive to error than equivalent parametric methods. For NDs which represent greater than 50 percent of the data, the test of proportions should be used. The test of proportions is used to identify what number of detections in a compliance well, relative to the background well, is an indication of a statistically significant increase. These and other methods of handling non-detection data are discussed in USEPA (1989).

Comparisons to Regulatory Limits

If ground-water data must be evaluated to determine whether a parameter has exceeded a regulatory limit (e.g., an MCL), a confidence interval approach based on the distribution of the compliance well data, should be used. The confidence interval is designed to contain the true mean of the data with a specified level of confidence (generally 99 percent at the lower limit). The lower limit is then compared to the regulatory value and if the lower limit is larger, it is considered significant evidence that the regulatory level has been exceeded.

The data or log transformations of the raw data must meet normality assumptions if the student t-distribution is used. If nonparametric methods are employed, a minimum of seven independent data values must be available from a sampling event that is not effected by seasonality. Other distributions may be used to create the confidence interval so long as the data follow the assumed distribution. For further guidance refer to USEPA (1989).

5.10 DETECTION MONITORING PROGRAM 40 CFR §258.54

5.10.1 Statement of Regulation

(a) Detection monitoring is required at MSWLF units at all groundwater monitoring wells defined under §§258.51(a)(1) and (a)(2) of this part. At a minimum, a detection monitoring program must include the monitoring for the constituents listed in Appendix I of this part.

1) The Director of an approved State may delete any of the Appendix I monitoring parameters for a MSWLF unit if it can be shown that the removed constituents are not reasonably expected to be in or derived from the waste contained in the unit.

2) The Director of an approved State may establish an alternative list of inorganic indicator parameters for a MSWLF unit, in lieu of some or all of the heavy metals (constituents 1-15 in Appendix I), if the alternative parameters provide a reliable indication of inorganic releases from the MSWLF unit to the ground water. In determining alternative parameters, the Director shall consider the following factors:

(i) The types, quantities, and concentrations of constituents in wastes managed at the MSWLF unit;

(ii) The mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the MSWLF unit;

(iii) The detectability of indicator parameters, waste constituents, and reaction products in the ground water; and

(iv) The concentration or values and coefficients of variation of monitoring parameters or constituents in the ground-water background.

(b) The monitoring frequency for all constituents listed in Appendix I, or the alternative list approved in accordance with paragraph (a)(2), shall be at least semiannual during the active life of the facility (including closure) and the post-closure period. A minimum of four independent samples from each well (background and downgradient) must be collected and analyzed for the Appendix I constituents, or the alternative list approved in accordance with paragraph (a)(2), during the first semiannual sampling event. At least one sample from each well (background and downgradient) must be collected and analyzed during subsequent semiannual sampling events. The Director of an approved State may specify an appropriate alternative frequency for repeated sampling and analysis for Appendix I constituents, or the alternative list approved in accordance with paragraph (a)(2), during the active life (including closure) and the post-closure care period. The alternative frequency during the active life (including closure) shall be no less than annual. The alternative frequency shall be based on consideration of the following factors:

1) Lithology of the aquifer and unsaturated zone;

2) Hydraulic conductivity of the aquifer and unsaturated zone;

3) Ground-water flow rates;

4) Minimum distance between upgradient edge of the MSWLF unit and downgradient monitoring well screen (minimum distance of travel); and

5) Resource value of the aquifer.

(c) If the owner or operator determines, pursuant to §258.53(g) of this part, that there is a statistically significant increase over background for one or more of the constituents listed in Appendix I or the alternative list approved in accordance with paragraph (a)(2), at any monitoring well at the boundary specified under §258.51(a)(2), the owner or operator:

(1) Must, within 14 days of this finding, place a notice in the operating record indicating which constituents have shown statistically significant changes from background levels, and notify the State Director that this notice was placed in the operating record; and

(2) Must establish an assessment monitoring program meeting the requirements of §258.55 of this part within 90 days, except as provided for in paragraph (3) below.

(3) The owner/operator may demonstrate that a source other than a MSWLF unit caused the contamination or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by a qualified groundwater scientist or approved by the Director of an approved State and be placed in the operating record. If a successful demonstration is made and documented, the owner or operator may continue detection monitoring as specified in this section. If after 90 days, a successful demonstration is not made, the owner or operator must initiate an assessment monitoring program as required in §258.55.

<u>5.10.2 Applicability</u>

Except for the small landfill exemption and the no migration demonstration, detection monitoring is required at existing MSWLF units, lateral expansions, and new MSWLF units. Monitoring must occur at least semiannually at both background wells and downgradient well locations. Monitoring parameters must include all Appendix I constituents unless an alternative list has been established by the Director of an approved State.

The first semiannual monitoring event must include four independent samples which are analyzed for all constituents in the Appendix I or alternative list. Each subsequent semiannual event must include, at a minimum, the collection and analysis of one sample from all wells. The Director of an approved State may specify an alternative sampling frequency. The monitoring requirement continues throughout the active life of the landfill and the post-closure care period.

If an owner or operator determines that a statistically significant increase over background has occurred for one or more Appendix I constituents (or constituents on an alternative list), a notice must be placed in the facility operating record. The owner or operator must notify the State Director within 14 days of the finding. Within 90 days the owner or operator must establish an assessment monitoring program in conformance to the requirements of §258.55.

If evidence exists that a statistically significant increase is due to factors unrelated to the unit, the owner or operator may make a demonstration to this effect to the Director of an approved State or place a certified demonstration in the operating record. The potential reasons for an apparent statistical increase may include:

- A source other than the landfill;
- A seasonal fluctuation in the data;
- An analytical error;
- A statistical error; or
- A sampling error.

The demonstration that one of these reasons is responsible for the statistically significant increase from background must be certified by a qualified groundwater scientist or approved by the Director of an approved State. If a successful demonstration is made and documented, the owner or operator may continue detection monitoring.

If a successful demonstration is not made within 90 days, the owner or operator must initiate an assessment monitoring program. A flow chart for detection monitoring program is provided in Figure 5-5.

5.10.3 Technical Considerations

If there is a statistically significant increase over background during detection monitoring for one or more constituents listed in Appendix I of Part 258, the owner or operator is required to begin assessment monitoring. This "trigger" for Phase II monitoring is based on Appendix I constituents only. The trigger will not change even if the Director of an approved State allows the use of geochemical parameters in lieu of some or all of the heavy metals. In the situation where an owner or operator suspects that a statistically significant increase in a geochemical parameter is caused by temporal or spatial variability, the owner or operator will have to demonstrate that the increase was due to natural variation to avoid proceeding to assessment monitoring.

Alternate List

There are situations where an alternate list of inorganic parameters may be established. In these cases, the inorganic parameters would be used in place of some or all of the heavy metals (Parameters 1 through 15) in Appendix I. These alternate parameters must provide a reliable indication of inorganic releases from the MSWLF unit to ground-water.

The types, quantities, and concentrations of wastes managed at the MSWLF unit play an important role in determining whether or not an alternative list of parameters would be appropriate. If an owner or operator has definite knowledge of the nature of wastes accepted, then an alternative list may be acceptable. Usually a waste would have to be homogeneous for this type of knowledge. A demonstration could be submitted that documents the presence or absence of different constituents.

A potential problem in substituting geochemical parameters for metals on the alternate list is that many of the alternate inorganic parameters are naturally occurring. As a result, there is a possibility that relying on these parameters may falsely indicate releases. However, elevated levels of these parameters have been shown to indicate releases from MSWLFs. Using alternate inorganic parameters is reasonable in cases where natural background levels are not high enough to mask the detection of a statistically significant increase. Using alternate parameters would also be acceptable when there is minimal natural spatial and temporal variability in the background parameters.

The alternate list may only be granted by an approved State on a site-specific basis, because ground-water chemistry may vary from site to site. The alternative list may contain both metals and geochemical parameters. Complete replacement of metals with geochemical parameters may

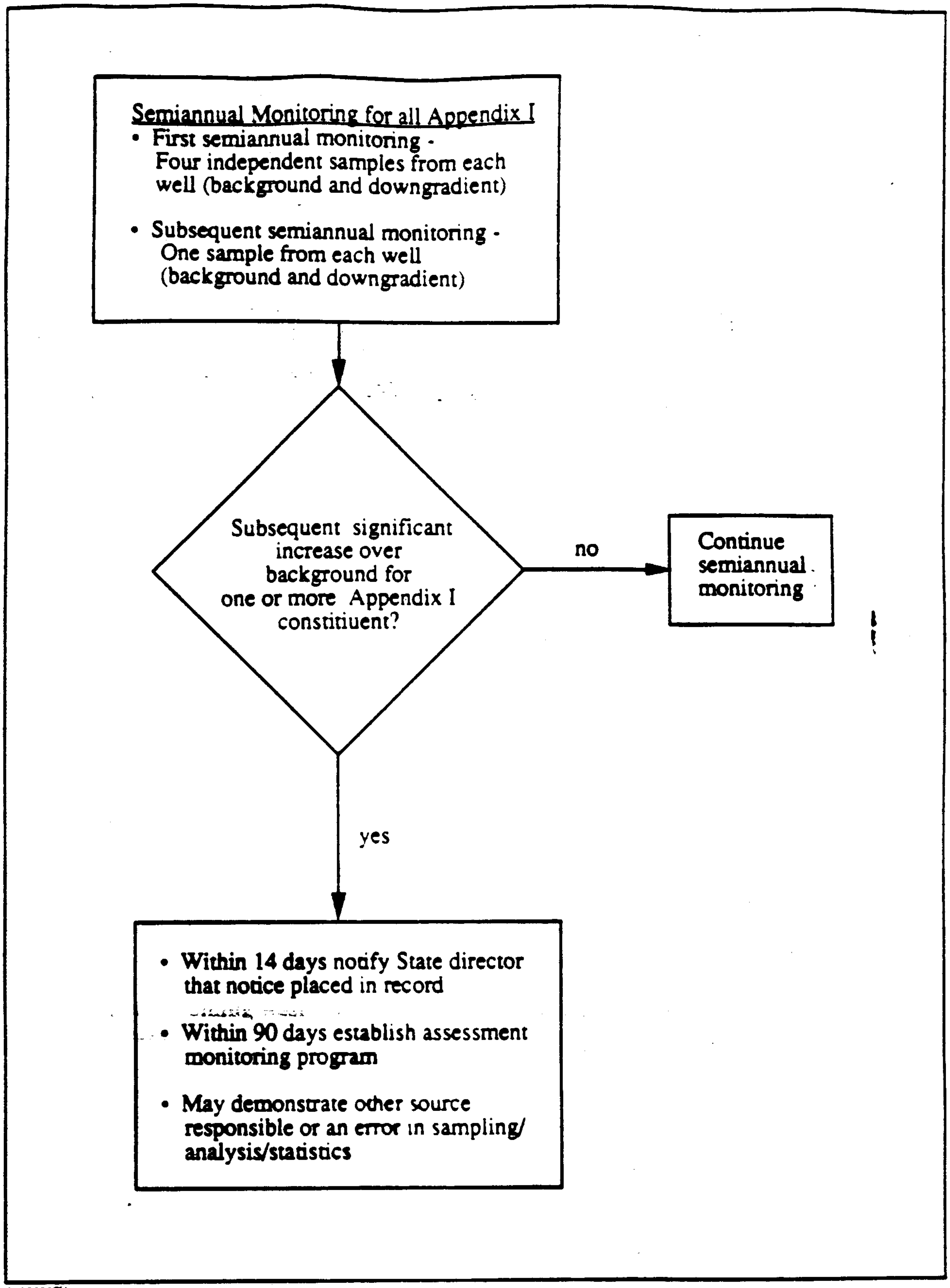


FIGURE 5-5
DETECTION MONITORING PROGRAM

not be protective in all cases. The option of establishing an alternate list applies only to Parameters 1 through 15 of Appendix I. The alternate list does not allow removal of the volatile organic compounds (Appendix I, Parameters 16 through 62).

Alternative Frequency

In approved States, 40 CFR § 258.54(b) allows the Director to specify an alternative frequency for ground-water monitoring. The alternative frequency is applicable during the active life, including closure, and the post-closure period. The alternative frequency can be no less than annual.

The option to have an alternative frequency was based on the variability of geologic settings encountered nationally. For example, for MSWLFs located in an area with low ground-water flow rates, it may be necessary to monitor ground-water less frequently. The flow rate is dependent on the lithology and hydraulic conductivities of the aquifer. An aquifer with a high clay content has a lower hydraulic conductivity than a sand and gravel aquifer. In this case a reduced frequency may be appropriate.

Contaminant transport rates can be significant in the unsaturated zone as well. Releases in the unsaturated zone follow preferential flow paths. The releases may be further mobilized by wetting events, thus providing recharge to the aquifer.

The need to vary monitoring frequency must be evaluated on a site-specific basis. The sampling frequency chosen must be sufficient to protect human health and the environment. Depending on the ground-water flow rate, and the resource value of the aquifer, less frequent monitoring may be allowable or more frequent monitoring may be necessary. Because of these reasons, an approved State may specify an alternative frequency for repeated sampling and analysis of Appendix I constituents based on:

1) Lithology of the aquifer and the unsaturated zone;

2) Hydraulic conductivity of the aquifer and the vadose zone;

3) Ground-water flow rates;

4) Minimum distance between the upgradient edge of the MSWLF unit and the downgradient well screen; and

5) The resource value of the aquifer.

Approved States also can set alternative frequencies for monitoring during post closure based on the same factors. This alternative frequency for ground-water monitoring must be evaluated on a site-specific basis.

Notification

The notification requirement under 40 CFR § 258.54(c) requires an owner or operator to place a notice in the operating record that indicates which constituents have shown statistically significant increases and to notify the State Director that the notice was placed in the operating record. The constituents can be from either Appendix I or from an alternate list.

Demonstrations of Other Reasons For Statistical Increase

An owner or operator is allowed 90 days to demonstrate that the statistically significant increase was caused by errors or by a source other than the landfill. The demonstration allowed in § 258.54(c)(3) may include:

1) A demonstration that the increase results from an alternate source;

2) An evaluation that geologic material caused the increase (i.e., filtered versus unfiltered results);

3) A comprehensive audit of sampling, laboratory, and evaluation procedures; and

4) Resampling and analysis to verify the presence and concentration of the constituents that changed.

A demonstration, that the change is the result of a source other than the MSWLF, should include:

- Existence of an alternate source;
- Existence of a hydrogeologic transport flow path and regime from the alternative source to the well with the significant change;
- Presence of the constituent(s) (or precursor constituents) and other possible compounds at the alternate source or along the transport flow path prior to possible release from the MSWLF;
- Relative concentration and distribution of constituents in the zone of contamination should be more strongly linked to the alternate source than to the MSWLF when the fate and transport characteristics of the constituents are considered;
- The concentration observed in groundwater could not have resulted from the MSWLF given the waste constituents and concentrations in the MSWLF leachate and wastes, and site hydrogeologic conditions;
- Historic consistency of alternate source with hydrogeologic conditions and findings of the monitoring program.

The demonstration must be documented, certified by a qualified groundwater scientist, and placed in the operating record of the facility.

Demonstrations of Other Sources of Error

A successful demonstration that the statistically significant change is the result of an error in sampling, analysis, or data validation may include the following:

- Clear indication of transcription or calculation error from analysis;
- Clear indication of a systematic error in analysis or data reduction;
- Resampling, analysis, and evaluation results; and

- Taking corrective measures to prevent the recurrence of the error and incorporating these measures into the groundwater monitoring program.

If resampling is necessary, the sample taken must be independent of the previous sample. More than one sample may be required to substantiate the contention that the original sample was not representative of the groundwater quality in the affected well(s).

5.11 ASSESSMENT MONITORING PROGRAM 40 CFR §258.55(a)-(f)

5.11.1 Statement of Regulation

(a) Assessment monitoring is required whenever a statistically significant increase over background has been detected for one or more of the constituents listed in Appendix I or in the alternate list approved in accordance with § 258.54(a)(2).

(b) Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator must sample and analyze the groundwater for all constituents identified in Appendix II of this part. A minimum of one sample from each downgradient well must be collected and analyzed during each sampling event. For any new constituent detected in the downgradient wells as a result of the complete Appendix II analysis, a minimum of four independent samples from each well (background and downgradient) must be collected and analyzed to establish background for the new constituents. The Director of an approved State may specify an appropriate subset of wells to be sampled and analyzed for Appendix II constituents during assessment monitoring. The Director of an approved State may delete any of the Appendix II monitoring parameters for a MSWLF unit if it can be shown that the removed constituents are not reasonably expected to be contained in or derived from the waste contained in the unit.

(c) The Director of an approved State may specify an appropriate alternate frequency for repeated sampling and analysis for the full set of Appendix II constituents required by §258.55(b) of this part, during the active life (including closure) and post-closure care of the unit considering the following factors:

(1) Lithology of the aquifer and unsaturated zone;

(2) Hydraulic conductivity of the aquifer and unsaturated zone;

(3) Groundwater flow rates;

(4) Minimum distance between upgradient edge of the MSWLF unit and downgradient monitoring well screen (minimum distance of travel);

(5) Resource value of the aquifer; and

(6) Nature (fate and transport) of any constituents detected in response to this section.

(d) After obtaining the results from the initial or subsequent sampling events required in paragraph (b) of this section, the owner or operator must:

(1) Within 14 days, place a notice in the operating record identifying the Appendix II constituents that have been detected and notify the State Director that this notice has been placed in the operating record;

(2) Within 90 days, and on at least a semiannual basis thereafter, resample all wells specified by § 258.51(a) conduct analyses for all constituents in Appendix I to this Part or in the alternative list approved in accordance with §258.54(a)(2), and for those constituents in Appendix II that are detected in response to paragraph (b) of this section and record their concentrations in the facility operating record. At least one sample from each well (background and downgradient) must be collected and analyzed during these sampling events. The Director of an approved State may specify an alternative monitoring frequency during the active life (including closure) and the post closure period for the constituents referred to in this paragraph. The alternative frequency for Appendix I constituents or the alternate list approved in accordance with §258.54(a)(2) during the active life (including closure) shall be no less than annual. The alternative frequency shall be based on consideration of the factors specified in paragraph (c) of this section;

(3) Establish background concentrations for any constituents detected pursuant to paragraphs (b) or (d)(2) of this section; and

(4) Establish groundwater protection standards for all constituents detected pursuant to paragraph (b) or (d)(2) of this section. The ground-water protection standards shall be established in accordance with paragraphs (h) or (i) of this section.

(e) If the concentrations of all Appendix II constituents are shown to be at or below background values, using the statistical procedures in §258.53(g), for two consecutive sampling events, the owner or operator must notify the State Director of this finding and may return to detection monitoring.

(f) If the concentrations of any Appendix II constituents are above background values, but all concentrations are below the groundwater protection standard established under paragraphs (h) or (i) of this section, using the statistical procedures in §258.53(g), the owner or operator must continue assessment monitoring in accordance with this section.

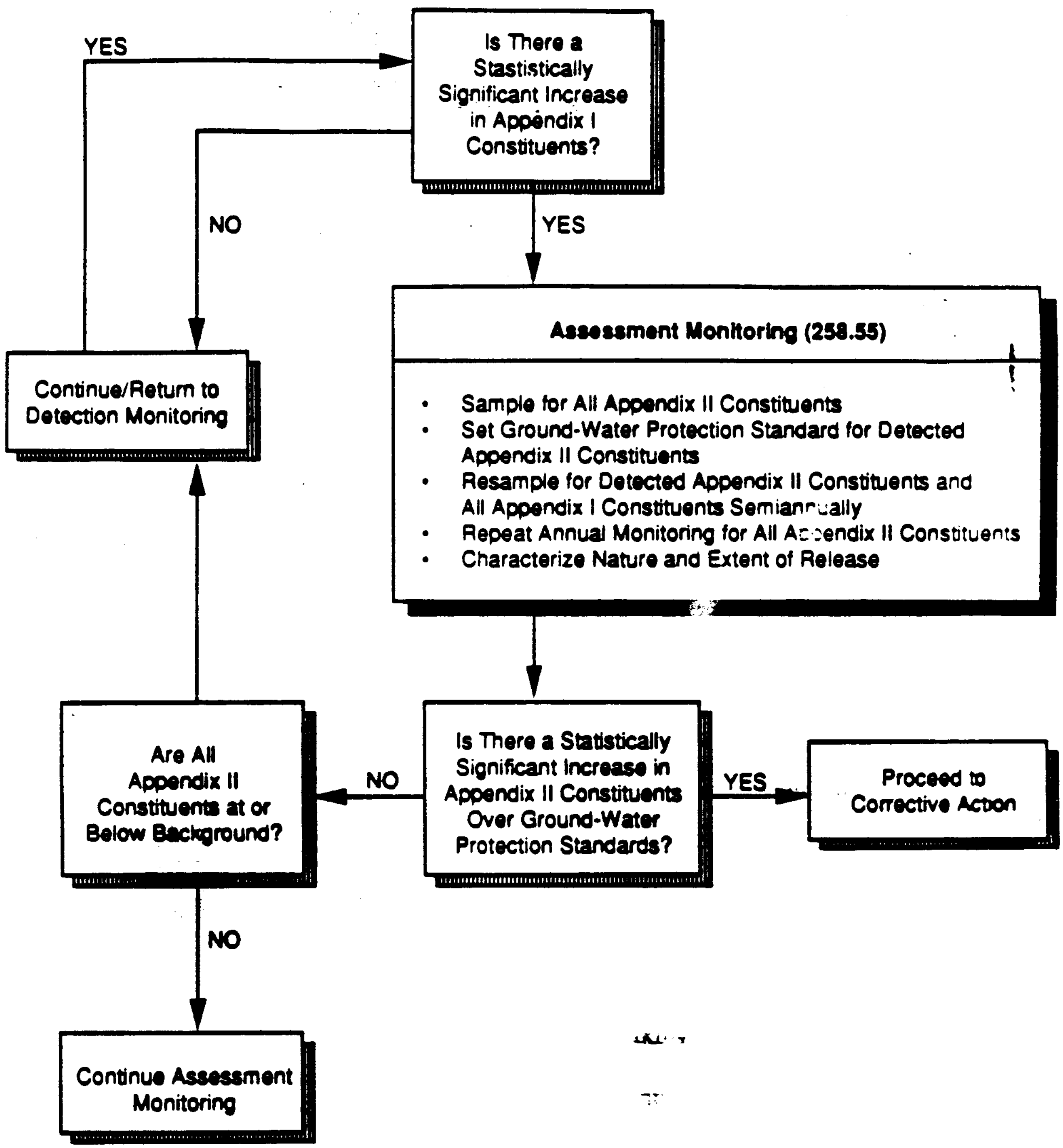
5.11.2 Applicability

Assessment monitoring is required at all existing units, lateral expansions, and new facilities whenever any of the constituents listed in Appendix I are detected at a concentration which is a statistically significant increase over background. A flow chart pertaining to applicability requirements is presented as Figure 5-6.

Within 90 days of beginning assessment monitoring, the owner or operator must resample all downgradient wells and analyze the samples for all Appendix II constituents. If any new Appendix II constituents are identified in this process, four independent samples must be collected from all upgradient and downgradient wells and analyzed for those

Figure 5 - 6

ASSESSMENT MONITORING



new constituents to establish background. The Appendix II constituents must be monitored in each well annually for the duration of assessment monitoring program. In an approved State, the Director may reduce the number of Appendix II constituents to be analyzed if it can be reasonably shown that those constituents are not present in the wastes and the leachates derived from the wastes.

The Director of an approved State may specify an alternate frequency for repeated sampling and analysis of Appendix II constituents. This frequency may be decreased or increased pending consideration of the factors in §258.55(c)(1)-(6).

After initial assessment sampling, the owner or operator must place the results in the operating record and notify the State Director that this notice has been placed in the operating record. Within 90 days of receiving these initial results the owner or operator must resample all wells for all Appendix I and Appendix II constituents. This combined list of constituents must be sampled at least semiannually thereafter and the list must be updated to include any newly detected Appendix II constituents annually.

Within the 90 day period, the owner or operator must establish background values and groundwater protection standards (GWPS) for all Appendix II constituents detected. The requirements for determining GWPS are provided in §258.56(h). If the concentrations of all Appendix II constituents are below the background values after two independent, consecutive sampling events, the owner or operator may return to detection monitoring after notification has been made to the State Director. If after these two sampling events, any detected Appendix II constituent is statistically above background, the assessment monitoring program must be continued.

5.11.3 Technical Considerations

The purpose of assessment monitoring is to evaluate whether specific waste constituents, in addition to those identified during detection monitoring, are present at statistically significant levels above background to establish GWPS for each constituent that is detected, and to evaluate if the GWPS is exceeded. If a GWPS criterion is exceeded, the State and downgradient land owners are notified, the nature and extent of the release characterized, and corrective measures in accordance with 40 CFR §258.56 are assessed. The assessment monitoring program is phased. The first phase assesses the presence of additional assessment monitoring constituents (Appendix II or an alternate list designated by an approved State) in all downgradient wells. If concentrations of all Appendix II constituents are at or below background using the statistical procedures in §258.53(g) for two consecutive sampling periods, then the owner or operator can return to detection monitoring.

Following notification of a statistically significant increase of any Appendix I constituent above background, the owner or operator has 90 days to develop and implement the assessment monitoring program. Implementation of the program involves sampling monitoring wells for groundwater passing the relevant point of compliance for the unit (i.e., the management unit boundary or alternative boundary specified by an approved State). Downgradient wells are identified in §258.51(a)(2). Initiation of assessment monitoring does not end the detection monitoring program. §258.55(b) specifies that the Appendix I constituents must continue to be analyzed for at least semiannually. Within the 90 day period the owner or operator must collect at least one sample from each downgradient well and analyze the samples for the Appendix II parameters. If a downgradient well shows detectable quantities of a new Appendix II constituent, four independent samples must be collected from all background and downgradient wells to establish background for the new constituent(s). The date, well locations, parameters detected, and their concentrations must be documented in the operating record of the facility, and the State Director must be notified within 14 days of the initial detection of Appendix II parameters. On a semiannual basis thereafter, both background and downgradient wells must be sampled for all Appendix II constituents.

Alternate List

In an approved State, the Director may delete Appendix II parameters that the owner or operator can demonstrate would not be anticipated at the facility. A demonstration would be based on a characterization of the wastes contained in the unit and an assessment of the leachate constituents. Additional information on the alternate list can be found in Section 5.10.3.

Alternate Frequency

The Director of an authorized State may specify an alternate sampling frequency, other than semiannually, for both the active and post-closure periods of the facility. A change in the monitoring frequency must take into account the fate and transport of constituents in groundwater, including the rate of transport and the distance (or time) from the upgradient side of the landfill to the closest monitoring well. Specifically these factors include:

1) Lithology of the aquifer and unsaturated zone;

2) Hydraulic conductivity of the aquifer and unsaturated zone;

3) Groundwater flow rates;

4) Minimum distance of travel (between the MSWLF unit edge to downgradient monitoring wells); and

5) Nature of the detected constituents.

The monitoring frequency must be sufficient to allow early detection of ground-water contamination. If contamination is detected early, the volume of ground-water actually contaminated and the required remedial response will be smaller. The frequency of monitoring may, after a successful demonstration, be reduced in groundwater systems with relatively slow flow rates (clays, tills). Additional information on the alternate frequency can be found in Section 5.10.3.

If a facility is conducting an assessment monitoring program, it may return to detection monitoring if it can be shown that detected assessment constituents are statistically below background. The statistical procedures must be in accordance with §258.53(g). If the concentrations of any Appendix II constituent is above established background, but below the ground-water protection standard for that parameter, the owner or operator must continue assessment monitoring.

5.12 ASSESSMENT MONITORING PROGRAM 40 CFR §258.55(g)

5.12.1 Statement of Regulation

(g) If one or more Appendix II constituents are detected at statistically significant levels above the groundwater protection standard established under paragraphs (h) or (i) of this section in any sampling event, the owner or operator must, within 14 days of this finding, place a notice in the operating record identifying the Appendix II constituents that have exceeded the groundwater protection standard and, notify the State Director and all appropriate local government officials that the notice has been placed in the operating record. The owner or operator also:

(1) (i) Must characterize the nature and extent of the release by installing additional monitoring wells as necessary;

(ii) Must install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with §258.55(d)(2);

(iii) Must notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site if indicated by sampling of wells in accordance with §258.55(g)(i); and

(iv) Must initiate an assessment of corrective measures as required by §255.56 of this part within 90 days; or

(2) May demonstrate that a source other than a MSWLF unit caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by a qualified groundwater scientist or approved by the Director of an approved State and placed in the operating record. If a successful demonstration is made the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to §258.55, and may return to detection monitoring if the Appendix II constituents are below background as specified in §258.55(e). Until a successful demonstration is made, the owner or operator must comply with §258.55(g) including initiating an assessment of corrective measures.

5.12.2 Applicability

This requirement applies to facilities in assessment monitoring and is applicable during the active life, closure and post-closure care.

5.12.3 Technical Considerations

If an Appendix II constituent(s) exceeds a groundwater protection standard (GWPS) the owner or operator must notify the State Director within 14 days and place a notice of these findings in the operating record of the MSWLF facility. In addition, the owner or operator must:

1) Characterize the lateral and vertical extent of the release or plume by installing and sampling an appropriate number of additional monitoring wells;
2) Install at least one additional well downgradient at the facility property boundary in the path of the contaminant plume and sample that well for all Appendix II compounds initially, and thereafter in conformance with the frequency of the monitoring program;
3) Notify all property owners whose land overlies the suspected plume if the sampling of any property boundary well(s) indicates that contaminants have migrated off-site;
4) Initiate an assessment of corrective measures as required by §258.56 within 90 days.

In assessment monitoring, the owner or operator may demonstrate that a source other than the MSWLF caused the contamination or that the statistically significant increase was the result of an error in sampling, analysis, statistical evaluation, or natural variation in ground-water quality. Factors that may influence exceeding a GWPS are given at §258.55(g)(2). The demonstration must be certified by a qualified groundwater scientist or approved by the Director of an approved State. Until a successful demonstration is made, the owner or operator must comply with §258.55(g) and initiate assessment of corrective measures. If the demonstration is successful, the monitoring may return to the detection program provided that no Appendix II constituent is at or above background for two consecutive sampling periods. More detailed information regarding additional wells can be found under Plume Delineation in Section 5.13.2.

Release Investigation

If the GWPS is exceeded, a series of actions must be taken. These actions are described in the next several paragraphs. The owner or operator must investigate the extent of the release by installing additional monitoring wells and obtaining additional groundwater samples. The investigation should identify plume geometry both laterally and vertically. Prior to such field activities, records of site operation and maintenance activities should be reviewed to identify possible release locations within the landfill and whether such releases are expected to be transient (e.g., one time release due to repaired liner) or long-term. Due to the presence of dissolved ionic constituents such as iron, magnesium, calcium, sodium, potassium, chloride, sulfate, and carbonate typically associated with MSWLF leachates, geophysical techniques such as resistivity and terrain conductivity may be useful in defining the plume. The nature of the release should describe the rate and direction of migration, the chemical and physical characteristics, and to the extent available, the cause of the release.

Property Boundary Monitoring Well

At least one monitoring well must be installed at the facility boundary in the direction of contaminant migration. Additional wells may be required to delineate the plume. The monitoring well at the facility boundary must be screened to monitor all stratigraphic units which could be preferential flow paths for contaminant transport in the uppermost aquifer. This, in some cases, may require installation of nested wells or individual wells screened in several discrete intervals. The boundary well must be sampled semiannually, or at an alternate frequency determined by the Director of an approved State. The samples must be analyzed for all Appendix II constituents that have been detected in the wells located at the unit or alternate boundary.

Notification of Adjoining Residents and Property Owners

If ground-water monitoring indicates that contamination has moved off-site, the owner or operator must notify property owners or residents whose land surface overlies any part of the contaminant plume. While the requirement does not describe the contents of the notice, it is expected that the notice could include the following:

- Date of detected release;
- Chemical composition of release;
- Reference to the constituent, reported concentration, and the GWPS;
- People at the MSWLF with whom to discuss the finding, including telephone numbers;
- Plans and schedules for future activities; and
- Interim recommendations or remedies to protect human health and the environment.

Demonstrations of Other Sources of Error

The owner or operator may demonstrate that the source of contamination was not the MSWLF. Considerations are discussed in Section 5.10.3.

Return to Detection Monitoring

A facility conducting assessment monitoring may return to detection monitoring if the concentrations of all Appendix II constituents are at or below background, using the statistical procedures in §258.53(g) for two consecutive sampling periods. The requirement for two consecutive sampling events will reduce the possibility of false negatives. False negatives occur when monitoring fails to detect contamination or an increase in a concentration of a hazardous constituent. By requiring a specific time period, the self implementing structure of the rule is provided.

5.13 ASSESSMENT MONITORING PROGRAM 40 CFR §258.55(h)-(j)

5.13.1 Statement of Regulation

(h) The owner or operator must establish a groundwater protection standard for each Appendix II constituent detected in the groundwater. The groundwater protection standard shall be:

(1) For constituents for which a maximum contaminant level (MCL) has been promulgated under Section 1412 of the Safe Drinking Water Act (codified) under 40 CFR Part 141, the MCL for that constituent;

(2) For constituents for which MCLs have not been promulgated, the background concentration for the constituent established from wells in accordance with §258.51(a)(1); or

(3) For constituents for which the background level is higher than the MCL identified under subparagraph (1) above or health based levels identified under §258.55(i)(1), the background concentration.

(i) The Director of an approved State may establish an alternative groundwater protection standard for constituents for which MCLs have not been established.

These groundwater protection standards shall be appropriate health based levels that satisfy the following criteria:

(1) The level is derived in a manner consistent with Agency guidelines for assessing the health risks of environmental pollutants (51 FR 33992, 34006, 34014, 34028);

(2) The level is based on scientifically valid studies conducted in accordance with the Toxic Substances Control Act Good Laboratory Practice Standards (40 CFR Part 792) or equivalent;

(3) For carcinogens, the level represents a concentration associated with an excess lifetime cancer risk level (due to continuous lifetime exposure) with the 1×10^{-4} to 1×10^{-6} range; and

(4) For systemic toxicants, the level represents a concentration to which the human population (including sensitive subgroups) could be exposed to on a daily basis that is likely to be without appreciable risk of deleterious effects during a lifetime. For purposes of this subpart, systemic toxicants include toxic chemicals that cause effects other than cancer or mutation.

(j) In establishing groundwater protection standards under paragraph (i), the Director of an approved State may consider the following:

(1) Multiple contaminants in the groundwater;

(2) Exposure threats to sensitive environmental receptors; and

(3) Other site-specific exposure or potential exposure to groundwater.

5.13.2 Applicability

The criteria are applicable to all facilities conducting assessment monitoring where any Appendix II constituents have been detected. The owner or operator must establish a GWPS for each detected Appendix II constituent.

If the constituent has a promulgated maximum concentration limit (MCL), then the GWPS is the MCL. If no MCL has been published for a given Appendix II constituent, the background concentration of the constituent becomes the GWPS. In cases where the background concentration is higher than a promulgated MCL, the GWPS is set at the background level.

In approved States, the Director may establish an alternate GWPS for constituents for which MCLs have not been established. Any alternative GWPS should incorporate health based data and consider the factors in §258.55(j).

5.13.3 Technical Considerations

For each assessment constituent detected above background, a GWPS must be established. The GWPS are intended to represent the achievable constituent concentration after remediation and are the goal of the corrective action. The GWPS is to be set at either the MCL or background. Where the background concentration is higher than the MCL, then the GWPS is established at background.

Directors of approved States have the option of establishing alternate GWPS for constituents without an MCL. This alternate GWPS must be an appropriate health based level based on specific criteria. These levels must:

- Be consistency with USEPA health risk assessment guidance;
- Be based on scientifically valid studies;
- Be within a risk range of $1x10^{-4}$ to $1x10^{-7}$ for carcinogens; and
- For a non-carcinogen or non-mutagen, be equal to a concentration to which the human population could be exposed on a daily basis without appreciable risk of deleterious effects during a lifetime.

The health based GWPS may be established considering the presence of more than one constituent, sensitive environmental receptors, and other site specific exposure pathways. Risk assessments to establish the GWPS must consider cumulative effects of multiple pathways to receptors and cumulative effects on risk exposure of the presence of multiple contaminants. Guidance and procedures for establishing a health based risk assessment may be found in "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites," USEPA (1988); "RCRA Groundwater Monitoring Technical Enforcement Guidance Document," USEPA (1986a); and "Test Methods for Evaluating Solid Wastes, SW-846," Third Edition, USEPA (1986b).

5.14 ASSESSMENT OF CORRECTIVE MEASURES 40 CFR §258.56

5.14.1 Statement of Regulation

(a) Within 90 days of finding that any of the constituents listed in Appendix II have been detected at a statistically significant level exceeding the groundwater protection standards defined under §258.55(h) and (i) of this part, the owner or operator must initiate an assessment of corrective measures. Such an assessment must be completed within a reasonable period of time.

(b) The owner or operator must continue to monitor in accordance with the assessment monitoring program as specified in §258.55.

(c) The assessment shall include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under §258.57, addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete the remedy;

(3) The costs of remedy implementation; and

(4) The institutional requirements such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

(d) The owner or operator must discuss the results of the corrective measures assessment, prior to the selection of remedy, in a public meeting with interested and affected parties.

5.14.2 Applicability

An assessment of corrective measures must be conducted whenever any Appendix II constituents are detected at statistically significant levels greater than the GWPS. The assessment of corrective measures must be initiated within 90 days. During the initiation of an assessment of corrective measures, detection and assessment monitoring must be continued.

The assessment of corrective measures must consider both time and cost aspects as well as performance considerations of corrective options. The assessment should evaluate how effectively an option might be expected to work (performance and reliability), to what extent the option will cause incidental impacts, and how these impacts are to be controlled (e.g., impacts associated with treatment including transfer of contaminants to other media such as air or surface water). If the implementation will require additional state or local permits, such requirements should be identified. Finally, the proposed corrective measures must be discussed in a public meeting with interested and affected parties.

5.14.3 Technical Considerations

An assessment of corrective measures is site-specific and will vary significantly depending on the age of the facility, its design, the quality of the facility's historical records, the nature of the contaminants found in the groundwater, the complexity of the site hydrogeology, and location with respect to sensitive receptors. Corrective measures may generally be approached from two directions: 1) identifying and remediating the source of contamination and 2) identifying and remediating the known contamination. Since each case will be different in terms of timing and scope, the owner or operator should be prepared to document that, to the best of his technical and financial abilities, a diligent effort has been made to complete the assessment in the shortest time practicable. The factors listed in §258.56(c)(1) are to be considered in assessing corrective measures. These general factors are discussed below in terms of source evaluation, plume delineation, and treatment options.

Source Evaluation

As part of the assessment of corrective measures, the owner or operator will need to determine the nature of the source of the release. The first step in this determination is to review available site information. For new facilities, where waste receipt records and accurate design information is available, this may be a relatively simple task. At some older facilities where detailed records of waste received and details of design or phases of operation in the facilities history may not be as well documented, source definition may become a less precise task. Design, climatological, and waste type information should be used to evaluate the duration of the release, potential seasonal effects due to precipitation (increased infiltration and leachate generation and potential contact between groundwater and the lowest elevation of waste disposal), and possible constituent concentrations. If the facility source evaluation is able to identify a repairable engineering condition (e.g., unlined storage ponds, failed cover system, leaky leachate transport pipes, past conditions of contaminated storm overflow) that likely contributed to the cause of contamination, such information should be brought to light as part of the assessment of corrective measures.

The existing information on the site geology and hydrogeology, ground-water monitoring results, as well as topographic and cultural information need to be clearly and accurately documented. This information may include soil boring logs, test pit and monitoring well logs, geophysical data, water level elevation data, and other information collected during facility design or operation. The information should be expressed in a manner that will aid interpretation of data. Such data may include isopach maps of the thickness of the upper aquifer and important strata, isoconcentration maps of contaminants, flow nets, cross-sections, and contour maps. Additional guidance on data which may be useful in a source evaluation may be found in the following series on RCRA Facility Investigation Guidance: Volume I of IV - "Development of An RFI Work Plan and General Considerations for RCRA Facility Investigations," (USEPA, 1989a) Volume IV of IV - "Case Study

Examples," (USEPA, 1989d) and "Practical Guide For Assessing and Remediating Contaminated Sites" (USEPA, 1989).

Ground-Water Assessment

Identification of corrective measures for groundwater contamination requires the following core information:

- Plume definition (includes the type(s), concentration, and spatial distribution of the contaminants);
- The amenability of the contaminants to specific treatment and potential for contaminant to interfere with treatability;
- Fate of the contaminants (whether chemical transformations have, are or may occur and degree to which the species are adsorbed or absorbed to the geologic matrix);
- Stratigraphy and hydraulic properties of the aquifer;
- Treatment concentration goals and objectives; and
- Immediate measures to limit further plume migration (e.g., containment options) or measures to minimize further introduction of contaminants to groundwater.

The process by which a remedial action is undertaken will generally include the following sequence of investigations:

- Hydrogeologic investigation which may include additional well installations, detailed vertical and lateral sampling to characterize the plume, and core sampling to determine adsorption of constituents on geologic matrix;
- Risk assessment to determine impact on sensitive receptors which may include identification of the treatment contaminant concentration goals other than groundwater protection standards (GWPS);
- Literature and technical review of treatment technologies which may be considered for further study or implementation;
- Cost estimate of different treatment options;
- Time estimate for completion of remediation under the different treatment options;
- Bench scale treatability studies conducted to assess potential effectiveness of options;
- Selection of technology or technologies and proposal preparation for regulatory and public review and comment;
- Full scale pilot study for verification of treatability and optimizing the selected technology;
- Initiating full scale treatment technology; review effectiveness and making adjustments as necessary; and
- Continuing corrective action until treatment goals are established.

Contaminant Plume Delineation

To effectively assess corrective measure options, the lateral and vertical extent of contamination must be known. Upon exceeding a GWPS in the Assessment Monitoring program, it may be necessary to install additional wells to characterize the plume. At least one additional well must be added at the property boundary in the direction of contaminant migration to allow timely notification to potentially affected parties if any contamination migrates off-site. §258.55(d)(2) allows the Director of an approved State to determine an appropriate subset of wells to be monitored, however this one additional well must always be included. This well, located at the unit boundary, must be sampled semiannually or at an alternate frequency, determined by the Director of an approved State. The ground-water samples from this well must be analyzed for the Appendix II constituents that have been found in wells located at the unit or the alternate boundary.

Circumstances that may require additional monitoring include:

- Facilities that have not determined the horizontal and vertical extent of the plume;
- Locations with heterogeneous or transient ground-water flow regimes; and
- Mounding associated with MSWLF units.

Since the requirements for additional monitoring are site-specific, the rule does not specify requirements for cases where additional wells are necessary nor for the number of additional wells that must be installed.

The purpose of the additional monitoring wells is to delineate the contaminant plume boundary and to demonstrate the effectiveness of the corrective action in meeting the GWPS. Wells installed for this purpose are not subject to the assessment monitoring requirements for Appendix II analysis.

During this process, the owner or operator is not relieved from continuing the normal detection and assessment monitoring.

The rate of plume advance and the change in contaminant concentrations with time must be monitored to allow prediction of the extent and timing of impact to sensitive receptors. The receptors may include both users of ground-water and surface water bodies where contaminated ground-water may be discharged. In some cases, transfer of volatile compounds from ground-water to the soil and to the air may provide an additional receptor pathway. Information regarding the aquifer characteristics (e.g., hydraulic conductivity, storage coefficients, and effective porosity) need to be developed for modeling of the contaminant transport if sufficient data is not presently available. Anisotropy and variability of aquifer characteristics need to be estimated, as well as magnitude and duration of source inputs, to help explain present and predicted plume configuration.

Most treatment options for ground-water contamination at MSWLFs will involve pump and treat or in-situ biological technologies (bio-remediation). The cost and duration of treatment will depend on the size of the plume, the pumping characteristics of the aquifer, and chemical transport phenomena. Source and ground-water control measures to reduce the rate of contaminant migration should be included in the costs of any remedial activity undertaken. Ground-water modeling of the plume may be initiated to establish the following:

- The locations and pumping rates for withdrawal and/or injection wells;
- Predictions of contaminant concentrations at exposure points;
- Locations of additional monitoring wells;
- The effect source control options may have on groundwater remediation; and
- The effects of advection and dispersion, retardation, adsorption and other attenuation processes on the plume dimensions and contaminant concentrations.

Any modeling effort must take into consideration that simulations of remedial response measures and contaminant transport are based on many necessary simplifying assumptions which affect the accuracy of the model. These assumptions include boundary conditions, degree and spatial variability of anisotropy, dispersivity, effective porosity, stratigraphy, and the algorithms used to solve contaminant transport equations. Model selection should be appropriate for the amount of data available and the technical uncertainty of the model results must be documented by a sensitivity analysis on the input parameters. A sensitivity analysis is generally accomplished after model calibration by varying one input parameter at a time over a realistic range and then evaluating changes in model output. For additional information on modeling, refer to the Further Information Section of Chapter 5.0 and the "RCRA Facility Investigation Guidance," Volume II of IV - "Soil, Groundwater and Subsurface Gas Releases" (USEPA, 1989b).

Corrective Measures Assessment

For different treatment options to be compared, substantial amounts of technical information may need to be assembled and assessed. The objective of this information gathering task is to conceptually identify for each treatment technology:

- The expected performance of individual approaches;
- The time frame when individual approaches can realistically be implemented;
- The technical feasibility of the remediation to be successful, including new and innovative technologies, performance, reliability and ease of implementation, safety and cross media impacts;
- The anticipated time frame when remediation should be complete;

- The anticipated cost of the remediation including capital expenditures, design, on-going engineering, monitoring of results;

- Technical and financial capability of the owner/operator to successfully complete the remediation;

- Disposal requirements for treatment residuals; and

- Other regulatory or institutional requirements including State and local permits, prohibitions, or environmental restrictions that may effect the implementation of the proposed remedial activity.

The performance objectives of the corrective measures should be considered in terms of source reduction, cleanup goals, and cleanup time frame. Source reduction would include measures to reduce or stop further releases and may include repair of existing facility components (liner systems, leachate storage pond liners, piping systems, cover systems) upgrading of components (liners and cover systems), or premature closure in extreme cases. The technology proposed as a cleanup measure should be the best available technology within given financial constraints.

The technologies identified should be reliable from historical perspectives of their application elsewhere. New innovative technologies are not discouraged if they can be shown, with a reasonable degree of confidence, to be potentially reliable.

Since most treatment processes, including bio-restoration, potentially produce byproducts or release contaminants to different media (e.g., air stripping of volatile compounds), the impacts of such potential releases must be evaluated. Releases to air may constitute a safety concern and must be addressed as part of the alternatives assessment process. Other cross media impacts, including transfer of contaminants from soils to ground-water, surface water, or air should be assessed and addressed in the assessment of corrective actions. Guidance for addressing air and soil transport and contamination are provided in USEPA (1989b and 1989c).

Analyses should be conducted on treatment options to determine whether or not they are protective of human health and the environment. Environmental monitoring of exposure routes (air and water) may necessitate health monitoring for personnel involved in treatment activities if unacceptable levels of exposure are possible. On a case-to-case basis, implementation plans may require both forms of monitoring.

The conceptual development of individual corrective measures requires an understanding of the physio-chemical relationships and interferences between the constituents and the sequence of treatment segments that must be implemented. Proper sequencing of treatment methods to produce a feasible remedial program must be evaluated to avoid interference between the presence of some constituents and the effective removal of the targeted compound. In addition, screening and design parameters of potential treatment options should be evaluated in the early stages of conceptual development and planning, to eliminate technically unsuitable treatment methods. In general, selection of an appropriate treatment method will require the experience of a qualified professional (environmental, chemical or hazardous waste engineer or scientist) and will necessitate a literature review of the best available treatment technologies.

Numerous case studies and published papers from scientific and engineering technical journals exist on treatability of specific compounds and groups of related compounds. Development of new technologies and refinements have been rapid. A compendium of available literature which includes treatment technologies for organic and inorganic contaminants technology selection, and other sources of information (literature search data bases pertinent to ground-water extraction, treatment and responses) has been prepared in draft form by USEPA in the "Practical Guide for Assessing and Remediating Contaminated Sites" (USEPA, 1989e).

The general approach to remediation typically will take one of three forms:

- Active restoration;
- Containment; or
- Natural attenuation.

The selection of a particular approach or combination of approaches must be based on the corrective action objectives. These general approaches are outlined in Table 5-1. It should be emphasized that ultimately, the objective of a treatment program should be to restore ground-water to pre-existing conditions or to levels below applicable MCLs while simultaneously restricting further releases of contaminants to groundwater. Once treatment objectives are met, the chance of re-contamination should be mitigated to the extent practicable from an engineering standpoint.

Active Restoration

Active restoration generally includes groundwater extraction, followed by on-site or off-site treatment. Off-site treatment may include sending the contaminated water to a local publicly owned treatment works (POTW) or a facility designed to treat those contaminants. Treated ground-water may be re-injected or discharged to a local body of surface water, depending on local, State, and Federal requirements. Typical treatment practices that may be implemented include coagulation and precipitation for some metals and organic compounds, chemical oxidation for the destruction of a number of organic compounds, air stripping to remove volatile organic compounds, and biological degradation.

The rate of contaminant removal from ground-water will be dependent on the rate of ground-water removal, the cation exchange capacity of the soil, and partition coefficients of the constituents sorbed to the soil (USEPA, 1988). As the concentration of contaminants in the ground-water is reduced, the rate at which constituents become partitioned from the soil to aqueous phase may also be

TECHNOLOGY	TYPICAL SCREENING PARAMETERS	TYPICAL DESIGN PARAMETERS [a]
Extraction	Aquifer storage coefficient Soil type/porosity Hydraulic conductivity Aquifer saturated thickness Contaminant sorption Contaminant solubility	Aquifer parameters Depth to the aquifer Number of wells Well Extraction Rate Contaminant distribution Presence of non-aqueous phase
Air-stripping	Contaminant volatility Disposal of treated water	Ground-water temperature Influent flow rate Contaminant concentrations
Carbon adsorption	Contaminant adsorptability Total organic carbon Disposal of treated water Metals separation	Influent flow rate Carbon adsorptive capacity Contaminant concentrations
Chemical destruction (e.g., KPEG, peroxide treatment)	Susceptibility to reaction Total organic carbon	Influent flow rate Dose of reactant Contaminant concentrations
Metals precipitation	Metals solubility pH Metals concentration Management of residuals Disposal of treated water	Influent flow rate Alkalinity/acidity Coagulant dosage Contaminant concentrations
Nonaqueous phase separation	Contaminant solubility Contaminant concentrations Specific gravity	Influent flow rate Total suspended solids
In situ biodegradation	Soil type/porosity, permeability—primary and secondary Aquifer properties Distribution of micro-organisms Dissolved oxygen Contaminant concentration	Nutrient requirements Contaminant distribution Injection/extraction well flow rates Aquifer parameters Biodegradation rate
In situ solvent wash and extraction	Soil type/porosity, permeability—primary and secondary Contaminant solubility; Sorption properties Organic moisture content	Aquifer parameters Depth to the aquifer Contaminant distribution Contaminant concentrations
In situ vapor extraction	Soil type/porosity, permeability—primary and secondary Contaminant volality Contaminant concentration	Contaminant distribution Well radius of influence Extraction well flow rates Hydraulic conductivity
In situ vitrification	Contaminant concentration Depth of contamination Area of contamination Soil type/moisture content Presence of reactive compounds Electrical conductivity	Contaminant distribution Underlying geology Rate of carbon dosage for off-gas treatment

Source: USEPA (1988)

[a] When possible, data for design can be collected during implementation of an interim remedy. Design parameters also include considerations such as standards to be attained for all emissions to air and water and any generation of solid water.

TABLE 5-1
Typical Technology Selection and Design Parameters

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reduced. The amount of flushing of the aquifer material required to remove the contaminants to an acceptable level will generally determine the time frame required for restoration. The time frame is site-specific and may last indefinitely.

In-situ methods may be appropriate for some sites, particularly where pump and treat technologies create serious adverse effects or where it may be financially unattractive. In-situ methods may include biological restoration requiring pH control, addition of specific micro-organisms, or addition of nutrients and substrate to augment and encourage degradation by native microbial populations. Bio-remediation will require laboratory treatability studies and pilot field studies to determine the feasibility and the reliability of treatment implemented on a full scale. It must be demonstrated that the treatment techniques will not inadvertently cause degradation of a target chemical to another compound that has unacceptable health risks and which is not amenable to further degradation. Alternative in-situ methods may also be designed to increase the effectiveness of desorption or removal of contaminants from the aquifer matrix. Such methodologies may include steam stripping, soil flushing, vapor extraction and solvent wash and extraction for removal of strongly sorbed organic compounds. Most of these methods also may be used in unsaturated zones where residual contaminants may be sorbed to the geologic matrix during periodic fluctuations of the water table. Details of in-situ methods may be found in several sources (USEPA, 1988; USEPA, 1985; and Eckenfelder, 1989).

Plume Containment

Methods to contain the plume movement include passive hydraulic barriers, such as grout curtains and slurry walls, and active gradient control systems involving pumping wells and french drains. The purpose of plume containment is to limit the spread of the contaminants. The type of aquifer criteria that favor plume containment include:

- Water naturally unsuited for consumption;
- Contaminants present in low concentration with low mobility;
- Low potential for exposure to contaminants and risks associated with exposure; and
- Aquifer has low transmissivity and low future user demand.

Often, it may be advantageous for the owner or operator to consider implementing ground-water controls to inhibit further contamination or spread of contamination. If ground-water pumping, to capture the leading edge of the contamination plume, is considered, the contaminated water must be managed in conformance with all applicable Federal and State requirements. Under most conditions, it is necessary to consult with the regulatory agencies prior to initiating an interim remedial actions.

Source Control

Source control measures should be evaluated to limit the migration of the plume. The rule does not limit the definition of source control to exclude any specific type of remediation. Remedies must control the source so as to reduce or eliminate further releases by identifying and locating the cause of the release (e.g., torn geomembrane, excessive head due to blocked leachate collection system, leaking leachate collection well or pipe). Source control measures may include:

- Modifying the operational procedures (e.g., ban on specific wastes or lowering the head over the leachate collection system through more frequent leachate removal);
- Undertaking more extensive and effective maintenance activities (e.g., excavate waste to repair a liner failure or a clogged leachate collection system); and
- Preventing additional leachate generation that may reach a liner failure (e.g., using a portable or temporary rain shelter during operations, capping landfill areas that contribute to leachate migrating from identified failure areas).

Where the risk to human health and environment is significant, and other alternatives are not considered effective, excavation of deposited wastes for treatment and/or off-site disposal may be considered.

Public Participation

The owner or operator is required to hold a public meeting to discuss the groundwater contamination problem and identify proposed remedies. Notifications, such as contacting local public agencies, town governments, State governments, and posting a notice in prominent local papers are effective. The public meeting should provide a detailed discussion of how the owner or operator has addressed the factors at §258.56(c)(1)-(4).

5.15 SELECTION OF REMEDY 40 CFR §258.57 (a)-(b)

5.15.1 Statement of Regulation

(a) Based on the results of the corrective measure assessment conducted under §258.56, the owner or operator must select a remedy that, at a minimum, meets the standards listed in paragraph (b) below. The owner or operator must notify the State Director, within 14 days of selecting a remedy, that a report describing the selected remedy has been placed in the operating record and how it meets the standards in paragraph (b) of this section.

(b) Remedies must:

(1) Be protective of human health and the environment;

(2) Attain the ground-water protection standard as specified pursuant to §§258.55(h) or (i);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of Appendix II constituents into the environment that may pose a threat to human health or the environment; and

(4) Comply with standards for management of wastes as specified in §258.58(d).

5.15.2 Applicability

These provisions apply to facilities that have been required to initiate and sustain an assessment of corrective measures. The selection of a remedy is closely related to the assessment process and cannot be accomplished unless a sufficiently thorough evaluation of alternatives has been accomplished. The process of documenting the selected remedy requires that a report be placed in the facility operating record which clearly defines the corrective action objectives and demonstrates why the selected remedy is anticipated to meet those objectives. The State Director must be notified within 14 days of the placement of the report in the operating records of the facility. The study must identify how it will be protective of human health and the environment, attain the GWPS (either background, MCLs or, in approved States, health based standards if applicable), attain source control objectives and comply with waste management standards (§258.58(d)) which require compliance with applicable Federal regulations for waste disposal under remedial or interim response measures.

5.15.3 Technical Considerations

The final method selected for implementation must evaluate the factors at §258.57(b)(1)-(4). The selection procedure is the documentation process detailing how standards are met.

The report documenting the capability of the selected method to meet the factors at §258.57(b)(1)-(4) should include such information as:

- Theoretical calculations;
- Comparison to existing studies and results of similar treatment case histories; and
- Bench scale or pilot scale treatability test results.

The demonstration presented in the report must document the alternative option selection process.

5.16 SELECTION OF REMEDY 40 CFR §258.57 (c)

5.16.1 Statement of Regulation

(c) In selecting a remedy that meets the standards of §258.57(b), the owner or operator shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;

(ii) Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remedy;

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;

(iv) Short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal or containment;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases;

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) Practicable capability of the owner or operator, including a consideration of the technical and economic capability.

(5) The degree to which community concerns are addressed by a potential remedy(s).

5.16.2 Applicability

The provisions apply to facilities that have completed the selection of a remedy for corrective action. The rule presents the considerations and factors the owner or operator must evaluate when addressing the performance standards of a selected corrective measure.

5.16.3 Technical Considerations

The owner or operator must consider specific topics to satisfy the performance criteria under selection of the final corrective measure. These topics must be addressed in the report documenting the selection of a particular corrective action. The general topic areas which must be considered include:

- The anticipated effectiveness of the corrective action both in the long and short terms;
- The anticipated effectiveness of source reduction efforts to reduce further releases to ground-water;
- The ability to implement the corrective measure;
- The capability of the owner or operator in financial and technical areas to ensure completion of the corrective measure; and
- The degree to which the selected remedy will address concerns raised by the community.

Effectiveness of Corrective Action

In selecting the remedial action, the anticipated effectiveness should be evaluated in terms of both long-term and short-term anticipated results as well as the probability of success or degree of technical uncertainty in the technology. Review of case studies where similar technologies have been applied provide the best measures to judge technical uncertainty, especially when relatively new technologies are applied. The long-term, post-cleanup, effectiveness may be judged on the ability of the proposed remedy to mitigate further releases of contaminants to the environment as well as to the feasibility of meeting or exceeding the ground-water protection standards as the remedial objective. The owner or operator must make a reasonable effort to estimate and quantify risks based on exposure pathways and estimates of exposure levels and durations. These estimates include risks for both ground-water and cross-media contamination.

The source control measures that will be implemented, including excavation, transportation, redisposal and containment, should be evaluated with respect to potential exposure and risk to human health and the environment. The source control measures should be viewed as an integral component of the overall corrective action. Health considerations must address monitoring risks to workers and the general public and provide contingency plans should an unanticipated exposure occur. Potential exposure should consider both long and short term cases before, during and after implementation of corrective actions.

The time to complete the remedial activity must be estimated as it will have direct financial impacts on the project management needs and financial capability of the owner or operator to meet the remedial objectives. The long-term costs of the remedial alternatives and the long-term financial condition of the owner or operator should be reviewed carefully. The implementation schedule should indicate quality control measures to assess the progress of the corrective measure.

The operational reliability of the corrective measures should be considered. The institutional controls and management practices developed to assess the reliability should be identified.

Source Control Effectiveness

Source control measures identified in previous sections should be discussed in terms of their expected effectiveness. If source control will be removal and re-disposal of wastes, the residual materials, such as contaminated soils above the water table, should be quantified and their potential to cause further contamination be evaluated. Engineering controls intended to upgrade or repair deficient conditions in landfill component systems, including cover systems, should be quantified in anticipated effectiveness considering current and future conditions. This assessment may indicate to what extent it is technically and financially practicable to make use of existing technologies. The decision against using a certain technology may be based on health considerations and potential for unacceptable exposure(s) to both workers and the public.

Implementation of Remedial Action

The ease of implementing the proposed remedial action will impact the schedule and start-up success of the remedial action. Key factors to be assessed are:

- The availability of technical expertise;
- Construction of equipment or technology;
- The ability to properly manage and dispose of wastes generated by treatment; and
- The likelihood of obtaining local permits and public support for the proposed project.

Technical considerations, including pH control, ground-water extraction feasibility, or the ability to inject nutrients, may need to be considered depending on the proposed treatment method. Potential impacts such as potential cross media contamination need to be reviewed as part of the overall feasibility of the project.

The schedule of remedial activities should identify the start and end points of the following:

- Permitting phase;
- Construction and start-up period at which initial implementation success will be evaluated, including time to correct any unexpected problems;
- Time when full scale treatment will be initiated and duration of treatment period;
- Implementation and completion of source control measures, including time frame for solving problems associated with interim management and disposal of waste materials or treatment residuals.

Long lead time items should be identified early in the process and those tasks should be initiated early to ensure that the implementation is brought on line in the shortest practicable period.

Community Concerns

The public meetings held during assessment of alternative measures are intended to elicit public comment and response. The owner or operator must, by means of meeting minutes and record of written comments, identify which public concerns have been expressed and addressed by corrective measure options.

Practical Capability

The owner or operator must be technically and financially capable of implementing the chosen remedial alternative and seeing the project through to completion, including provisions for future changes to the remedial plan after progress is reviewed. If either technical or financial capability is inadequate for a particular alternative, then other alternatives with similar levels of protectiveness should be considered for implementation.

5.17 SELECTION OF REMEDY 40 CFR §258.57 (d)

5.17.1 Statement of Regulation

(d) The owner or operator shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. Such a schedule must require the initiation of remedial activities within a reasonable period of time taking into consideration the factors set forth in paragraphs (d) (1-8). The owner or operator must consider the following factors in determining the schedule of remedial activities:

(1) Extent and nature of contamination;

(2) Practical capabilities of remedial technologies in achieving compliance with groundwater protection standards established under §§258.55(g) or (h) and other objectives of the remedy;

(3) Availability of treatment or disposal capacity for wastes managed during implementation of the remedy;

(4) Desirability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;

(5) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

(6) Resource value of the aquifer including:

(i) Current and future uses;

(ii) Proximity and withdrawal rate of users;

(iii) Groundwater quantity and quality;

(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituent;

(v) The hydrogeologic characteristic of the facility and surrounding land;

(vi) Groundwater removal and treatment costs; and

(vii) The cost and availability of alternative water supplies.

(7) Practicable capability of the owner or operator.

(8) Other relevant factors.

5.17.2 Applicability

The requirements of §258.57(d) apply to owners or operators of all new, existing, and laterally expanded facilities and should be complied prior to implementing corrective measures. The owner or operator must specify the schedule for remedial activities based upon the following considerations:

- The size and nature of the contaminated area at the time the corrective measure is to be implemented;
- The practicable capabilities of the remedial technology selected;
- Alternative interim disposal capacity;
- Potential use of alternate technologies not currently available;
- Potential health risks existing prior to completion of the remedy; and
- Resource value of the aquifer.

5.17.3 Technical Considerations

The time schedule for implementing and completing the remedial activity will be influenced by many factors that should be considered by the owner or operator. The most critical of the factors is the nature and extent of the contamination which will determine the ultimate treatment rate. The scale of the treatment facility and the rates of ground-water extraction or injection should be balanced for system optimization, capital resources, and remedial time frame objectives. Depending on the treatment selected, treatment retention times will vary. The nature of the contamination will influence the degree to which the aquifer must be flushed to remove adsorbed species. These factors, which in part define the practicable capability of the alternative (treatment efficiency, treatment rate and replenishment of contaminants by natural processes), should be considered when selecting the remedy.

In addition, the rate at which treatment may occur may be restricted by the availability or capacity to handle treatment residues and handle the normal flow of wastes to the facility as remediation occurs. Alternative residue treatment or disposal capacity should be identified as part of the implementation plan schedule.

If contaminant migration is slow due to low transport properties of the aquifer, additional time may be available to evaluate the value of emerging and promising technologies. The use of such technologies is not excluded as part of the requirement to implement a remedial action as soon as it is practicable. By delaying implementation to allow new technologies to come to market, the merit of such technologies must be evaluated in terms of ultimate cost considerations, additional environmental impact, and potential for increased risk to sensitive receptors. If a new technology clearly is superior to existing options in attaining GWPS, it may be appropriate to delay implementation if the additional risks can be managed, quantified, and mitigated or controlled.

In setting the implementation schedule, the owner or operator should make an assessment of risk of exposure to human health and the environment within the time frame of reaching treatment objectives. If the risk is unacceptable from health based assessments of exposure paths and exposure limits, the implementation time scale should be accelerated or the selected remedy altered to provide a higher degree of protectiveness.

The schedule may also need to consider the resource value of the aquifer, as it may pertain to current and future use, proximity to users, quality and quantity of groundwater, agricultural value and uses (irrigation water source or impact on adjacent agricultural lands), and the availability of alternate supplies of water of similar quantity and quality. Based on these factors, a relative assessment of the aquifers resource value to the local community can be established. Impacts to the resource and the degree of financial or health related distress by users should be considered. The implementation time frame should attempt to minimize the amount of loss of value of the resource to users prior to treatment objectives being attained. The possibility that alternative water supplies will have to be developed as part of the remedial activities may need to be considered.

5.18 SELECTION OF REMEDY 40 CFR §258.57 (e)

5.18.1 Statement of Regulation

(e) The Director of an approved State may determine that remediation of a release of an Appendix II constituent from a MSWLF unit is not necessary if the owner or operator demonstrates to the satisfaction of the Director of an approved State that:

(1) The ground-water is additionally contaminated by substances that have originated from a source other than a MSWLF unit and those substances are present in concentrations such that cleanup of the release from the MSWLF unit would provide no significant reduction in risk to actual or potential receptors; or

(2) The constituent(s) is present in ground-water that:

(i) Is not currently or reasonably expected to be a potential source of drinking water; and

(ii) Is not hydraulically connected with waters to which the hazardous constituents are migrating or are likely to migrate in a concentration(s) that would exceed the ground-water protection standards established under §258.55(h) or (i); or

(3) Remediation of the release(s) is technically impracticable; or

(4) Remediation results in unacceptable cross-media impacts.

(f) A determination by the Director of an approved State pursuant to paragraph (e) above shall not affect the authority of the State to require the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the ground-water, to prevent exposure to the ground-water, or to remediate the groundwater to concentrations that are technically practicable and significantly reduce threats to human health or the environment.

5.18.2 Applicability

The criteria under §258.57(e) apply in approved States only. Remediation of an Appendix II constituent may be necessary if: 1) a source other than the MSWLF is partly responsible for the ground-water contamination or 2) under circumstances where the resource value of the aquifer is extremely limited cleanup will not be required or 3) cleanup is not technically feasible or 4) cleanup will result in cross-media impacts of larger concern than the existing problem. The Director may make a determination that remediation is not required, however, a State is not prohibited from requiring source control.

5.18.3 Technical Considerations

There are three situations where an approved State may not require cleanup of hazardous constituents released to ground-water from an MSWLF. If sufficient evidence exists to document that the ground-water is contaminated by multiple sources other than the MSWLF, the Director of an approved State may grant a waiver from implementing some or all of the corrective measure requirements. The owner or operator must demonstrate that cleanup of a release from a MSWLF would provide no significant reduction in risk to receptors due to concentration of constituents from the other source. If the MSWLF owners or operators were to remediate contaminants for which the MSWLF unit was responsible, there would be no net reduction of threat to sensitive receptors and no net benefit from costs incurred.

A waiver from corrective measures also may be granted if the contaminated ground-water is not a current or potential future drinking water source, and it is not hydraulically connected to a ground-water system that is, or may in the future be, a source of drinking water. The owner or operator must demonstrate that the uppermost aquifer is not hydraulically connected with a lower aquifer. The owner or operator may seek an exemption if it can be demonstrated that attenuation, advection/dispersion, or other natural processes can remove the threat to interconnected aquifers. The owner or operator may seek the latter exemption if the contaminated zone is not a drinking water resource.

The Director of an approved State may waive clean up requirements if remediation is not technically feasible, or would result in cross media contamination. A successful demonstration must identify that the contaminated groundwater cannot be remediated due to unacceptable responses to treatment. Feasibility problems may also pertain to a creation of an unacceptable risk that cross-media impacts would occur as a result of corrective action. If the owner or operator can demonstrate that cross-media impacts are uncontrollable (e.g., movement in response to groundwater pumping) under a given remedial option and no cross-media impacts would result from a no action option, then the Director of an approved State may determine that remediation is not necessary.

A waiver of remedial obligation does not release the owner or operator from the responsibility of conducting source control measures. Source control must be implemented to the maximum extent practicable to minimize future risk of exposure of contaminants to ground-water.

5.19 IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM 40 CFR §258.58 (a)

5.19.1 Statement of Regulation

(a) Based on the schedule established under §258.57(d) for initiation and completion of remedial activities the owner/operator must:

(1) Establish and implement a corrective action groundwater monitoring program that:

(i) At a minimum, meets the requirements of an assessment monitoring program under §258.55;

(ii) Indicates the effectiveness of the corrective action remedy; and

(iii) Demonstrates compliance with groundwater protection standard pursuant to paragraph (e) of this section.

(2) Implement the corrective action remedy selected under §258.57; and

(3) Take any interim measures necessary to ensure the protection of human health and the environment. Interim measures should, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to §258.57. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:

(i) Time required to develop and implement a final remedy;

(ii) Actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;

(iii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(iv) Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;

(v) Weather conditions that may cause hazardous constituents to migrate or be released;

(vi) Risks of fire or explosion, or potential for exposure to hazardous constituents as a result of an accident or failure of a container or handling system; and

(vii) Other situations that may pose threats to human health and the environment.

5.19.2 Applicability

The provisions apply to facilities that are required to initiate and conduct corrective actions.

While initiating corrective actions, the owner or operator is required to continue assessment monitoring to evaluate the effectiveness of remedial actions and to detect any new constituents which may require remediation. The ground-water monitoring program needs to be sufficient to enable the owner or operator to determine that the remedial objectives have been attained at completion.

While conducting remedial activities, the owner or operator must take any interim actions, including source reduction measures, to augment the objectives of the remedial program. The interim measures must contribute to reducing the spread of contamination and be consistent with the objective of the remedial action program.

5.19.3 Technical Considerations

Implementation of the corrective measure encompasses all activities necessary to initiate and continue remediation. The owner or operator must continue assessment monitoring so that if interim measures are necessary, they can be anticipated and conducted to protect human health and the environment and to enable the corrective action to meet its stated objectives.

Monitoring Activities

During the implementation period, ground-water monitoring must be conducted. If the remedial action is not effectively curtailing further degradation or the spread of the contaminant plume, it may be necessary to install additional monitoring wells. The improvement rate of the condition of the aquifer must be monitored and compared to the clean-up objectives. If problems are encountered during the remedial action, the performance objectives of the corrective measure must be reviewed. If it becomes apparent that the GWPS will not be achievable technically, in a realistic time frame, then replacement of the system with an alternative measure may be warranted.

Additionally, the owner/operator must monitor the potential exposure pathways which may be affected as a result of source control activities. This type of monitoring includes air monitoring, explosion potential monitoring, health monitoring of personnel undertaking removal activities, and monitoring of surface waters potentially affected by source control actions.

Interim Measures

If monitoring activities indicate that unacceptable risks to human health and the environment may exist prior to implementation of the corrective action, the owner or operator is required to assess and conduct interim measures to protect receptors. Interim measures may require containment or gradient control of ground-water migration. If the contamination migrates off-site, the owner or operator must notify all affected property owners. Off-site migration, interim measures may include providing an alternative water supply for either human, livestock, or irrigation needs.

Interim measures also pertain to source control activities which may be implemented as part of the overall corrective action. Interim measures should be developed with consideration to maintaining conformity to the objectives of the final corrective action.

5.20 IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM 40 CFR §258.58 (b) - (d)

5.20.1 Statement of Regulation

(b) An owner or operator may determine, based on information developed after implementation of the remedy has begun or other information, that compliance with requirements of §258.57(b) are not being achieved through the remedy selected. In such cases, the owner or operator must implement other methods or techniques that could practicably achieve compliance with the requirements, unless the owner or operator makes the determination under §258.58(c).

(c) If the owner or operator determines that compliance with requirements under §258.57(b) cannot be practically achieved with any currently available methods, the owner or operator must:

(1) Obtain certification of a qualified groundwater specialist or approval by the Director of an approved State that compliance with requirements under §258.57(b) cannot be practically achieved with any currently available methods;

(2) Implement alternate measures to control exposure of humans or the environment to residual contamination, as necessary to protect human health and the environment; and

(3) Implement alternate measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures that are:

(i) Technically practicable; and

(ii) Consistent with the overall objective of the remedy.

(4) Notify the State Director within 14 days that a report justifying the alternative measures prior to implementing the alternative measures has been placed in the operating record.

(d) All solid wastes that are managed pursuant to a remedy required under §258.57, or an interim measure required under §258.58(a)(3), shall be managed in a manner:

(1) That is protective of human health and the environment; and

(2) That complies with applicable RCRA requirements.

5.20.2 Applicability

The requirements are applicable when it becomes apparent that the remedy selected will not achieve the GWPS or other significant objectives (e.g., protection of sensitive receptors) of the remedial program. In determining that the selected corrective action approach will not achieve desired results, the owner or operator must implement alternate corrective measures to achieve the GWPS. If it becomes evident that the cleanup goals are not technically obtainable by existing practicable technology, the owner or operator must implement actions to protect sensitive receptors from residual contamination. Notification must be given to the Director of an approved State within 14 days justifying the alternative measures. All wastes that are managed by the MSWLF during corrective action, including those wastes generated from the remedial processes, must be managed according to applicable RCRA requirements in a manner that is protective of human health and the environment.

5.20.3 Technical Considerations

An owner or operator is required to continue the assessment monitoring program during the remedial action. Through monitoring, the short and long term success of the remedial action can be gauged against expected progress. During the remedial action it may be necessary to install additional ground-water monitoring wells or pumping or injection wells, to adjust to conditions that vary from initial assessments about the ground-water flow system. As remediation progresses and data is compiled, it may become evident that initial treatability assumptions are not being attained. The reasons for unsatisfactory results may include:

- Refractory compounds that are not amenable to removal or destruction (de-toxification);
- The presence of compounds that interfere with treatment methods identified for target compounds;
- Inappropriately applied technology;
- Failure of source control measures to achieve desired results;
- Failure of ground-water control systems to achieve adequate containment or removal of contaminated ground-water;
- Residual concentrations above GWPS cannot be effectively reduced further, given that treatment efficiencies are too low; and
- Transformation or degradation of target compounds to different forms which are not amenable to further treatment by present or alternative technologies.

The owner or operator must re-evaluate additional treatment assumptions and compare them to existing conditions to determine if they were implemented properly. If implementation occurred as designed, the owner or operator should attempt to modify or upgrade existing remedial technology to optimize performance and to improve treatment effectiveness. If the existing technology cannot be made to perform, the owner or operator must evaluate alternative approaches while continuing the present remediation. During this re-evaluation period the owner or operator may suspend treatment only if continuation of the implemented technology clearly increases the risk to sensitive receptors or to cross-media contamination.

5.21 IMPLEMENTATION OF THE CORRECTIVE ACTION PROGRAM 40 CFR §258.58 (e)- (g)

5.21.1 Statement of Regulation

(e) Remedies selected pursuant to §258.57 shall be considered complete when:

(1) The owner or operator complies with the groundwater protection standards established under §§258.55(h) or (i) at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under §258.51(a).

(2) Compliance with the groundwater protection standards established under §§258.55(h) or (i) has been achieved by demonstrating that concentrations of Appendix II constituents have not exceeded the groundwater protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in §258.53(g) and (h). The Director of an approved State may specify an alternative length of time during which the owner or operator must demonstrate that concentrations of Appendix II constituents have not exceeded the groundwater protection standard(s) taking into consideration:

(i) Extent and concentration of the release(s);

(ii) Behavior characteristics of the hazardous constituents in the groundwater;

(iii) Accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variabilities that may affect the accuracy; and

(iv) Characteristics of the groundwater.

(3) All actions required to complete the remedy have been satisfied.

(f) Upon completion of the remedy, the owner or operator must notify the State Director within 14 days that a certification that the remedy has been completed in compliance with the requirements of §258.58(e) has been placed in the operating record. The certification must be signed by the owner or operator and by a qualified groundwater specialist or approved by the Director of an approved State.

(g) When, upon completion of the certification, the owner or operator determines that the corrective action remedy has been completed in accordance with the requirements under paragraph (e) of this section, the owner or operator shall be released from the requirements for financial assurance for corrective action under §258.73.

§258.59 [Reserved].

5.21.2 Applicability

These criteria apply to facilities conducting corrective action. In order to discontinue corrective actions, the ground-water quality must be remediated to achieve the GWPS for each contaminant within the plume boundary. Compliance will be established when, after three consecutive years of monitoring, the results show significant statistical evidence that constituent values are below the GWPS.

5.21.3 Technical Considerations

The minimum period of compliance is three consecutive years at all points within the contaminant plume. An alternate period may be established by the Director of an approved State. Compliance is achieved when the concentrations of Appendix II constituents do not exceed the GWPS. Statistical procedures in §258.53 must be used to demonstrate compliance with the GWPS.

The preferred statistical method for comparison is to construct a 99 percent confidence interval around the mean of the last three years of data and compare the upper limit of the confidence interval to the GWPS. If the confidence upper interval is less than the GWPS, it would be considered significant evidence that the standard is no longer being exceeded. The confidence interval must be based on the appropriate model describing the distribution of the data.

After determining that the ground-water quality is in compliance with the GWPS at all points within the contaminant plume, a notice to this effect must be placed within the operating record and the State Director notified within 14 days. The certification must be signed by the owner or operator and a qualified ground-water scientist or approved by the Director of an approved State. Upon completion of the remedial action, the owner or operator is released from the financial assurance requirements pertaining to corrective actions.

The Director of an approved State may require an alternate time period (other than three years) to prove compliance. In determining an alternate period the Director must consider the following:

- The extent and concentration of the release(s);
- The behavior characteristics (fate and transport) of the hazardous constituents in the ground-water;
- Accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variabilities that may affect the accuracy; and
- The characteristics of the groundwater.

Consideration of these factors may result in an extension of the time required to show compliance with remediation objectives.

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6.0
SUBPART F
CLOSURE AND POST-CLOSURE

6.1 INTRODUCTION

The criteria for landfill closure focuses on two central themes: the need to establish low-maintenance cover systems and the need to design a final cover that minimizes the infiltration of precipitation into the waste. Landfill closure technology, design, and maintenance procedures continue to evolve as new geosynthetic materials become available, performance requirements become more specific, and limited performance history becomes available for the relatively few number of landfills that have been closed using current procedures and materials. Critical technical issues that must be faced by the designer include the:

- Degree and rate of post-closure settlement and stresses imposed on soil liner components;
- Long-term durability and survivability of cover system;
- Long-term waste decomposition and management of landfill leachate and gases; and
- Environmental performance of the combined bottom liner and final cover system.

Full closure and post-closure care requirements apply to all MSWLF units that receive wastes on or after October 9, 1993. For MSWLF units that stop receiving wastes prior to October 9, 1993, only the final cover requirements of §258.60(a) apply.

6.2 FINAL COVER DESIGN 40 CFR §258.60 (a)

6.2.1 Statement of Regulation

(a) Owner or operator of all MSWLF units must install a final cover system that is designed to minimize infiltration and erosion. The final cover system must be comprised of an erosion layer underlain by an infiltration layer as follows:

(1) The infiltration layer must be comprised of a minimum of 18 inches of earthen material that has a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1 x 10^{-5} cm/SEC, whichever is less, and

(2) The erosion layer must consist of 6 inches of earthen material that is capable of sustaining native plant growth.

6.2.2 Applicability

The final cover system required to close a MSWLF unit, whether the unit is an existing unit, a new unit, or a lateral expansion of an existing unit, must be comprised of an infiltration layer that is a minimum of 18 inches thick, overlain by an erosion layer that is a minimum of 6 inches thick.

The infiltration layer should minimize, over the long term, liquid infiltration into the waste. The infiltration layer must have a hydraulic conductivity less than or equal to any bottom liner or natural subsoils present to prevent a "bathtub" effect. In no case can the infiltration layer have a hydraulic conductivity greater than 1×10^{-5} cm/sec regardless of the permeability of underlying liners or natural subsoils. If a synthetic membrane is in the bottom liner, there must be a flexible membrane liner (FML) in the final cover.

This cover system applies to all MSWLF units required to close in accordance with Part 258. The final cover requirements include MSWLF units that receive wastes after October 9, 1991 but stop receiving wastes prior to October 9, 1993. Installation of the final cover must be completed within six months of the last receipt of wastes. Units that fail to complete the cover system installation will be subject to all Part 258 requirements. In approved States, an alternate cover system may be approved by the Director (see subsection 6.3).

6.2.3 Technical Considerations

Design criteria for a final cover system should be selected to:

- Minimize infiltration of precipitation into the waste;
- Promote good surface drainage;
- Resist erosion;
- Restrict landfill gas migration or enhance recovery;
- Separate waste from vectors (e.g., animals and insects);
- Improve aesthetics;
- Minimize long-term maintenance; and
- Otherwise protect human health and the environment.

The first three points are directly related to the regulatory requirements. The other points typically are considered in designing cover systems for landfills.

Reduction of infiltration in a well designed final cover system is acheived through good surface drainage and runoff with minimal erosion, transpiration of water by plants in the vegetative cover and root zone, and restriction of percolation through earthen material. The cover system should be designed to provide the desired level of long-term performance with minimal maintenance. Surface water runoff should be properly controlled to prevent excessive erosion and soil loss. The vegetative cover should not contain deeply rooted plants that could damage the underlying infiltration layer. In addition, the cover system should be stable geotechnically to prevent failure, such as sliding, that may occur between the erosion and infiltration layers, within these layers, or within the waste. Figure 6-1 illustrates the two components required for the final cover system.

6.2.3.1 INFILTRATION LAYER

The infiltration layer must be at least 18 inches thick and consist of earthen material that has a hydraulic conductivity (coefficient of permeability) less than or equal to the hydraulic conductivity of any bottom liner system or natural subsoils. Units that have a composite liner with an FML likely will require a geomembrane in the final cover to meet the performance standards. MSWLF units with poor or non-existant bottom liners possessing hydraulic conductivities of less than 1×10^{-5} cm/sec must have an infiltration layer which meets the 1×10^{-5} cm/sec minimum requirement.

The earthen material used for the infiltration layer should be free of rocks, clods, debris, cobbles, rubbish, and roots that may increase the hydraulic conductivity by promoting preferential flow paths. To facilitate runoff while minimizing erosion, the surface of the compacted soil should have a minimum slope of 2 percent and a maximum slope of 5 percent after allowance for settlement. Membrane and clay layers should be placed below the maximum depth of frost penetration avoid freeze-thaw effects (USEPA, 1989b). In some areas of the country the erosion layer will need to be thicker than the minimum requirement of six inches. Figure 6-2 depicts the maximum regional depths of frost penetration. Freeze-thaw effects may include development of microfractures or realignment of interstitial fines which can increase the hydraulic conductivity of clays by as much as an order of magnitude (USEPA, 1990). Infiltration layers may be subject to desiccation depending on the climate and soil water retention in the erosion layer. Fracturing and volumetric shrinking of the clay due to water loss may increase the hydraulic conductivity of the infiltration layer.

The infiltration layer is designed and constructed in a manner similar to that used for soil liners (USEPA, 1988), with the following differences:

- Since the cover is generally not subject to large overburden loads, the issue of compressive stresses is less critical unless post-closure land use will exert large loads.
- The soil cover is subject to loadings from settlement of underlying materials. The extent of settlement anticipated should be evaluated and a closure and post-closure maintenance plan designed to compensate for the effects of settlement.
- Direct shear tests performed on construction materials should be conducted at lower shear stresses than those used for liner system designs.

The design of a final cover is site-specific and the relative performance of cover design options may be compared and evaluated by the HELP (Hydrologic Evaluation of Landfill Performance)

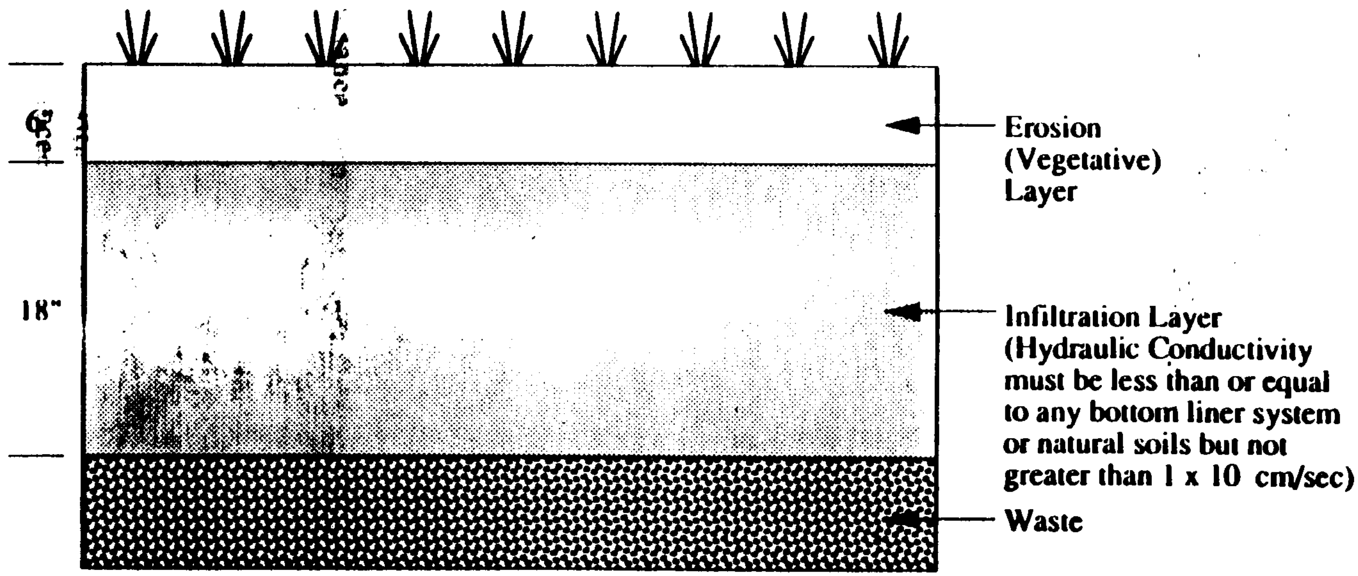
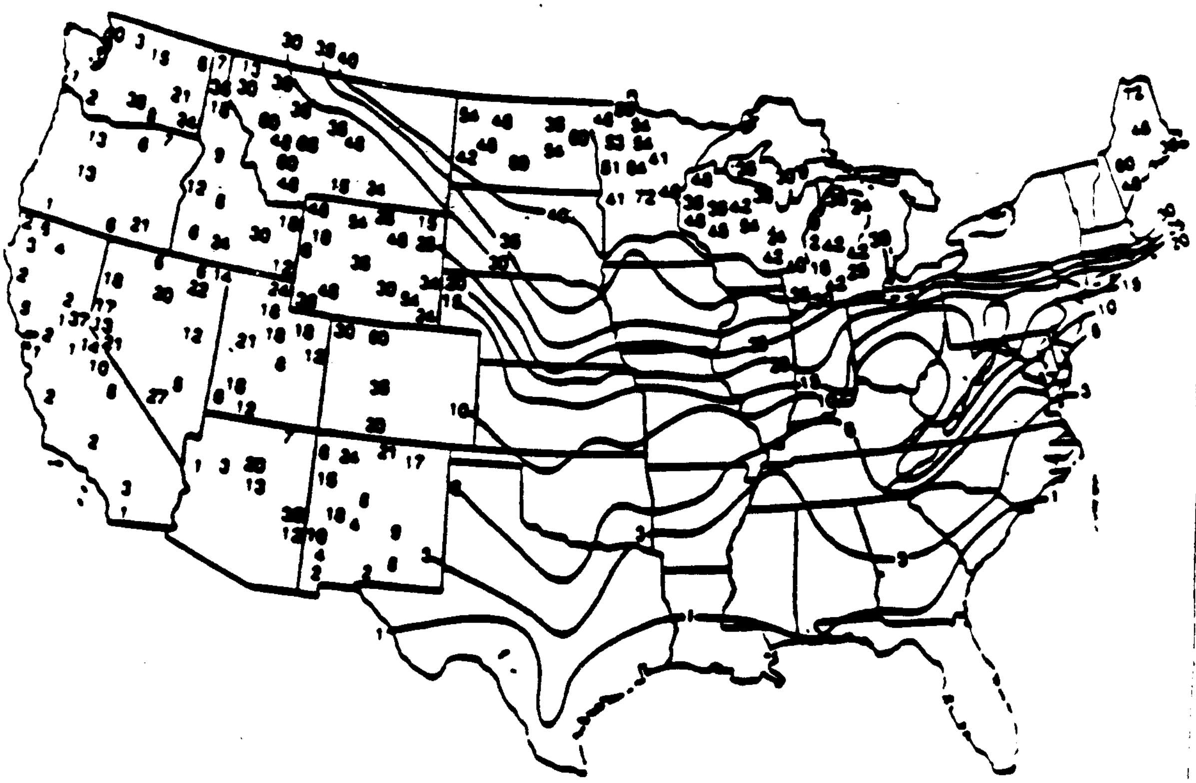


FIGURE 6-1
Minimum Requirement for
Final Cover Design



Source: USEPA (1989)

FIGURE 6-2
Regional Depth of Frost Penetration in Inches

model. HELP was developed by the U.S. Army Corps of Engineers for the USEPA and is widely used for evaluating expected hydraulic performance of landfill cover/liner systems (USEPA, 1988).

The HELP program calculates daily, average, and peak estimates of water movement across, into, through, and out of landfills. The input parameters for the model include soil properties, precipitation and other climatological data, vegetation type, and landfill design information. Default climatologic and soil data are available but should be verified as reasonable for the site modeled. Outputs from the model include precipitation, runoff, percolation through the base of each cover layer subprofile, evapotranspiration, and lateral drainage from each profile. The model also calculates the maximum head on the barrier soil layer of each subprofile and the maximum and minimum soil moisture content of the evaporative zone. Data from the model are presented in a tabular report format and include the input parameters used and a summary of the simulation results. Results are presented in several tables of daily, monthly, and annual totals for each year specified. A summary of the outputs is also produced, which includes average monthly totals, average annual totals and peak daily values for various simulation variables (USEPA, 1988).

The HELP model may be used to estimate the hydraulic performance of the cover system designed for a MSWLF unit. Useful information from HELP would be surface runoff, duration and quantity of water storage within the erosion layer, and net infiltration through the cover system to evaluate whether leachate will accumulate within the landfill. For the model to be used properly, the HELP Model User's Guide and documentation should be consulted.

6.2.3.2 GEOMEMBRANES

If a geomembrane is used as an infiltration layer, the geomembrane should be at least 20 mils (0.5 mm) in thickness, although some geomembrane materials may require a greater thickness. Increased thickness and tensile strengths may be necessary to prevent failure under stresses caused by construction and waste settlement during the post-closure care period. The strength, resistance to sliding, hydraulic performance, and actual thickness of HDPE sheets should be carefully evaluated. The quality and performance of some textured sheets may be difficult to evaluate due to variability of the textured surface.

6.2.3.3 EROSION LAYER

A vegetated cover not only improves the appearance of the site, but also controls erosion of the final cover and may require only minimal maintenance. The vegetation component of the erosion layer should have the following specifications and characteristics (USEPA, 1989b):

- Locally adapted perennial plants which are resistant to drought and temperature extremes;
- Roots that will not disrupt the low-permeability layer;
- The ability to thrive in low-nutrient soil with minimum nutrient addition;

- Sufficient plant density to minimize cover soil erosion; and

- The ability to survive and function with little or no maintenance (e.g., self-supportive).

The use of deep-rooted shrubs and trees is generally inappropriate because the root systems may penetrate the infiltration layer and create preferential pathways of percolation. A large number of suitable plant species such as grasses and low-growing plants are available for various climates. The timing of seeding (spring or fall in most climates) is critical to successful germination and establishment of the vegetative cover (USEPA, 1989b). Temporary winter covers may be grown from fast growing seed stock such as winter rye.

Selecting the soil for the vegetative cover (erosion layer) should consider soil type, nutrient levels and pH levels; climate; species of the vegitation selected; mulching; and seeding time. Loam, a balanced mixture of clay, silt, and sand, is generally preferred because it is relatively easy to maintain in good condition, it provides a conducive environment for seed germination, and it is easily penetrated by roots (USEPA, 1988).

Erosion can deteriorate the performance of the final cover of a MSWLF unit by impairing vegetative growth or causing rills which require maintenance and repair. Extreme erosion may lead to the exposure of the infiltration layer, initiate or contribute to sliding failures, or expose the waste. Anticipated erosion due to surface water runoff for given design criteria may be approximated using the USDA Universal Soil Loss Equation (USEPA, 1989a). By evaluating erosion loss, the design may be optimized to reduce maintenance through selection of the best available soil materials or by allowing excess soil to increase the time required before maintenance is needed. Parameters in the equation include the following:

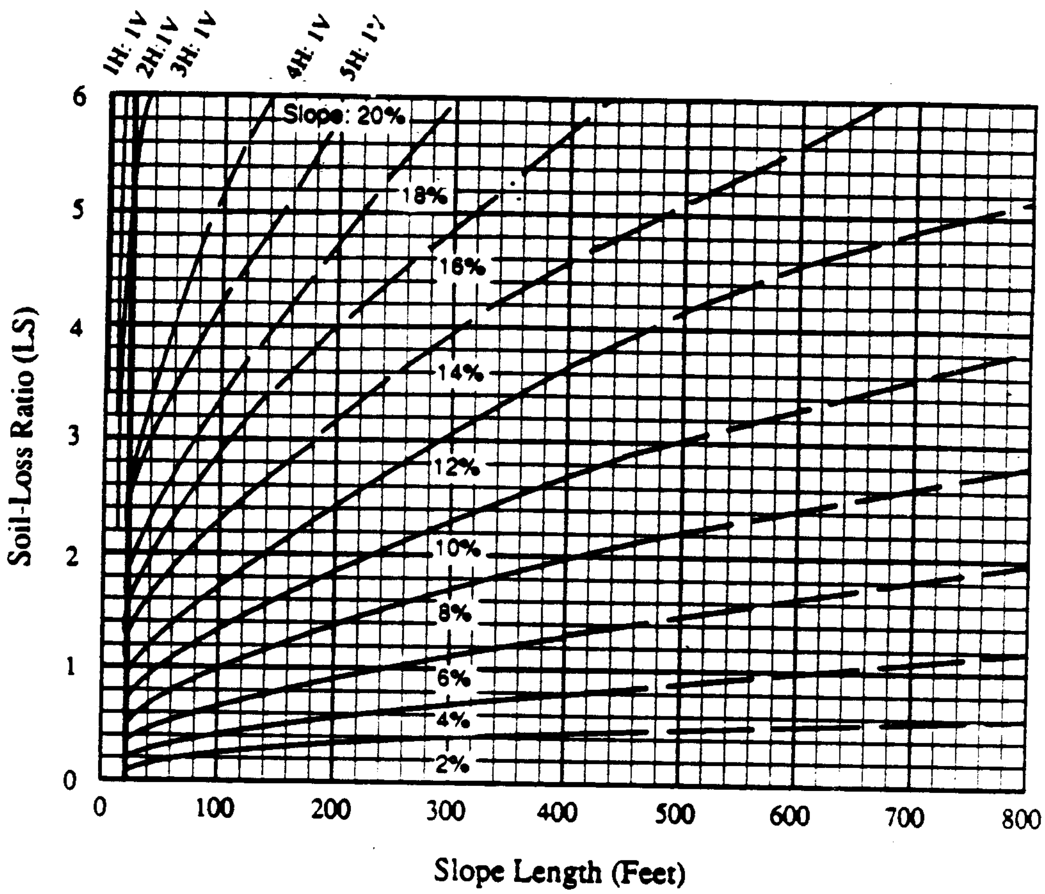
$$X = RKSLCP$$

where X = Soil loss
R = Rainfall erosion index
K = Soil erodibility index
S = Slope gradient factor
L = Crop management factor
P = Erosion control practice

Values for the Universal Soil Loss Equation parameters may be obtained from the U. S. Soil Conservation Service (SCS) Technical Guidance Document available at local SCS offices located throughout the United States. The soil-loss ratio may also be determined graphically (Figure 6-3) as a function of the slope length and the slope. This ratio is then used in the following equation to approximate soil loss from water erosion (USEPA, 1989a):

$$X' = I'K'C'L'V'$$

where X' = Annual wind erosion
I' = Field roughness factor
K' = Soil erodibility index
C' = Climate factor
L' = Field length factor
V' = Vegetative cover factor



Source: USEPA, 1989

FIGURE 6-3
Soil Erosion Due To Slope

The erosion layer also must be constructed of earthen materials. This requirement prohibits the use of pavement or other material that is not capable of sustaining native plant growth. The opportunity for alternate designs is available to owners or operators in approved States.

6.2.3.4 ADDITIONAL COVER SYSTEM REQUIREMENTS

Maximum reduction of post-closure leachate volume generation may be achieved with a composite cover comprised of a geomembrane and a soil component with low hydraulic conductivity. The hydraulic properties of these components are discussed in Section 4.0 (Subpart D).

Other components that may be used in the final cover system include a drainage layer, a gas vent layer, and a biotic barrier layer. These components are discussed in the following sections and are shown in Figure 6-4.

6.3 ALTERNATIVE FINAL COVER DESIGN 40 CFR §258.60(b)

6.3.1 Statement of Regulation

(b) The Director of an of approved State may approve an alternative final cover design that includes:

(1) An infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in (a)(1) of this section, and

(2) An erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in (a)(2) of this section.

6.3.2 Applicability

The opportunity to have an alternate final cover system is available to owners or operators in approved States only. The rule allows Director of an approved State to approve alternate final cover systems that can achieve equivalent performance as the minimum designs specified in §258.60(a). This provides an opportunity to incorporate technology, or improvements into cover designs and to address site-specific conditions. The use of amended soil as well as the design of the infiltration layer must be approved by the Director of an approved State.

6.3.3 Technical Considerations

An alternative material and/or an alternative thickness may be used for an infiltration layer as long as the infiltration requirement specified in §258.60(a)(1) is met.

An armored surface can be used as an alternate to the six-inch layer that can sustain plant growth. An armored surface, or hardened cap, is generally used in arid regions or on steep slopes where the establishment and maintenance of vegetation may be hindered by lack of soil or excessive runoff.

An armored surface (comprised of cobble-rich soils or soils rich in weathered rock fragments) is used to prevent erosion.

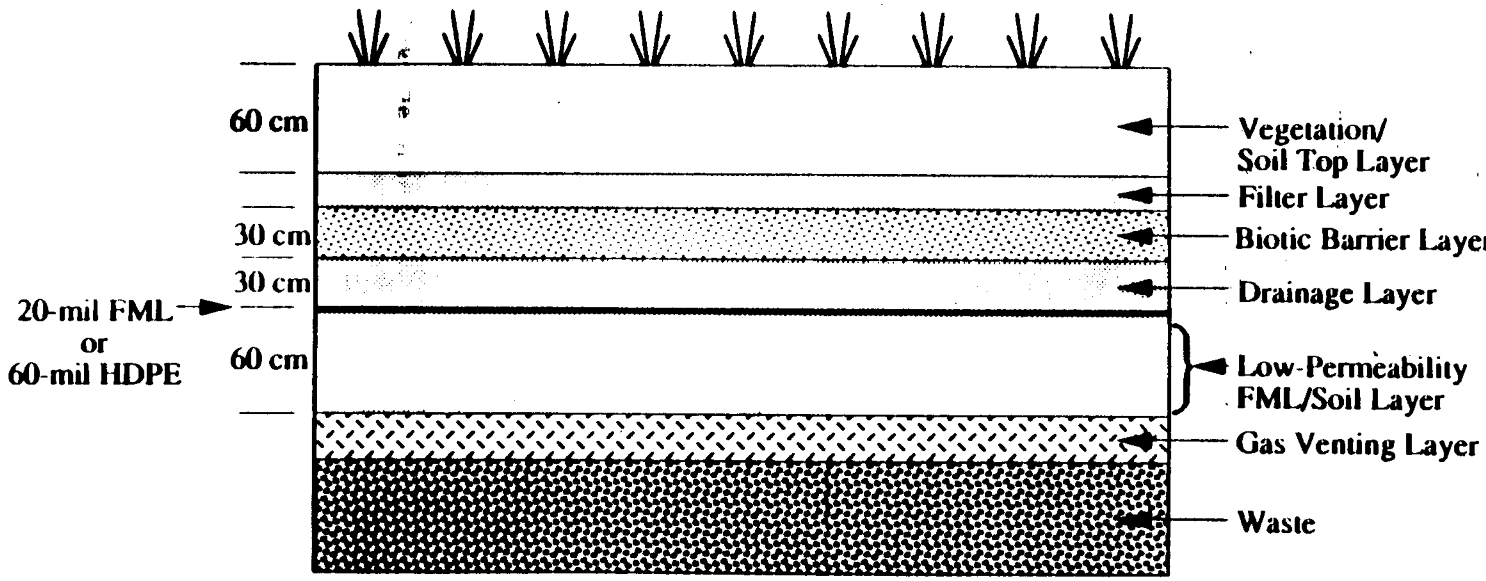


FIGURE 6-4
Recommended Final Cover Design

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The characteristics of the materials used for an armored surface typically are (USEPA, 1989b):

- Capable of remaining in place and minimizing erosion of the armored layer and the underlying infiltration layer during extreme weather events of rainfall and/or wind;
- Capable of accommodating settlement of the underlying material without compromising the component;
- Designed with a surface slope approximately the same as the underlying soil (at least 2 percent slope); and
- Are capable of controlling the rate of soil erosion.

The erosion layer may be made of asphalt or concrete. These materials promote runoff with negligible erosion. However, asphalt and concrete deteriorate due to thermal expansion and deformation caused by subsidence. Crushed rock may be spread over the landfill cover in areas where weather conditions such as wind, heavy rain, or temperature extremes commonly cause deterioration of vegetative covers (USEPA, 1989b).

6.4 Other considerations

6.4.1 DRAINAGE LAYER

A permeable drainage layer, constructed of soil or geosynthetic drainage material, may be constructed between the erosion layer and the underlying infiltration layer. The drainage layer in a final cover system removes percolating water that has infiltrated through the erosion layer after surface runoff and evapotranspiration losses. By removing water in contact with the low-permeability layer, the potential for leachate generation is diminished.

Owners or operators should consider methods to minimize physical clogging of the drainage layer by root systems. A filter layer, composed of either a low nutrient soil or geosynthetic material, may be placed between the drainage layer and the cover soil to help minimize root penetration.

Typically, if granular drainage layer material is used, the filter layer is at least 12 in. (30 cm) thick with a hydraulic conductivity in the range of 1×10^{-2} cm/sec to 1×10^{-3} cm/sec. The layer is sloped at least 2 percent but no greater than 5 percent after settlement. Granular drainage material will vary from site to site depending on the type of material that is locally available and economical to use. Typically, the material should be no coarser than 3/8 inch (0.95 cm), classified according to the Universal Soil Classification System (USCS) as type SP, smooth and rounded, and free of debris that could damage an underlying geomembrane (USEPA, 1989b). Crushed stone generally is not appropriate because of the sharpness of the particles. If the available drainage material is of poor quality, it may be necessary to increase the thickness and/or slope of the drainage layer to maintain adequate drainage. The HELP model, which was discussed in Section 4.0 (Subpart D) can be used as an analytical tool to evaluate the relative expected performance of alternative final cover designs.

If geosynthetic materials are used as a drainage layer, the fully saturated effective transmissivity should be the equivalent of 1 foot of soil (30 cm) with a hydraulic conductivity range of 1×10^{-2} cm/sec to 1×10^{-3} cm/sec. Transmissivity can be calculated as the hydraulic conductivity multiplied by the drainage layer thickness. A filter layer (preferably a non-woven needle punch fabric) should be placed above the geosynthetic material to minimize intrusion and clogging by roots or soil material from the top layer.

6.4.2 GAS VENT LAYER

Landfill gas collection systems serve to inhibit gas migration. The gas collection systems typically are installed directly beneath the infiltration layer. The function of a gas vent layer is to collect combustible gases (methane) and other potentially harmful gases (hydrogen sulfide) generated by methanogenic and other anaerobic micro-organisms during biological decay of putrefactive or landfilled organic wastes, and to divert these gases via a pipe system through the infiltration layer. A more detailed discussion concerning landfill gas is provided in Section 3.0 (Subpart C).

The gas vent layer is usually 12 in. (30 cm) thick and should be located between the infiltration layer and the waste layer. Materials used in construction of the gas vent layer should be medium to coarse-grained porous materials such as those used in the drainage layer. Geosynthetic materials may be substituted for granular materials in the vent layer if equivalent performance can be demonstrated. Venting to an exterior collection point for disposal or treatment should be provided by means such as horizontal pipes patterned laterally throughout the gas vent layer, which channel gases to vertical risers or lateral headers. If vertical risers are used, their number should be minimized (as they are frequently vandalized) and located at high points in the cross-section (USEPA, 1989b). Condensates will form within the gas collection pipes and some means should be incorporated into the design for drainage of condensate to prevent blockage by accumulation in low points. Condensate may be returned directly to the landfill.

The most obvious potential problem with gas collection systems is gas vent pipe penetrations placed through the cover system. Settlement within the landfill may cause concentrated stresses at the penetrations resulting in infiltration layer or pipe failure. If a geomembrane is used in the infiltration layer, adequate flexibility and slack material should be provided at these connections. Alternatively, if an active gas control system is planned, penetrations may be carried out through the sides of the cover directly above the liner anchor trenches where effects of settlement would be less pronounced. The gas collection system also may be connected into the leachate collection system to vent gases that may form inside the leachate collection pipes as well as to remove gas condensates that form within the gas collections pipes. Landfill gas systems are also discussed in Section 3.0 (Subpart C).

6.4.3 SETTLEMENT AND SUBSIDENCE

Excessive settlement and subsidence, caused by decomposition and consolidation of the wastes, can impair the integrity of the final cover system. Specifically, settlement can contribute to:

- Ponding of surface water on the cap;
- Disruption of gas collection pipe systems;
- Fracturing of low permeability infiltration layers; and
- Failure of geomembranes.

The degree and rate of settlement can be estimated. Good records regarding the type, quantity and location of waste materials disposed will improve the estimate. Settlement is caused by the deterioration and deformation of the waste layers and by consolidation of the waste. Settlement due to consolidation may be minimized by compacting the waste during daily operation of the landfill or by landfilling baled waste. Organic wastes will continue to degrade and deteriorate after closure of the landfill.

Several models have been developed to analyze the process of differential settlement. Most equate the layered cover to a beam or column undergoing deflection due to various loading conditions. While these models are useful to designers in understanding the qualitative relationship between various land disposal unit characteristics and in identifying the constraining factors, accurate quantitative analytical methods have not been developed (USEPA, 1988).

If the amount of settlement can be estimated, either from an analytical approach or empirical relationships from data collected during the operating life of the facility, the designer should attempt to estimate the potential strain imposed on the cover system components. Due to the uncertainties inherent in the settlement analysis, a biaxial strain calculation should be sufficient to estimate the stresses which may be imposed on the cover system. The amount of strain a liner is capable of enduring may be as low as several percent and five to twelve percent for geomembranes (USEPA, 1990). Geomembrane testing may be included as part of the design process to estimate safety factors against cover system failure.

The cover system may be designed with a greater thickness and/or slope to compensate for settlement after closure. However, even if settlement and subsidence are considered in the design of the final cover, ponding may still occur after closure and can be corrected during post-closure maintenance.

6.4.4 SLIDING INSTABILITY

The slope angle, slope length and overlying soil load limit the stability of component interfaces (geomembrane with soil, geotextile, and geotextile/soil). Soil water pore pressures developed along interfaces can also dramatically reduce stability. If the design slope is steeper than the effective friction angles between the material, sliding instability will generally occur. Sudden sliding has the potential to cause tears in geomembranes that require considerable time and expense to repair. Unstable slopes may require remedial measures to improve stability as a means of offsetting potential long-term maintenance costs.

The friction angles between various media are best determined by laboratory direct shear tests that represent the design loading conditions. Methods to improve stability include designs with flatter slopes, using textured material, constructing benches in the cover system, or reinforcing the cover soil above the membrane with geogrid or geotextile to minimize the driving force on the interface of concern. Methods for applying these design features can be found in USEPA (1989), USEPA (1990), and Richardson and Koerner (1987).

6.5 CLOSURE PLAN 40 CFR §258.60(c)-(d)

6.5.1 Statement of Regulation

(c) The owner or operator must prepare a written closure plan that describes the steps necessary to close all MSWLF units at any point during its active life in accordance with the cover design requirements in §258.60(a) or (b), as applicable. The closure plan, at a minimum, must include the following information:

(1) A description of the final cover, designed in accordance with §258.60(a) and the methods and procedures to be used to install the cover;

(2) An estimate of the largest area of the MSWLF unit ever requiring a final cover as required under §258.60(a) at any time during the active life;

(3) An estimate of the maximum inventory of wastes ever on-site over the active life of the landfill facility; and

(4) A schedule for completing all activities necessary to satisfy the closure criteria in §258.60.

(d) The owner or operator must notify the State Director that a closure plan has been prepared and placed in the operating record no later than the effective date of this part, or by the initial receipt of waste, whichever is later.

6.5.2 Applicability

An owner or operator of any MSWLF unit that receives wastes on or after October 9, 1991 must prepare a closure plan, and place the plan in the operating record. The plan must describe specific steps and activities that will be followed to close the unit at any time after it first receives waste through the time it reaches its waste disposal capacity.

The closure plan must include at least the following information:

- A description of the final cover and the methods and procedures to be used to install the cover:
- An estimate of the largest area which will have to be covered (typically this is the area that will exist when the final full capacity is attained); and

- A schedule for completing closure.

The area requiring cover should be estimated for the operating period from initial receipt of waste through closure. A cover system design, or a design report, is not an essential part of a closure plan although either may be incorporated as part of the plan.

The closure plan must be prepared, and placed in the operating record, prior to October 9, 1993 or by the initial receipt of waste whichever is later. The owner or operator must notify the State Director when the plan has been completed and placed in the operating record.

6.5.3 Technical Considerations

The closure plan is a critical document that describes the steps that an owner or operator will take to ensure that all units will be closed in a manner that is protective of human health and the environment. Closure plans provide the basis for cost estimates that in turn establish the amount of financial responsibility that must be demonstrated.

The closure plan must account for all areas of the MSWLF that are subject to Part 258 regulations and are not closed in accordance with §258.60. Portions of the landfill that have a daily cover, but not a final cover, must be included in the estimate. The area to be covered at any point during the active life of the operating unit can be determined by examining design and planned operation procedures and comparing them with construction records, operation records, and field observations. Units are frequently operated in phases, with some phases conducted on top of previously deposited waste. If the owner or operator routinely closes landfill cells as they are filled, the plan should indicate the greatest number of cells open at one time. Figure 6-5 depicts simplified examples of increasing areas throughout the active life of a unit.

The estimate must account for the maximum amount of waste on-site that may need to be disposed in the MSWLF over the life of the facility (this includes any waste on-site yet to be disposed). The maximum volume of waste ever on-site can be estimated from the maximum capacity of each unit and any operational procedures that may involve transfer of wastes to off-site facilities. Where insufficient design, construction, and operational records are found, areas and volumes may be estimated from topographic maps and/or aerial photographs.

Steps that may be included in the closure plan are as follows:

- Notifying State Director of intent to initiate closure §258.60(e);
- Determining area to receive final cover;
- Developing closure schedule;
- Preparing construction contract documents and secure contractor;
- Having an independent registered professional engineer to observe closure activities and provide certification;

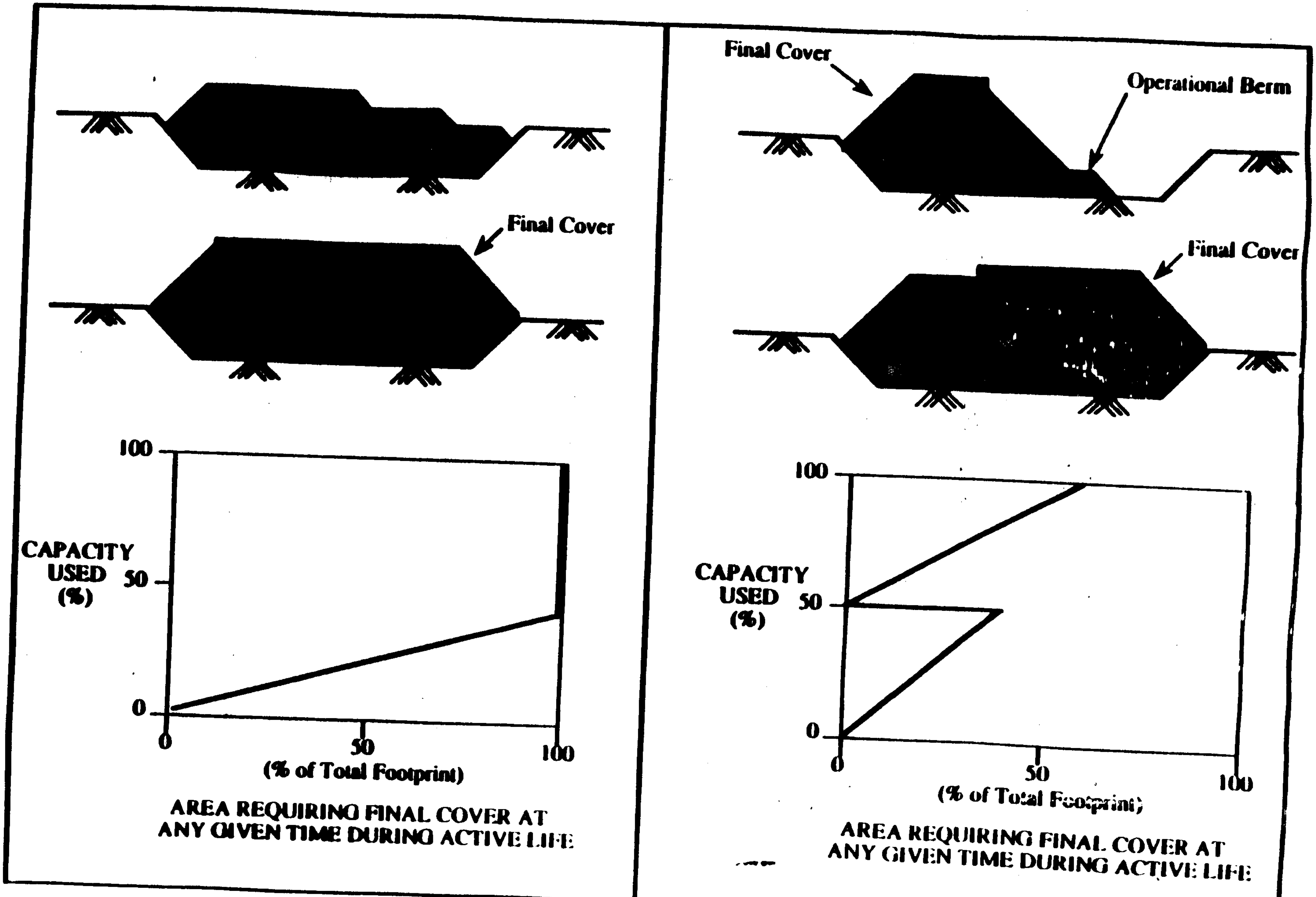

FIG 6.5 ESTIMATE OF AREA REQUIRING FINAL COVER AT ANY GIVEN TIME DURING UNIT'S ACTIVE LIFE

- Securing borrow material;
- Constructing the cover system;
- Obtaining signed certificate and place in operating record;
- Notifying State Director that certificate was placed in operating record; and
- Recording notation in deed to land or other similar instrument.

The closure plan should include a description of the final cover system and the methods and procedures that will be used to install the cover.

The description of the methods, procedures and processes may include design documents; construction specifications for the final cover system, including erosion control measures; quality control testing procedures for the construction materials; and quality assurance procedures for construction. A general discussion of the methods and procedures for cover installation are presented in Section 4.0.

6.6 CLOSURE CRITERIA 40 CFR §258.60 (e) - (j)

6.6.1 Statement of Regulation

(e) Prior to beginning closure of each MSWLF unit as specified in §258.60(f), an owner or operator must notify the State Director that a notice of the intent to close the unit has been placed in the operating record.

(f) The owner or operator must begin closure activities of each MSWLF unit no later than 30 days after the date on which the MSWLF unit receives the known final receipt of wastes or, if the MSWLF unit has remaining capacity and there is a reasonable likelihood that the MSWLF unit will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Director of an approved State if the owner or operator demonstrates that the MSWLF unit has the capacity to receive additional wastes and the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environment from the unclosed MSWLF unit.

(g) The owner or operator of all MSWLF units must complete closure activities of each MSWLF unit in accordance with the closure plan within 180 days following the beginning of closure as specified in paragraph (f). Extensions of the closure period may be granted by the Director of an approved State if the owner or operator demonstrates that closure will, of necessity, take longer than 180 days and he has taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed MSWLF unit.

(h) Following closure of each MSWLF unit, the owner or operator must notify the State Director that a certification, signed by an independent registered professional engineer or

approved by Director of an approved State, verifying that closure has been completed in accordance with the closure plan, has been placed in the operating record.

(i)(1) Following closure of all MSWLF units, the owner or operator must record a notation on the deed to the landfill facility property, or some other instrument that is normally examined during title search, and notify the State Director that the notation has been recorded and a copy has been placed in the operating record.

(2) The notation on the deed must in perpetuity notify any potential purchaser of the property that:

(i) The land has been used as a landfill facility; and

(ii) Its use is restricted under §258.61(c)(3).

(j) The owner or operator may request permission from the Director of an approved State to remove the notation from the deed if all wastes are removed from the facility.

6.6.2 Applicability

The closure requirements are applicable to all MSWLF units that receive wastes after October 9, 1993. The owner or operator is required to:

- Notify the State Director of the intent to close;
- Begin closure within 30 days of the last receipt of waste (or 1 year if there is remaining capacity and it is likely that it may be used);
- Complete closure within 180 days following the beginning of closure;
- Obtain a certification, by an independent registered professional engineer, that closure was completed in accordance with the closure plan;
- Place the certificate in operating record and notify the State Director; and
- Note on a deed (or some other instrument) that the land was used as a landfill and that its use is restricted.

Should all wastes be removed from the unit in an approved State, the owner or operator may request permission from the Director to remove the note on the deed. In approved States, the period of time to begin or complete closure may be extended by the Director.

6.6.3 Technical Considerations

Closure activities must begin within 30 days of the last receipt of waste and must be completed within 180 days. Some MSWLF units, such as those in seasonal population areas, may have remaining capacity but will not receive the next load of waste for a lengthy period of time. These MSWLF units must receive waste within one year or they must close.
Extensions to both the 1-year and 180-day requirements are available to owners or operators of MSWLF units in approved States. An extention may be granted if

the owner or operator can demonstrate that there is remaining capacity or additional time is needed to complete closure. The owner or operator must take, and continue to take, all steps necessary to prevent threats to human health and the environment from the unclosed MSWLF unit. In general, this requirement should be readily established for a unit in compliance with the requirements of Part 258. The owner or operator may need to demonstrate how access to the unclosed unit will be controlled prior to closure or receipt of waste and how the various environmental control and monitoring systems (e.g., surface runoff, surface run-on, leachate collection, gas control system, and ground water and gas monitoring) will be operated and maintained while the unit remains unclosed.

Following closure of each MSWLF unit, the owner or operator must have a certification, signed by an independent registered professional engineer, verifying closure. In approved States, the Director can approve the certification. The certificate should verify that closure was completed in accordance with the closure plan. This certification should be based on knowledge of the closure plan, observations made during closure, and documentation of closure activities provided by the owner or operator. The signed certification must be placed in the operating record and the State Director must be notified that the certification was completed and placed in the record.

After closure of all units at a MSWLF facility, the owner or operator must record a notation in the deed or records typically examined during a title search, that the property was used as a MSWLF and that its use is restricted under 40 CFR §258.61(c)(3). §258.61(c)(3) states:

"... Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of the containment systems or the function of the monitoring systems unless necessary to comply with the requirements of Part 258." and;

"The Director of an approved State may approve any other disturbance if the owner or operator demonstrates that disturbance of the final cover, liner, or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment."

These restrictions are described further in subsection 6.8 (Post-Closure Plan) of this document.

The owner or operator may request permission from the Director of an approved State to remove the notation to a deed. The request should document that all wastes are removed from the facility. Such documentation may include photographs, ground water and soil testing in the area where wastes were deposited, and reports of waste removal activity.

6.7 POST-CLOSURE CARE REQUIREMENTS 40 CFR §258.61

6.7.1 Statement of Regulation

(a) Following closure of each MSWLF unit, the owner or operator must conduct post-closure care. Post-closure care must be conducted for 30 years, except as provided under paragraph (b) of this part, and consist of at least the following:

(1) Maintaining the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(2) Maintaining and operating the leachate collection system in accordance with the requirements in §258.40. The Director of an approved State may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to human health and the environment;

(3) Monitoring the ground water in accordance with the requirements of Subpart E and maintaining the ground-water monitoring system, if applicable; and

(4) Maintaining and operating the gas monitoring system in accordance with the requirements of §258.23.

(b) The length of the post-closure care period may be:

(1) Decreased by the Director of an approved State if the owner or operator demonstrates that the reduced period is sufficient to protect human health and the environment and this demonstration is approved by the Director of an approved State; or

(2) Increased by the Director of an approved State if the Director of an approved State determines that the lengthened period is necessary to protect human health and the environment.

6.7.2 Applicability

Post-closure care requirements apply to MSWLF units that stop receiving waste after October 9, 1993. They also apply to units that stop receiving waste between October 9, 1991 and October 9, 1993 and fail to complete closure within six months of the final receipt of waste. The length of the post-closure care period may be increased or decreased by the Director of an approved State.

Post-closure care requirements are focussed on operating and maintaining the proper functioning of four systems that prevent or monitor releases from the MSWLF unit:

- Cover system;
- Leachate collection system;
- Ground water monitoring system; and
- Gas monitoring system.

Owners or operators must comply with these requirements for a period of 30 years following closure. In approved States, the post-closure care period may be shortened if the owner or operator demonstrates to the satisfaction of the Director that human health and the environment are protected. Conversely, the Director may determine that a period longer than 30 years is necessary. The requirement to operate and maintain the leachate collection system may be eliminated by the Director of an approved State if the owner or operator demonstrates that leachate does not pose a threat to human health and the environment.

6.7.3 Technical Considerations

When the final cover is installed, repairs and maintenance may be necessary for the cover to continue functioning properly. Maintenance may include inspection, testing, and cleaning of leachate collection and removal system pipes, repairs of final cover, and repairs of gas and ground-water monitoring networks.

Inspections should be made on a routine basis. A schedule should be developed to check that routine inspections are completed. Records of inspections detailing observations should be kept in a log book so that changes in any of MSWLF systems can be monitored and changes in post-closure care personnel will not affect post-closure care due to lack of knowledge of routine activities. The activities and frequency of inspections are subject to State review to ensure that units are monitored and maintained for as long as is necessary to protect human health and the environment.

Inspecting the final cover may be performed on the ground and through aerial photography. Inspections performed should be conducted at appropriate intervals and the condition of the facility should be recorded with notes, maps, and photographs. The inspector should take notice of eroded banks, patches of dead vegetation, animal burrows, subsidence, and cracks along the cover. The inspector should also note the condition of concrete structures (e.g., manholes), leachate collection and removal pipes, gas monitoring systems and monitoring wells.

For larger facilities, annual aerial photography may be a useful way to document the extent of vegetative stress and settlement if either of these has been observed. It is important to coordinate the photography with the site "walkover" to verify interpretations made from aerial photographs. Aerial photography should not be used in place of a site walkover but in conjunction with the site walkover. USEPA (1987) provides further information on using aerial photography for inspecting a landfill facility.

Optical topographic surveys of the landfill may be used to determine whether settlement has occurred. These should be repeated every few years until settlement behavior is established. If settlement plates are used, they should be permanent and protected from vandalism and accidental disturbance (USEPA, 1987). Depressions caused by settlement may lead to ponding and should be filled in with soil. Excessive settlement may warrant reconstructing or adding to portions of the infiltration layer. Damage caused by settlement such as tension cracks and tears in the synthetic membrane should be repaired.

Cover systems that have areas where the slope is greater than 5 percent may be susceptible to erosion. Large and small rills (crevices) may form along the cover where water has eroded the cover. This may lead to exposure of the synthetic geomembrane and, in severe cases, depending on the cover system installed, exposure of the waste. Erosion may lead to increased infiltration of surface water into the landfill. Areas showing signs of erosion should be repaired.

Vegetation established on the cover should be mowed at least twice a year to suppress weed and brush growth. Mowing of the vegetative cover typically occurs during the warmer, early and late summer months in temperate climates. Fertilization may be necessary to encourage and sustain desirable vegetative growth. Insecticides may be used to eliminate insect populations that are detrimental to the vegetation. Animal burrows, if present, should be filled in with soil as a deterrent.

Leachate collection and removal systems should be inspected to check that they are working properly. Leachate collection and removal pipes may be flushed and pressure cleaned on a regular schedule (annually) to reduce the accumulation of sediment and precipitation and biological fouling.

Gas collection systems should be inspected to check that they are working properly. Vents should be checked to ensure they are not clogged by foreign matter such as rocks. If not working properly, the gas collection systems should be flushed and pressure cleaned.

At some landfills, leachate concentrations eventually may become low enough not to pose a threat to human health or the environment. In an approved State, the Director may allow an owner or operator to cease managing leachate if the owner or operator can demonstrate that the leachate no longer poses a threat to human health and the environment. The demonstration should address direct exposures of leachate releases to ground-water, surface water, or seeps. Indirect effects such as accumulated leachate adversely affecting the chemical, physical, and structural containment systems that prevent leachate release also should be addressed in the demonstration.

The threat posed by direct exposures to leachate released to ground-water, to surface waters, or through seeps may be assessed using health-based criteria. These criteria and methods, available through the Integrated Risk Information System (IRIS) (a database maintained by USEPA), the RCRA Facility Investigation Guidance (USEPA, 1989C), the Risk Assessment Guidance for Superfund (USEPA, 1989d), and other USEPA Guidance Documents, include MCLs from the Safe Drinking Water Act, and ambient water quality criteria from the Clean Water Act. These criteria and assessment procedures are described in Section 5.0 (Subpart E) of this document.

Concentrations at the points of exposure, and rather than concentrations in the leachate in the collection system, often may be used when assessing threats.

6.7 POST-CLOSURE PLAN 40 CFR §258.61(c)-(d)

6.8.1 Statement of Regulation

(c) The owner or operator of all MSWLF units must prepare a written post-closure plan that includes, at a minimum, the following information:

(1) A description of the monitoring and maintenance activities required in §258.61(a) for each MSWLF unit, and the frequency at which these activities will be performed;

(2) Name, address, and telephone number of the person or office to contact about the facility during the post-closure period; and

(3) A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in Part 258. The Director of an approved State may approve any other disturbance if the owner or operator demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of waste, will not increase the potential threat to human health or the environment.

(d) The owner or operator must notify the State Director that a post-closure plan has been prepared and placed in the operating record no later than the effective date of this part, or by the initial receipt of waste, whichever is later.

(e) Following completion of the post-closure care period for each MSWLF unit, the owner or operator must notify the State Director that a certification, signed by an independent registered professional engineer or approved by the Director of an approved State, verifying that post-closure care has been completed in accordance with the post-closure plan, has been placed in the operating record.

6.8.2 Applicability

Owners and operators of existing, new, and lateral expansions of existing MSWLF units that stop receiving waste after October 9, 1993 are required to provide a post-closure plan. MSWLF units that received the final waste shipment between October 9, 1991 and October 9, 1993 but failed to complete installation of a final cover system within six months of the final receipt of waste also are required to provide a post-closure plan.

The post-closure plan describes the monitoring activities that will be conducted throughout the 30-year period. The plan also establishes:

- The schedule or frequency at which these activities are conducted;
- Name, address, and telephone number of a person to contact about the facility;

- A description of planned use that does not disturb the final cover; and
- The procedure for verifying that post-closure care was provided in accordance with the plan.

In approved States only, the owner or operator may request the Director to approve a use that disturbs the final cover based on a demonstration that the use will not increase potential threat to human health and the environment.

6.8.3 Technical Considerations

The State Director must be notified that a post-closure plan describing the maintenance activities required for each MSWLF unit has been placed in the operating record. The post-closure plan should provide a schedule for routine maintenance of the MSWLF unit systems. These systems include the final cover system, the leachate collection and removal system, and the landfill gas and ground-water monitoring systems.

The plan must include the name, address, and telephone number of the person or office to contact regarding the facility throughout the post-closure period. Additionally, the planned uses of the property during the post-closure period must be provided in the plan. These uses may not disturb the integrity of the final cover system, the liner system, and any other components of the containment or monitoring systems unless necessary to comply with the requirements of Part 258. An example of an acceptable disturbance may include remedial action necessary to minimize the threat to human health and the environment. Any other disturbances to any of the MSWLF components must be approved by the Director of an approved State.

Following completion of the post-closure care period, the State Director must be notified that an independent registered professional engineer has verified and certified that post-closure care has been completed in accordance with the post-closure plan and that this certification has been placed in the operating record. Alternatively, the Director of an approved State may approve the certification. Certification of post-closure care should be submitted for each MSWLF unit.

6.9 FURTHER INFORMATION

6.9.1 References

Giroud, J.P., Bonaparte, R., Beech, J.F., and Gross, B.A., "Design of Soil Layer - Geosynthetic Systems Overlying Voids". Journal of Geotextiles and Geomembranes, Vol. 9, No. 1, 1990, pp. 11-50.

Richardson, G.N. and R.M. Koerner, (1987). "Geosynthetic Design Guidance for Hazardous Waste Landfill Cells and Surface Impoundments"; Hazardous Waste Engineering Research Laboratory; USEPA, Office of Research and Development; Cincinnati, Ohio; Contract No. 68-07-3338.

U.S. EPA, (1987). "Design, Construction and Maintenance of Cover Systems for Hazardous Waste: An Engineering Guidance Document"; PB87-19156; EPA/600/2-87/039; U.S. Department of Commerce, National Technical Information Service; U.S. Army Engineering Waterways Experiment Station; Vicksburg, Mississippi.

U.S. EPA, (1988). "Guide to Technical Resources for the Design of Land Disposal Facilities"; EPA/625/6-88/018; U.S. EPA; Risk Reduction Engineering Laboratory and Center for Environmental Research Information; Office of Research and Development; Cincinnati, Ohio 45268.

U.S. EPA, (1989a). "Seminar Publication - Requirements for Hazardous Waste Landfill Design, Construction and Closure"; EPA/625/4-89/022; U.S. EPA; Center for Environmental Research Information; Office of Research and Development; Cincinnati, Ohio 45268.

U.S. EPA, (1989b). "Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments"; EPA/530-SW-89-047; U.S. EPA; Office of Solid Waste and Emergency Response; Washington, D.C. 20460.

U.S. EPA, (1989c). "Interim Final: RCRA Facility Investigation (RFI) Guidance"; EPA 530/SW-89-031; U.S. EPA; Waste Management Division; Office of Solid Waste; U.S. Environmental Protection Agency; Volumes I-IV; May 1989.

U.S. EPA, (1989d). "Interim Final: Risk Assessment Guidance For Superfund; Human Health Evaluation Manual Part A"; OS-230; U.S. EPA; Solid Waste and Emergency Response; July 1989.

U.S. EPA, (1990). "Seminars - Design and Construction of RCRA/CERCLA Final Covers"; CERI 90-50; U.S. EPA; Office of Research and Development; Washington, D.C. 20460.

6.9.2 Organizations

U.S. Department of Agriculture
Soil Conservation Service (SCS)
P.O. Box 2890
Washington, D.C. 20013-2890
(Physical Location: 14th and Independence Ave. N.W.)
(202) 447-5157

Note: This is the address to the SCS headquarters. To obtain the SCS Technical Guidance Document, SCS regional offices located throughout the United States should be contacted.

6.9.3 Models

Schroeder, et al., (1988). "The Hydrologic Evaluation of Landfill Performance (HELP) Model"; U.S.EPA; U.S. Army Engineer Waterways Experiment Station; Vicksburg, MS 39181-0631; October 1988.

APPENDIX U

Indiana Department of

Office of Solid and Ha

This document is provided for informational purposes. It is not an enforceable guidance document.

2B1

Registrant *

Solid Waste Facility Inspection Report

Date	Time
County	
Facility	Permit Yes * No
Location	Inspected By

Type Of Operation: Sanitary Landfill Construction/Demolition Processing Facility Incinerator Restricted Waste Site Type______ Collection Container Other______

OPERATIONAL REQUIREMENTS-LAND DISPOSAL

1. ACCESS CONTROL, 2-14-1
2. ON-SITE ROADS, 2-14-2
3. SIGNS, 2-14-3
4. SANITATION, 2-14-4
5. SCAVENGING, 2-14-5
6. SALVAGING, 2-14-6
7. SAFETY REQUIREMENTS, 2-14-7
8. RECORDS, 2-14-8
9. OPEN BURNING, 2-14-9 *
10. WASTE DEPOSIT AND COMPACTION, 2-14-10
11. DIVERSION OF SURFACE WATER, 2-14-11
12. COVER-GENERAL PROVISIONS, 2-14-12 *
13. COVER-SANITARY LANDFILLS & RWS TYPE I, 2-14-13 *
14. COVER-RWS TYPE II, 2-14-14 *
15. COVER-RWS TYPE III, 2-14-15 *
16. COVER-CONST/DEMO SITES, 2-14-16 *
17. DISPERSAL CONTROL, 2-14-17
18. GRADING & SOIL STABILIZATION, 2-14-18
19. FINAL COVER, 2-14-19
20. EXPLOSIVE GASES, 2-14-20
21. LEACHATE ON SITE, 2-14-21
22. LEACHATE OFF SITE, 2-14-21 *
23. LEACHATE COLLECTION, 2-14-22 *
24. LEACHATE DISPOSAL, 2-14-23 *
25. GROUNDWATER MONITORING WELLS, 2-14-24
26. PERMIT DEVIATION/MODIFICATION, 2-8-11 *

PROCESSING FACILITIES

27. FACILITY ACCESS & ROADS, 2-19-1
28. PUBLIC HEALTH & SAFETY, 2-19-2
29. FACILITY SANITATION, 2-19-3 *
30. USE OF CONTINGENCY PLAN, 2-19-4
31. SPECIAL WASTE, 2-19-5
32. RECORDS & REPORTS, 2-19-6
33. PERMIT DEVIATION/MODIFICATION, 2-8-11*

INCINERATORS

34. OPERATIONAL REQUIREMENTS, 2-20-3
35. ADDITIONAL OPERATIONAL REQUIREMENTS & INFECTIOUS WASTE, 2-20-4

SPECIAL WASTE

36. SPECIAL WASTE DISPOSAL, 2-21-15 *

Circled asterisk items identify major violation(s) of 329 IAC 2 or IC 13-7 and shall be corrected immediately

Comments: ______________________________

RECEIVED BY: ______________________

DISTRIBUTION: White-Office; Pink-Facility; Canary-Inspector

State Form 34505 (R/3-91)

OPEN DUMP INSPECTION REPORT

State Form 42033 (12-87)

Department of Environmental Management
Office of Solid and Hazardous Waste Management
Solid Waste Management Branch

Inspection Type ☐ Initial (INI) or ☐ Follow-up (FOL)		Registrant Number	
Date	Time	County	County Code
Area ☐ North (N) or ☐ South (S)	Inspected By		
Site Location			
Property Owner's name			
Property Owner's Address *(Street or Rural Route)*			
City		State	ZIP Code

INSPECTION FINDINGS

	YES	NO
SOLID WASTE OBSERVED?		
ARE COMBUSTIBLE WASTES PRESENT?		
IS ACCESS RESTRICTED?		
IS THERE EVIDENCE OF BURNING ON SITE?		
ARE WASTES BEING DEPOSITED IN WATER?		

If YES to the last question, please explain:

Approximate Size of Site: ☐ Less than ¼ Acre ☐ More than ¼ Acre

Status
☐ Active (A) ☐ Inactive (I) ☐ Closed (C)

Compliance
IC or NC

Comments:

Received By:

DISTRIBUTION: White Copy - File, Yellow Copy - Inspector, Pink Copy - Responsible Party

APPENDIX

V

Indiana Department of Envi
Application for RENEWAL of Solic

Instructions: This application shall be used to apply for renewal of solid waste facility permits. Pursuant to 329 IAC 2-8-9, this application must be received by the Commissioner of the Indiana Department of Environmental Management at least 120 days prior to the expiration date of the permit. Permit fees for renewal shall be assessed equal to 1/2 the initial permit fee. Upon completion, return this application and any additional materials to the following address:

Office of Solid and Hazardous Waste Management
Indiana Department of Environmental Management
105 South Meridian Street, P. O. Box 6015
Indianapolis, IN 46206-6015

Section A. Applicant(s) Information

Name			
Mailing Address, Street	City	State	Zip Code
AC - Telephone Number			

Section B. Property Owner(s) Information

Name			
Mailing Address, Street	City	State	Zip Code
AC - Telephone Number			

Section C. Facility Information

Name____________________ Permit No. __________

Mailing Address____________________

Facility Contact Person and Telephone #____________________

County and General Location____________________

- Type of Operation -

- O Sanitary Landfill
- O Construction/Demolition
- O Incinerator - 10 tons/day or greater
- O Infectious Waste Incinerator - 7 tons/day or greater
- O Restricted Waste Site TYPE I
- O Restricted Waste Site TYPE II
- O Restricted Waste Site TYPE III
- O Solid Waste Processing Facility

Number of acres permitted for landfilling____________________

Number of acres completed____________________

Remaining life of facility ________ years

Volume of waste received ________ cubic yards per day, or ________ tons per day

Type of waste received____________________

Section D. Attachments Required

1. A legal description (defined by 329 IAC 2-2-1(b)(30)) of the facility location, including the acreage thereof.
2. A topographic plot plan accurately identifying the following information to a scale as required by 329 IAC 2-11-3(a):
   - A. areas of final cover, grading and seeding;
   - B. filled areas lacking final cover, grading and seeding;
   - C. current areas of operation - including depth of fill; and
   - D. projected fill areas on a per year basis for the next five years.
3. A copy of the fee transmittal form and check.

Section E. Signatories

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit information."

____
Applicant Signature

____
Date

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
SOLID WASTE FACILITY PERMIT APPLICATION

FEE TRANSMITTAL FORM

Instruction:

This form shall be used to transmit fees for all solid waste management facility permits (**NEW** permits, **RENEWALS** of permits, **MAJOR MODIFICATIONS*** of permits and **ANNUAL OPERATING FEES**) pursuant to 329 IAC 2-8, and is to accompany all payments. Make check or money order payable to the Indiana Department of Environmental Management. Upon completion, return this form and appropriate fees to the following address:

Cashier, Room 140
Indiana Department of Environmental Management
105 South Meridian Street
P. O. Box 7060
Indianapolis, IN 46206-7060

(**NOTE:** A **COPY** of your check and a **COPY** of this fee transmittal form must be attached to your permit application).

Section A. Applicant(s) Information

Name:		
Mailing Address: Street		City
State	Zip Code	AC-Telephone Number:
Facility Name and County:		

*"Major Modification" means any change in a permitted solid waste facility which would increase the facility's permitted capacity to process or dispose of solid waste. (Per 329 IAC 2-2-1 as amended on February 19, 1991).

Section B. Solid Waste Permit Fee Schedule

1. Non-Government Entities

The following fees are to accompany new permit applications and major modifications to existing permits.

	Permit Application for New Sites and Major Modifications
Sanitary Landfill	
> 500 tons/day	☐ $20,000
250-499 tons/day	☐ $20,000
100-249 tons/day	☐ $20,000
< 100 tons/day	☐ $20,000
Processing Facilities (non-incineration)	☐ $ 5,000
Incinerators	
≥ 500 tons/day	☐ $20,000
250-499 tons/day	☐ $20,000
100-249 tons/day	☐ $20,000
10-99 tons/day	☐ $20,000
Infectious Waste Incinerator (≥ 7 tons/day)	☐ $ 4,000
Restricted Waste Site Type I	☐ $14,000
Restricted Waste Site Type II	☐ $ 4,000
Restricted Waste Site Type III	☐ $ 2,000
Construction/Demolition Site	☐ $ 1,000
Waste Tire Cutting Facility	☐ $ 100

2. Government Entities

	Permit Application for New Sites and Major Modifications	Permit Renewal
Sanitary Landfill	☐ $ 1,000	☐ $ 500
Processing Facility (non-incineration)	☐ $ 500	☐ $ 250
Incinerator (≥ 10 tons/day)	☐ $ 1,000	☐ $ 500
Infectious Waste Incinerator (≥ 7 tons/day)	☐ $ 1,000	☐ $ 500
Restricted Waste Site Type I	☐ $ 1,000	☐ $ 500
Restricted Waste Site Type II	☐ $ 1,000	☐ $ 500
Restricted Waste Site Type III	☐ $ 500	☐ $ 250
Construction/Demolition Site	☐ $ 500	☐ $ 250

APPENDIX

W

DISTRICT SOLID WASTE PLAN REVIEW FORMAT

This guidance document was developed by IDEM staff with input from the public. It is intended to provide a consistent framework for review of the District Solid Waste Management Plans by the Indiana Department of Environmental Management (IDEM). This document consists of a list of review criteria that will be used by IDEM staff in reviewing District Plans. Districts may use this document as further guidance in finalizing their District Solid Waste Plan.

As the District Plan review process proceeds, this document may be subject to updates as experience dictates and new statutes are enacted. THIS FINAL DRAFT ISSUED APRIL 27, 1992 SUPERSEDES ALL OTHER CRITERIA ISSUED.

REVIEW CRITERIA OF DISTRICT SOLID WASTE MANAGEMENT PLANS

The following criteria are to be considered during review of each District Solid Waste Management Plan (hereafter referred to as the Plan). These criteria have been developed to maintain consistency in review of the Plans and to provide the Districts with guidelines and considerations for development of their Plans.

These criteria may not be an exhaustive list of every issue that must be addressed in the Plan. If an Indiana Department of Environmental Management (IDEM) Planner determines during a Plan review that an issue or special situation, not common with all the Districts, must be addressed, the Planner will indicate these issues either verbally or in writing to the District.

It is imperative that each District complete all sections of the Plan, as indicated in the District Solid Waste Management Plan Format (Volume II of the Indiana Solid Waste Management Plan). After evaluating a section, the IDEM planner should circle either **Y** (yes, the section is complete), **N** (no, the section has not been addressed), or **I** (the section has incomplete information). If information is missing, the Plan must include an explanation and justification for the omissions. If there is no explanation, or the IDEM Planner determines that the omission requires attention, this shall be indicated either verbally or in writing to the District.

These criteria are arranged into the major parts (indicated by underscoring) of the District Solid Waste Management Plan Format (hereafter referred to as the Format). Additionally, within each major part, criteria are grouped according to the subparts which also match the Format.

Executive Summary

Y N I 1. Does the Plan have an Executive Summary? Does it include the major points of the Plan?

Y N I 2. Does the Plan have a complete and detailed Table of Contents, List of Tables and List of Figures?
COMMENTS:____

Part 1. Administrative Information

Y N I 1. Does the Plan include all of the information and signatures required in parts ***1.1-1.7*** of the Format? If information is missing, please list deficiencies.
COMMENTS:____

Y N I 2. Is a copy of the ordinance, if any, forming the District attached as an appendix?
If plan is submitted from a joint district, is a copy of the joint operating agreement attached?
COMMENTS:____

Part 2. Demographic Information/Facilities Inventory

2.1 Population

Y N I 1A. Are population projections provided for each county in the district for each year of the twenty year planning period?

Y N I 1B. What is the source/method of these projections?
COMMENTS:____

____

2.2 Residential /Commercial Waste Generation

Y N I 1A. Which method does the Plan use for determining residential/commercial waste generation?

____

Y N I 1B. Is the generation rate reported in Tons Per Year (TPY)?

Y N I 1C. To the extent determinable, are all the calculations accurate for residential/commercial generation rates?

Y N I 1D. Are tires, household hazardous waste, used oil, white goods, vegetative matter resulting from landscaping maintenance and land clearing projects (yard wastes) and other waste discussed in the State Plan (batteries, construction and demolition debris, and conditionally exempt hazardous waste) listed?

Y N I 1E. Are yard wastes, which will not be accepted at a sanitary landfill after September 30, 1994, listed?

Y N I 1F. Are other wastes (such as types of recyclables) which will be managed, listed?

Y N I 2A. Was the most recent U.S. E.P.A. study used for the district waste generation figures?

Y N I 2B. What are the methods used to calculate generation of solid waste not included in the U.S. E.P.A. Study (The study pertains to municipal solid waste only.)

Y N I 3A. Was a waste characterization study done on the district's waste?
COMMENTS:____

____

Y N I 3B. When was it conducted? List date: ____________________________

Y N I 3C. How many samples were taken? ____________________________

Y N I 3D. Is the location (s) of the waste characterization study listed?

Y N I 3E. Were waste samples conducted in each season of the year?

Y N I 4A. Was a waste characterization study from another locality selected for the generation figures for this plan? List characterization study (ies).____

Y N I 4B. Are the waste composition study or other study done recently, within the last three years?

Y N I 4C. Is the geographical area of the other study similar (economic base, rural vs. urban, etc.) to the District?

COMMENTS:____

Y N I 4D. Was the waste in study sampled during each season of the year?

Y N I 4E. How many samples were taken for the study?

Industrial Waste Generation

Y N I 5A. Did the district send out a survey to all industries in the district?

Y N I 5B. Does the Plan include a copy of the industrial solid waste generation survey instrument in the appendix?

Y N I 5C. Does the survey report the total number of industries in the District? (Check against Harris Directory)

Y N I 5D. To how many industries was the survey sent?

Y N I 5E. What was the response rate to the survey?

COMMENTS:____

Y N I 5F. Does the response rate represent at least 70% of the employees of the industrial sector?

Y N I 5G. What amount of the total industrial waste generated is reflected in the survey response?

COMMENTS:____

Y N I 5H. Does the response rate represent at least 80% of industrial waste generated in the district?

Y N I 5I. If the response and results from the industrial waste generation survey are limited, what provisions did the district implement to improve its understanding of the district's industrial waste stream?

COMMENTS:____

Y N I 5J. Does the survey form request, at a minimum, total waste generation, types of waste, amounts of each type, methods of disposal, and amounts recycled?

COMMENTS:____

Y N I 5K. Are types and amounts of industrial wastes designated in the survey instrument presented in a survey summary?

Y N I 5L. Are the figures given in Tons Per Year (TPY)?

Y N I 5M. Are the statutory conversions used? (3.3 cu. yds./ton compacted and 6 cu. yds./ton loose)

Y N I 6A. Does the Plan include a total waste generation estimate in Tons Per Year (TPY)?

Y N I 6B. Are all the calculations needed to determine the total waste generation included and explained in sufficient detail to determine their accuracy?

COMMENTS:____

Y N I 6C. Is total waste generation added correctly?

RESIDENTIAL/COMMERCIAL WASTE GENERATION PROJECTIONS

Y N I 7A. What method does the Plan use for residential/commercial waste generation projections?

COMMENTS:____

Y N I 7B. Is the method for calculating generation projections documented?

Y N I 7C. Are waste generation projections reported in Tons Per Year (TPY)?

Y N I 7D. Does the narrative description of each projection include the method used and reasons why the projections increase, decrease, or stay the same?

INDUSTRIAL WASTE GENERATION PROJECTIONS

Y N I 8A. What is the rationale for industrial waste generation projections?

COMMENTS:____

Y N I 8B. Are the projections reported in Tons Per Year (TPY)?

Y N I 8C. Do the narrative descriptions of the projections concur with the projections?

Y N I 8D. Does the narrative description of each projection include the method used and reasons why the projections increase, decrease, or stay the same?

2.3 Waste Reduction, Reuse, and Recycling in District

Y N I 1A. Are the projections for total amount of waste to be recycled listed?

Y N I 1B. Do the figures reflect when recycling programs/activities are to come on-line?

Y N I 1C. Are the projections for industrial recycling listed?

Y N I 1D. Are the projections for publicly available recycling listed?

Y N I 1E. Are any other recycling projections listed?

Y N I 2. Are projections for waste reduction listed?

Y N I 3. Are the projections for yard waste, municipal solid waste composting, lead-acid batteries, tires, and other methods listed?

Y N I 4. Are the recycling, reuse and reduction as a percentage of District waste calculated correctly from the baseline year? (Divide the total amount of waste reduction by the total amount of waste generated in the baseline year. The baseline year is when the district does its initial studies for plan development. Existing recycling, reuse, and reduction programs can count toward the goals, as long as the programs are still in force.)

Y N I 5. Is a footnote breaking down the recyclables by type included?
COMMENTS:____
____

2.4 Origin and Destination of Waste for Disposal

Y N I 1A. Are the projections for waste imported to/exported from the District listed?

Y N I 1B. Does the Plan compare projections to IDEM records such as quarterly reports?

Y N I 1C. If there is a significant deviation, is there an explanation?

Y N I 2A. Is the total waste landfilled in the District calculated correctly?

Y N I 2B. Is the total amount of waste incinerated in the District listed?

Y N I 3. Does the Plan list the sources of information for imported/exported waste?
COMMENTS:

2.5 Inventory of Existing Facilities/Activities

Y N I 1A. Does the inventory section (2.5.1-2.5.11) include the following where applicable: Solid waste landfills (open to public and captive), collection services, transportation services, transfer stations, incinerators/waste-to-energy facilities, publicly available recycling services, compost facilities, solid waste collection depots, waste tire piles, and open dumps?

Y N I 1B. Have all the questions been answered for all facilities?
COMMENTS:

Y N I 1C. Does the amounts of waste processed, received or disposed of in the base year (2.5.1#5) reflect the amounts indicated in 2.3 and 2.4?
COMMENTS:

Y N I 1D. At the District's discretion, are recyclable brokers and recyclable markets listed?

Y N I 2A. Is original design capacity for facilities reported in tons or in Tons Per Day (TPD)?

Y N I 2B. Are remaining capacity (tons) and life (years) for landfills reported?

Y N I 2C. Is the amount collected, processed, or disposed of in baseline year reported in tons?

Y N I 3. Are the statutory conversion factors used to determine tonnage of municipal solid waste if no scales are present? (3.3 cu. yds./ton compacted and 6 cu. yds./ton loose)
COMMENTS:

Y N I 4A. Is a narrative description of how remaining disposal capacity was calculated included for each existing final disposal facility?
COMMENTS:

Y N I 4B. Has the district compared remaining capacity calculations with IDEM information?
COMMENTS:

Y N I 4C. Is the name, registration, and company of the professional who determined the estimates for remaining capacity and life for landfills listed? When were they completed?
COMMENTS:________________________________

Y N I 5. Is the map of existing facilities included as an appendix?
COMMENTS:________________________________

Y N I 6. Are the products recycled listed in 2.5.7?

Y N I 7. What is the materials for compost listed 2.5.8?

2.6 Projection of Needed Facilities/Activities

Y N I 1. Do previous projections for generation and recycling rates and existing facilities demonstrate a need for additional capacity and/or programs? Are additional capacity and/or program needs identified?
COMMENTS:________________________________

Y N I 2. Are the additional programs, activities and facilities identified sufficient to meet the State goals and to manage the District's future needs for at least 20 years?
COMMENTS:________________________________

Y N I 3A. Is information provided on new facilities/activities and expansions of existing facilities/activities?

Y N I 3B. If there is a need for new facilities/activities, does the plan show how the need will be met?
COMMENTS:________________________________

Y N I 4. Does the Plan identify a strategy for siting additional recycling and composting programs, and solid waste sites, if needed?
COMMENTS:________________________________

Y N I 5A. Will the siting strategy involve experts, local officials, technical advisory groups and the public?

Y N I 5B. Is there a public participation component in the siting strategy?
COMMENTS:________________________________

2.7 Current and Future Problems

Y N I 1. Is there a discussion of current and future problems?

COMMENTS:____________________________________

Y N I 2. Does the Plan identify any facilities under Notice of Violation? Consent Decree? Agreed Order?

COMMENTS:____________________________________

Part 3. Solid Waste Management Plan

Y N I 1. Are the 35% and 50% solid waste final disposal reduction goals calculated properly from the initial planning year (baseline year)?

Y N I 2. Has the Plan outlined a specific strategy or specific strategies for reaching the 35% and 50% goals, or shown how the goals have already been reached?

COMMENTS:____________________________________

Y N I 3. Are all areas of the District included in the Plan?

Y N I 4A. How are source reduction, recycling and composting prioritized over landfilling and incineration?

COMMENTS:____________________________________

Y N I 4B. Does the Plan incorporate all solid waste recycling activities that were in operation within the District on the effective date of the Plan?

Y N I 5A. Which types of reduction and recycling programs are in existence or will be implemented?

COMMENTS:____________________________________

Y N I 5B. Which types of reduction and recycling programs in existence will be expanded, if needed?

COMMENTS:____________________________________

Y N I 5C. Are the amounts of reduction and recycling during the baseline year reported for each activity?

Y N I 5D. Are there strategies for increasing per capita recycling?

Y N I 5E. Does the Plan show the projected increases in recycling over the planning period?

Y N I 5F. Have initial markets been identified for the materials collected in planned recycling programs?

Y N I 5G. Is there a marketing strategy for recyclables that are or will be collected?

Y N I 6A. Is there narrative on how the proposed reductions will be achieved by waste reduction and minimization programs?

Y N I 6B. Are recyclables, that are used to calculate the reduction, defined? What are included specifically?

Y N I 7A. If composting is proposed, is a marketing plan discussed if material will be sold?

Y N I 7B. If compost will be sold, are proposed quantities of compost to be marketed and expected revenues per ton discussed?

Y N I 8. Are there specific provisions for managing yard wastes, tires, household hazardous waste, used oil, white goods, and other solid waste discussed in the State Plan (batteries, construction and demolition debris, and conditionally exempt hazardous waste)?

COMMENTS:______________________________________

Y N I 9A. Does the Plan account for existing permitted solid waste final disposal facilities?

Y N I 9B. Are facilities under Notice of Violation (N.O.V.), Consent Decree (C.D.), or Agreed Order (A.O.) addressed in the Plan?

Y N I 10A. Is the schedule for closure of existing facilities, expanding existing facilities, and establishment of new facilities considered in the Plan?

Y N I 10B. Can the activities and projects be completed in time to meet the District's solid waste management needs and the State goals?

Y N I 11. Do the strategies include incentives/disincentives or other mechanisms that will address any potential for increased open dumping problems, littering, improper storage of waste?

Y N I 12. Does the Plan identify alternative means of achieving goals and objectives based upon problems and needs of the District?

COMMENTS:______________________________________

Y N I 13. Will the strategies chosen in the Plan be in compliance with State and Federal regulations?

Y N I 14. Does the Plan "provide for and demonstrate the availability of and access to sufficient solid waste management final disposal capacity, either inside or outside of the district, to meet the solid waste management needs of the District" for a minimum of twenty years from the adoption of the district plan?

COMMENTS: ______________________________

Y N I 15. After provisions are made for achieving the 35% and 50% goals, is there access (in or out of the district) for final disposal?

Y N I 16. Does the Plan provide clear, specific guidance, including selection of appropriate solid waste management technologies and timetables to provide a smooth transition for management of solid waste in the District?

COMMENTS: ______________________________

Y N I 17. Is the Plan specifically tailored to this district, to include solid waste management strategies that are implementable in the district and that meet its unique needs? Size, growth, existing facilities and programs, and resources must be considered.

Y N I 18. What criteria were used to complete the narrative (e.g. availability of recycled markets; geographical condition of area, current air, waste, and soil quality concerns; competitive nature of regional solid waste industry; availability of capital investment, etc.)?

Part 4. Implementing and Financing Plan

4.1 Implementation of Plan

Y N I 1. Is there an implementation chart for district activities , programs, and facilities?

Y N I 2A. For programs such as source reduction and recycling, does the required chart show at least planning and implementation phases?

Y N I 2B. For facilities such as a landfill, does the chart show planning, siting, design, permitting, and construction phases?

Y N I 2C. Do these timelines reflect current statutory and regulatory requirements?

COMMENTS: ______________________________

Y N I 2D. Does the schedule for implementation account for the activities programs and facilities listed under 2.6?

Y N I 3. Is the designation of facilities contradictory to existing patterns of waste flow (if known)?

Y N I 4. If waste will be going to another Solid Waste Management District, does the Plan take into account that district's waste projections and solid waste management plans? District must check quarterly reports for information on out-of-district final disposal sites.

COMMENTS:____

Y N I 5A. Are dates (at least month and year) for filing applications for permits included?

COMMENTS:____

Y N I 5B. Does the implementation chart show the time frame between submittal of a permit application and the beginning of construction?

Y N I 6. Are dates given for implementation of recycling, reuse and reduction activities?

COMMENTS:____

Y N I 7. Who is the person to implement the district plan? List name, address and telephone number.

Y N I 8. Has the District considered Private Sector involvement for programs and facilities in the District?

4.2 Schedule of Capital Costs

Y N I 1A. Is there an analysis of costs (capital and operating) for each facility and activity identified in the Plan?

COMMENTS:____

Y N I 1B. Who prepared the analysis? List name, address, and telephone.

Y N I 1C. Does the analysis of alternatives include a cost comparison of the systems identified which will enable the district to reach the 35% and 50% reduction goals.

Y N I 2. Does the cost analysis provide a total cost per ton for the facility?

Y N I 3A. If money is borrowed, is the amount borrowed amortized over the life of the equipment, etc.?

Y N I 3B. Are total annual amortized costs added to the operating costs to determine annual facility costs?

Y N I 4. Does the Plan summarize and compare facility costs in annual increments for the entire planning period?

COMMENTS:____

4.3 Revenue Requirements

Y N I 1A. Are costs of operation and maintenance listed?
COMMENTS:____

Y N I 1B. What criteria have been used to ensure realistic operation and maintenance cost projections?

Y N I 2A. Are the annual revenues listed?
COMMENTS:____

Y N I 2B. Were conservative estimates used in making these cost projections?

Y N I 3. Is there an analysis of avoided disposal costs?
COMMENTS:____

4.4 Financing the Plan

Y N I 1. Does the Plan explain the methods to be used to finance implementation of the Plan?

Y N I 2. Are the methods for financing district plan development and implementation available to the district as a taxing entity and are the methods legal?

Y N I 3A. How were the fees, rates, and charges derived?
COMMENTS:____

Y N I 3B. If money will be borrowed, what, if any, is the interest rate?
COMMENTS:____

Y N I 4A. Does the Plan use different methods to fund capital and operating costs? List them.
COMMENTS:____

Y N I 4B. Is the payment method for capital expenditures identified?

Y N I 5A. Have District Solid Waste Management Fees been established by the District? Is a copy of the resolution included?

Y N I 5B. How will these Fees be used?

Y N I 6A. Does the district have a financial advisor and/or a bond counsel to bond a capital facility?

Y N I 6B. Who is advising the district on the method identified in 4B.

Y N I 7. Did the district submit a copy of the district budget?

COMMENTS:____

4.5 Public Information and Involvement in Plan Development and Implementation

Y N I 1A. Does the Plan include a narrative describing the materials and programs to inform and involve citizens and businesses, both during Plan development and implementation?

Y N I 1B. Does the narrative include programs and information on the following topics--State law and district planning process, solid waste management options being considered, planning schedule, obtaining information, and giving opinions?

COMMENTS:____

Y N I 2A. Does the Plan list media which will receive information on the planning process on a regular basis?

Y N I 2B. Does the Plan include a list of target populations and methods used to keep them informed?

Y N I 2C. Does the Plan include a public information program and material costs, and the source of funding for this section?

Y N I 3A. List number and dates of public meetings and hearings held during planning process. Is the list in compliance with IC 13-9.5-4-2?

COMMENTS:____

Y N I 3B. Does the Plan have a list of public comments?

Y N I 3C. How are public comments registered?

COMMENTS:____

Y N I 3D. Were the public meetings posted and advertised? Include copy of notice and when it was posted.

COMMENTS:____

Y N I 3E. Does the Plan list a contact person and address for registering public comments by mail?

Y N I 3F. Does the Plan list the cost of public meeting, advertising, and materials and the source of funding for this section?

COMMENTS:____

Y N I 4A. Does the make-up of the advisory committee appear to be balanced according to Public Law 25-1991?

Y N I 4B. Is there a copy of the resolution establishing the Advisory Committee?

Y N I 4C. Is a copy of Advisory Committee reports attached as an appendix?

Part 5. Surveillance and Enforcement Procedures

Y N I 1A. Does the Plan include a process for surveillance and enforcement?

COMMENTS:____

Y N I 1B. What is the agency or agencies vested with enforcement duties?

COMMENTS:____

Y N I 1C. What are the penalties?

COMMENTS:____

Y N I 1D. What is the agency or agencies vested with enforcement and or imposing penalties?

Y N I 2. Do the strategies include incentives/disincentives or other mechanisms that will address any potential for increased open dumping problems?

Y N I 3. Are copies of resolutions and ordinances for surveillance and enforcement procedures attached as an appendix?

COMMENTS:____

APPENDIX X

John Winters

TITLE 327

WATER POLLUTION CONTROL BOARD

From: 1991 Cumulate Supplement Indiana Administrative Code
certified 11/16/90 by Joseph H. Hogsett
34 pages (@0.15/pg) = $5.10

Cited in: 327 IAC 1-1-1; 327 IAC 1-1-3; 327 IAC 1-1-4; 327 IAC 2-1-9; 410 IAC 6-9-3; 675 IAC 16-1.1-4; 675 IAC 20-2-23; 675 IAC 20-2-25; 675 IAC 20-3-5; 675 IAC 20-3-8; 675 IAC 20-4-24; 675 IAC 20-4-25.

ARTICLE 1. GENERAL PROVISIONS

Cited in: 326 IAC 17-1-2; 327 IAC 2-1-9; 327 IAC 2-6-1; 327 IAC 3-1-2; 327 IAC 4-1-2; 327 IAC 5-1-2; 327 IAC 6-1-2; 327 IAC 8-2-1; 327 IAC 8-3-1; 327 IAC 8-10-1; 327 IAC 8-12-1; 327 IAC 11-2-2; 327 IAC 12-1-2.

Rule 1. Provisions Applicable Throughout Title 327

327 IAC 1-1-1 References to Federal Act

Authority: IC 4-22-9-5; IC 13-1-3; IC 13-7-7
Affected: IC 4-22-9-5; IC 13-1-3; IC 13-7-1-10; IC 13-7-7

Sec. 1. Unless otherwise indicated, references in these rules (327 IAC) to the Federal Water Pollution Control Act or to the Clean Water Act (CWA) shall mean the Federal Water Pollution Control Act as defined in IC 13-7-1-10. *(Water Pollution Control Board; 327 IAC 1-1-1; filed Sep 24, 1987, 3:00 pm: 11 IR 579)*

327 IAC 1-1-2 References to the Code of Federal Regulations

Authority: IC 13-1-3; IC 13-7-7
Affected: IC 13-1-3; IC 13-7-7

Sec. 2. Unless otherwise indicated, any reference to a provision of the Code of Federal Regulations (CFR) shall mean the July 1, 1986 revision. *(Water Pollution Control Board; 327 IAC 1-1-2; filed Sep 24, 1987, 3:00 pm: 11 IR 579)*

327 IAC 1-1-3 Severability

Authority: IC 13-1-3; IC 13-7-7
Affected: IC 13-1-3; IC 13-7-7

Sec. 3. If any provision of these rules (327 IAC) or the application thereof to any person or circumstance is held invalid, the invalidity shall not affect any other provisions or applications of these rules (327 IAC) which can be given effect without the invalid provision or application. *(Water Pollution Control Board; 327 IAC 1-1-3; filed Sep 24, 1987, 3:00 pm: 11 IR 579)*

327 IAC 1-1-4 Savings clause

Authority: IC 13-1-3; IC 13-7-7
Affected: IC 13-1-3; IC 13-7-7

Sec. 4. The repeal and reenactment in this Title (327 IAC) of any rule previously the responsibility of the water pollution control board shall not have the effect to release or extinguish any penalty or forfeiture incurred under the same, and such previous rule shall be treated as still remaining on in force for the purpose of sustaining any proper action, or prosecution for the enforcement of such penalty, forfeiture or liability. *(Water Pollution Control Board; 327 IAC 1-1-4; filed Sep 24, 1987, 3:00 pm: 11 IR 579)*

ARTICLE 2. WATER QUALITY STANDARDS

Rule 1. Water Quality Standards and Minimum Treatment Requirements Applicable to All State Waters

Cited in: 327 IAC 2-1-1; 327 IAC 2-1-3; 327 IAC 2-1-4; 327 IAC 2-1-8.8; 327 IAC 2-1-9.

327 IAC 2-1-1 Applicability of rule

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-4

Sec. 1. The water quality standards established by this rule shall apply to all waters of the state. *(Water Pollution Control Board; 327 IAC 2-1-1; filed Sep 24, 1987, 3:00 p.m.: 11 IR 579; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1018)*

327 IAC 2-1-1.5 Water quality goals
Authority: IC 13-1-3-7; IC 13-7-1-1; IC 13-7-7-5
Affected: IC 13-7-4-1

Sec. 1.5. The goal of the state is to restore and maintain the chemical, physical, and biological integrity of the waters of the state. In furtherance of this primary goal:

(1) it is the public policy of the state that the discharge of toxic substances in toxic amounts be prohibited; and

(2) it is the public policy of the state that the discharge of persistent and bioconcentrating toxic substances be reduced or eliminated.

(Water Pollution Control Board; 327 IAC 2-1-1.5; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1018)

327 IAC 2-1-2 Maintenance of surface water quality standards
Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-7-4-1

Sec. 2. The following policies of nondegradation are applicable to all surface waters of the state.

(1) For all waters of the state, existing beneficial uses shall be maintained and protected. No degradation of water quality shall be permitted which would interfere with or become injurious to existing and potential uses.

(2) All waters whose existing quality exceeds the standards established herein as of February 17, 1977, shall be maintained in their present high quality unless and until it is affirmatively demonstrated to the commissioner that limited degradation of such waters is justifiable on the basis of necessary economic or social factors and will not interfere with or become injurious to any beneficial uses made of, or presently possible, in such waters. In making a final determination under this subdivision, the commissioner shall give appropriate consideration to public participation and intergovernmental coordination.

(3) The following waters of high quality, as defined in subdivision (2), are designated by the board to be an outstanding state resource and shall be maintained in their present high quality without degradation:

(A) The Blue River in Washington, Crawford, and Harrison Counties, from river mile 57.0 to river mile 11.5.

(B) Cedar Creek in Allen and DeKalb Counties, from river mile 13.7 to its confluence with the St. Joseph River.

(C) The North Fork of Wildcat Creek in Carroll and Tippecanoe Counties, from river mile 43.11 to river mile 4.82.

(D) The South Fork of Wildcat Creek in Tippecanoe County, from river mile 10.21 to river mile 0.00.

(E) The Indiana portion of Lake Michigan.

(F) All waters incorporated in the Indiana Dunes National Lakeshore.

(4) Any determination made by the commissioner in accordance with section 316 of the Clean Water Act concerning alternative thermal effluent limitations will be considered to be consistent with the policies enunciated in this section.

(Water Pollution Control Board; 327 IAC 2-1-2; filed Sep 24, 1987, 3:00 p.m.: 11 IR 579; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1018; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003)

327 IAC 2-1-3 Surface water use designations; multiple uses
Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 3. (a) The following water uses are designated by the water pollution control board:

(1) Surface waters of the state are designated for full-body contact recreation as provided in section 6(d) of this rule.

(2) All waters, except as described in subdivision (5), will be capable of supporting a well-balanced, warm water aquatic community and, where natural temperatures will permit,

will be capable of supporting put-and-take trout fishing. All waters capable of supporting the natural reproduction of trout as of February 17, 1977, shall be so maintained. The Indiana portion of Lake Michigan, Trail Creek and its tributaries downstream to Lake Michigan, the East Branch of the Little Calumet River and its tributaries downstream to Lake Michigan via Burns Ditch, the St. Joseph River and its tributaries from the Twin Branch Dam in Mishawaka downstream to the Indiana-Michigan State Line, Kintzele Ditch (Black Ditch) from Beverly Drive downstream to Lake Michigan, the Galena River and its tributaries in LaPorte County shall be capable of supporting a salmonid fishery.

(3) All waters which are used for public or industrial water supply must meet the standards for those uses at the points where the water is withdrawn. This use designation and its corresponding water quality standards are not to be construed as imposing a user restriction on those exercising or desiring to exercise the use.

(4) All waters which are used for agricultural purposes must, as a minimum, meet the standards established in section 6(a) of this rule.

(5) All waters in which naturally poor physical characteristics (including lack of sufficient flow), naturally poor chemical quality, or irreversible man-induced conditions, which came into existence prior to January 1, 1983, and having been established by use attainability analysis, public comment period, and hearing may qualify to be classified for limited use and must be evaluated for restoration and upgrading at each triennial re[vie]w of this rule. Specific waters of the stat[e de]signated for limited use are listed in sect[ion 11].(a) of this rule.

(6) All waters which p[rovide u]nusual aquatic habitat, which are an [integr]al feature of an area of exceptional n[atural] beauty or character, or which support unique assemblages of aquatic organisms may be classified for exceptional use. Specific waters of the state designated for exceptional use are listed in section 11(b) of this rule.

(b) Where multiple uses have been designated for a body of water, the most protective of all simultaneously applicable standards will apply. *(Water Pollution Control Board; 327 IAC 2-1-3; filed Sep 24, 1987, 3:00 p.m.: 11 IR 580; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1019)*

Cited in: 327 IAC 2-1-6; 327 IAC 2-1-11.

327 IAC 2-1-4 Mixing zone guidelines

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 4. (a) All surface water quality standards in this rule, except those provided [in s]ection 6(a)(1) of this rule, are to be applied [at a] point outside of the mixing zone to allow fo[r a r]easonable admixture of waste effluents with the receiving waters.

(b) Due to varying physical, chemical, and biological conditions, no universal mixing zone may be prescribed. The commissioner shall determine the mixing zone upon application by the discharger. The applicability of the guideline set forth in subsection (c) will be on a case-by-case basis and any application to the commissioner shall contain the following information:

(1) The dilution ratio.

(2) The physical, chemical, and biological characteristics of the receiving body of water.

(3) The physical, chemical, and biological characteristics of the waste effluent.

(4) The present and anticipated uses of the receiving body of water.

(5) The measured or anticipated effect of the discharge on the quality of the receiving body of water.

(6) The existence of and impact upon any spawning or nursery areas of any indigenous aquatic species.

(7) Any obstruction of migratory routes of any indigenous aquatic species.

(8) The synergistic effects of overlapping mixing zones or the aggregate effects of adjacent mixing zones.

(c) The mixing zone should be limited to no more than one-fourth (1/4) (twenty-five percent (25%)) of the cross-sectional area and/or volume of flow of the stream, leaving at least three-fourths (3/4) (seventy-five percent (75%)) free as a zone of passage for aquatic biota nor should it extend over one-half (1/2) (fifty percent (50%)) of the width of the stream.

(d) Based on consideration of aquatic life or human health effects, the commissioner may deny a mixing zone for a discharge or certain substances in a discharge.

(e) Notwithstanding other subsections of this section, no mixing zone shall be allowed for discharges to lakes except for those consisting entirely of noncontact cooling water which meet the requirements set forth in Section 316(a) of the Federal Water Pollution Control Act of 1972. *(Water Pollution Control Board; 327 IAC 2-1-4; filed Sep 24, 1987, 3:00 p.m.: 11 IR 580; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1020)*

Cited in: 327 IAC 5-2-11.1.

327 IAC 2-1-5 Exception to quality standards applicability

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 5. All surface water quality standards in section 6 of this rule, except those provided in section 6(a)(1) of this rule will cease to be applicable when the stream flows are less than the average minimum seven (7) consecutive day low flow which occurs once in ten (10) years. This determination will be made using Low-Flow Characteristics of Indiana Streams, 1983, United States Department of the Interior, Geological Survey, or any additional information compiled on a comparable basis. *(Water Pollution Control Board; 327 IAC 2-1-5; filed Sep 24, 1987, 3:00 p.m.: 11 IR 581; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1020)*

327 IAC 2-1-6 Minimum surface water quality standards

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-8; IC 13-7-4-1; IC 14-2-1

Sec. 6. (a) The following are minimum water quality conditions:

(1) All waters at all times and at all places, including the mixing zone, shall meet the minimum conditions of being free from substances, materials, floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices, or other discharges:

(A) that will settle to form putrescent or otherwise objectionable deposits;

(B) that are in amounts sufficient to be unsightly or deleterious;

(C) that produce color, visible oil sheen, odor, or other conditions in such degree as to create a nuisance;

(D) which are in amounts sufficient to be acutely toxic to, or to otherwise severely injure or kill aquatic life, other animals, plants, or humans:

(i) to assure protection of aquatic life, concentrations of toxic substances shall not exceed the final acute value (FAV = 2 (AAC)) in the undiluted discharge or the acute aquatic criterion (AAC) outside the zone of initial dilution or, if applicable, the zone of discharge-induced mixing:

(AA) for certain substances, the AAC are established and set forth in Table 1 (which table incorporates Table 2; and

(BB) for substances for which an AAC is not specified in Table 1, or if a different AAC can be scientifically justified based on new toxicological data or site-specific conditions concerning water quality characteristics or species present, an AAC can be calculated by the commissioner using the procedures in section 8.2 of this rule; and

(ii) this clause shall not apply to the chemical control of plants and animals when that control is performed in compliance with approval conditions specified by the Indiana department of natural resources as provided by IC 14-2-1; and

(E) which are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such degree as to create a nuisance, be unsightly, or otherwise impair the designated uses.

(2) At all times, all waters outside of mixing zones shall be free of substances in concentrations which on the basis of available scientific data are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants. To assure protection against the adverse effects identified in this subdivision, the following requirements are established:

(A) A toxic substance or pollutant shall not be present in such waters in concentrations which exceed the most stringent of the following continuous criterion concentrations (CCCs):

(i) A chronic aquatic criterion (CAC) to protect aquatic life from chronic toxic effects.

(ii) A terrestrial life cycle safe concentration (TLSC) to protect terrestrial organisms from toxic effects which may result from the consumption of aquatic organisms and/or water from the waterbody.

(iii) A human life cycle safe concentration (HLSC) to protect human health from toxic effects which may result from the consumption of aquatic organisms and/or drinking water from the waterbody.

(iv) For carcinogenic substances, a criterion to protect human health from unacceptable cancer risk of greater than one (1) additional occurrence of cancer per one hundred thousand (100,000) population.

(B) For certain substances, one (1) or more of the CCCs identified in clause (A) are established and set forth in Table 1 (which table incorporates Table 2). If one (1) or more of the CCCs are absent from Table 1 or if a different criterion or criteria can be scientifically justified based on new toxicological data or site-specific conditions of water quality or resident species, such criterion or criteria may be calculated by the commissioner using the corresponding procedures prescribed by sections 8.3 through 8.6 of this rule.

(C) The CAC and TLSC for a substance apply in all waters outside a mixing zone for a discharge of that substance. Similarly, in waters where a public drinking water intake is not present or is unaffected by the discharge of a substance, the HLSC and the carcinogenic criterion for that substance based on consumption of organisms from the waterbody and only incidental ingestion of water shall apply to all waters outside the mixing zone for a discharge of that substance. In waters where a public drinking water intake is present, the HLSC and the carcinogenic criterion for a substance based on consumption of organisms and potable water from the waterbody shall apply at the point of the public drinking water intake.

(D) All CCCs shall be met at the point at which they apply (outside of the mixing zone or point of drinking water intake).

(3) The toxicity criteria set forth for metals in Table 1 are expressed in terms of the acid-soluble fraction of the metals (unless specified otherwise) in order to be consistent with the ambient water quality criteria published by

the U.S. Environmental Protection Agency (EPA) for these metals. In the absence of an analytical chemistry method approved by EPA for determination of the acid-soluble fraction of a metal, the criteria in Table 1 shall be enforced as total recoverable metals, except as otherwise provided in 327 IAC 5-2-11.1, until an acid-soluble analytical method is approved by EPA, and by the board through rulemaking.

Table 1
Water Quality Criteria for Specific Substances

Substances	AAC (Maximum)	CCC (4-Day Average)		
		Outside of Mixing Zone		Point of Water Intake
		Aquatic Life (CAC)	Human Health	Human Health
Metals ($\mu g/l$) (Acid soluble, except as indicated)				
Antimony			45,000 (T)	146 (T)
Arsenic (III)@	360	190	0.175 (C)	0.022 (C)
Barium				1,000 (D)
Beryllium			1.17 (C)	0.068 (C)
Cadmium #@	$e^{(1.128[\ln Hard^*]-3.828)}$	$e^{(0.7852[\ln Hard]-3.490)}$		10 (D)
Chromium (III)#@	$e^{(0.8190[\ln Hard]+3.688)}$	$e^{(0.8190[\ln Hard]+1.561)}$	3,433,000 (T)	170,000 (T)
Chromium (VI)@	(dissolved) 16	11		50 (D)
Copper #	$e^{(0.9422[\ln Hard]-1.464)}$	$e^{(0.8545[\ln Hard]-1.465)}$		
Lead #	$e^{(1.273[\ln Hard]-1.460)}$	$e^{(1.273[\ln Hard]-4.705)}$		50 (D)
Mercury @	2.4	0.012	0.15 (T)	0.14 (T)
Nickel #	$e^{(0.8460[\ln Hard]+3.3612)}$	$e^{(0.8460[\ln Hard]+1.1645)}$	100 (T)	13.4 (T)
Selenium	130**	35		10 (D)
Silver #	$e^{(1.72[\ln Hard]-6.52)}/2$**			50 (D)
Thallium			48 (T)	13 (T)
Zinc #	$e^{(0.8473[\ln Hard]+0.8604)}$	$e^{0.8473[\ln Hard]+0.7614}$		
Organics ($\mu g/l$)				
Acrolein			780 (T)	320 (T)
Acrylonitrile			6.5 (C)	0.58 (C)
Aldrin @	1.5**		0.00079 (C)	0.00074 (C)
Benzene @			400 (C)	6.6 (C)
Benzidine			0.0053 (C)	0.0012 (C)
Carbon Tetrachloride			69.4 (C)	4.0 (C)
Chlordane @	1.2**	0.0043	0.0048 (C)	0.0046 (C)
Chlorinated Benzenes				
Monochlorobenzene @				488 (T)
1,2,4,5-Tetrachlorobenzene			48 (T)	38 (T)
Pentachlorobenzene			85 (T)	74 (T)
Hexachlorbenzene @			0.0074 (C)	0.0072 (C)

Table 1—Con't
Water Quality Criteria for Specific Substances

Substances	AAC (Maximum)	CCC (4-Day Average) Outside of Mixing Zone: Aquatic Life (CAC)	CCC (4-Day Average) Outside of Mixing Zone: Human Health	CCC (4-Day Average) Point of Water Intake: Human Health
Chlorinated Ethanes				
1,2-dichloroethane			2,430 (C)	9.4 (C)
1,1,1-trichloroethane●			1,030,000 (T)	18,400 (T)
1,1,2-trichloroethane●			418 (C)	6.0 (C)
1,1,2,2,-tetrachloroethane●			107 (C)	1.7 (C)
Hexachloroethane●			87.4 (C)	19 (C)
Chlorinated Phenols				
2,4,5-trichlorophenol				2,600 (T)
2,4,6-trichlorophenol●			36 (C)	12 (C)
Chloroalkyl Ethers				
bis(2-chloroisopropyl) ether			4,360 (T)	34.7 (T)
bis(chloromethyl) ether			0.018 (C)	0.000038 (C)
bis(2-chloroethyl) ether			13.6 (C)	0.3 (C)
Chloroform			157 (C)	1.9 (C)
Chloropyrifos	0.083	0.041		
DDT●	0.55**	0.0010	0.00024 (C)	0.00024 (C)
Dichlorobenzenes●			2,600 (T)	400 (T)
Dichlorobenzidine●			0.2 (C)	0.1 (C)
1,1-dichloroethylene			18.5 (C)	0.33 (C)
2,4-dichlorophenol●				3,090 (T)
Dichloropropenes			14,100 (T)	87 (T)
Dieldrin●	1.3**	0.0019	0.00076 (C)	0.00071 (C)
2,4-dinitrotoluene●			91 (C)	1.1 (C)
Dioxin (2,3,7,8-TCDD)●			0.0000001 (C)	.0000001 (C)
1,2-diphenylhydrazine●			5.6 (C)	0.422 (C)
Endosulfan●	0.11**	0.056	159 (T)	74 (T)
Endrin●	0.09**	0.0023		1.0 (D)
Ethylbenzene●			3,280 (T)	1,400 (T)
Fluoranthene●			54 (T)	42 (T)
Halomethanes			157 (C)	1.9 (C)
Heptachlor●	0.26**	0.0038	0.0028 (C)	0.0028 (C)
Hexachlorobutadiene●			500 (C)	4.47 (C)
Hexachlorocyclohexane (HCH)				
alpha HCH●			0.31 (C)	0.09 (C)
beta HCH●			0.55 (C)	0.16 (C)
gamma HCH (Lindane)●	1.0**	0.080	0.63 (C)	0.19 (C)
Technical HCH●			0.41 (C)	0.12 (C)
Hexachlorocyclopentadiene●				206 (T)
Isophorone			520,000 (T)	5,200 (T)
Nitrobenzene				19,800 (T)
Nitrophenols				
2,4-dinitro-o-cresol			765 (T)	13.4 (T)
Dinitrophenol			14,300 (T)	70 (T)
Nitrosamines				
N-nitrosodiethylamine			12.4 (C)	0.008 (C)
N-nitrosodimethylamine			160 (C)	0.014 (C)
N-nitrosodibutylamine			5.9 (C)	0.064 (C)

Table 1—Con't
Water Quality Criteria for Specific Substances

Substances	AAC (Maximum)	CCC (4-Day Average) Outside of Mixing Zone: Aquatic Life (CAC)	CCC (4-Day Average) Outside of Mixing Zone: Human Health	CCC (4-Day Average) Point of Water Intake: Human Health
N-nitrosodiphenylamine@			161 (C)	49 (C)
N-nitrosopyrrolidine			919 (C)	0.16 (C)
Parathion@	0.065	0.013		
Pentachlorophenol@	$e^{(1.005\,[pH]\cdot 4.830)}$	$e^{(1.005[pH]\cdot 5.290)}$		1,000 (T)
Phenol				3,500 (T)
Phthalate Esters				
Dimethyl phthalate			2,900,000 (T)	313,000 (T)
Diethyl phthalate			1,800,000 (T)	350,000 (T)
Dibutyl phthalate@			154,000 (T)	34,000 (T)
Di-2-ethylhexyl phthalate			50,000 (T)	15,000 (T)
Polychlorinated Biphenyls (PCBs)@		0.014	0.00079 (C)	0.00079 (C)
Carcinogenic Polynuclear Aromatic Hydrocarbons (PAHs)			0.31 (C)	0.028 (C)
Tetrachloroethylene@			88.5 (C)	8 (C)
Toluene@			424,000 (T)	14,300 (T)
Toxaphene@	0.73	0.0002	.0073 (C)	.0071 (C)
Trichloroethylene@			807 (C)	27 (C)
Vinyl Chloride			5,246 (C)	20 (C)
Other Substances				
Asbestos (fibers/liter)				300,000 (C)
Chlorides (mg/l)	860	230		
Chlorine (Total Residual) (μg/l)	19	11		
Chlorine* (mg/l) (intermittent, total residual)	0.2			
Cyanide (Total) (μg/l)	22	5.2		200 (D)
Nitrate-N + Nitrite-N (mg/l)				10 (D)
Nitrite-N (mg/l)				1.0 (D)

Dissolved solids shall not exceed 750 mg/l in all waters.
Fluoride shall not exceed 2.0 mg/l in all waters, except the Ohio River and Interstate Wabash River where it shall not exceed 1.0 mg/l.
Sulfates shall not exceed 250 mg/l in all waters.

#See Table 2 for calculated AAC and CAC values at various hardness levels. The criteria from Table 2 may be utilized in the alternative to criteria from Table 1 to determine protective concentrations for the seven (7) metallic substances for acute and chronic toxicity based on the characteristic hardness for a particular waterbody. For hardness values other than those specifically listed in Table 2, the standard proportional interpolation technique should be used to obtain the corresponding criteria values.

*Natural logarithm of hardness in milligrams per liter $CaCO_3$.

**One-half (1/2) of the final acute value (FAV) as calculated by procedures developed by U.S. EPA in 1980. This value would correspond to acute aquatic values calculated using IDEM procedures or U.S. EPA procedures developed in 1985 in which the calculated FAV is divided by two (2) to reduce acute toxicity.

T is derived from threshold toxicity.
C is derived from nonthreshold cancer risk.
D is derived from drinking water standards, equal to or less than threshold toxicity.

● This substance, which has a log octanol-water partition coefficient greater than or equal to two (2.0), is considered to be bioconcentrating and of concern.

*To be considered an intermittent discharge, total residual chlorine shall not be detected in the discharge for a period of more than forty (40) minutes in duration and such periods shall be separated by at least five (5) hours.

Table 2

Acute (AAC) and chronic (CAC) aquatic criteria for certain metals at selected hardness values as calculated from equations in Table 1 (metals concentrations in micrograms per liter; hardness in milligrams per liter $CaCO_3$).

	Cadmium		Chromium III		Copper		Lead		Nickel		Silver		Zinc	
Hardness	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC	AAC	CAC
50	2	0.7	984	117	9	6	34	1	789	88	0.6	—	65	59
100	4	1.1	1737	207	18	12	82	3	1418	158	2	—	117	106
150	6	1.6	2420	289	26	17	137	5	1999	222	4	—	165	149
200	9	2.0	3064	365	34	21	197	8	2549	283	7	—	210	191
250	11	2.3	3679	435	42	26	282	10	3079	342	10	—	254	230
300	14	2.7	4270	509	50	30	331	13	3592	400	13	—	297	269
350	16	3.0	4845	577	58	34	402	16	4093	455	18	—	338	306
400	19	3.4	5405	644	65	39	477	19	4582	509	22	—	379	343
450	21	3.7	5962	709	73	43	554	22	5063	563	27	—	419	379
500	24	4.0	6488	773	81	47	634	25	5536	615	32	—	458	415

(b) This subsection establishes minimum water quality for aquatic life. In addition to subsection (a), subdivisions (1) through (5) are established to ensure conditions necessary for the maintenance of a well-balanced aquatic community. Subdivisions (1) through (5) are applicable at any point in the waters outside of the mixing zone:

(1) There shall be no substances which impart unpalatable flavor to food fish or result in noticeable offensive odors in the vicinity of the water.

(2) No pH values below six (6.0) nor above nine (9.0), except daily fluctuations which exceed pH nine (9.0) and are correlated with photosynthetic activity, shall be permitted.

(3) Concentrations of dissolved oxygen shall average at least five (5.0) milligrams per liter per calendar day and shall not be less than four (4.0) milligrams per liter at any time.

(4) The following conditions for temperature:

(A) There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions.

(B) The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained.

(C) The maximum temperature rise at any time or place above natural temperatures shall not exceed five degrees Fahrenheit (5° F) (two and eight-tenths degrees Celsius (2.8° C)) in streams and three degrees Fahrenheit (3° F) (one and seven-tenths degrees Celsius (1.7° C)) in lakes and reservoirs.

(D) Water temperatures shall not exceed the maximum limits in the following table during more than one percent (1%) of the hours in the twelve (12) month period ending with any month; at no time shall the water temperature at such locations exceed the maximum limits in Table 3 by more than three degrees Fahrenheit (3° F) (one and seven-tenths degrees Celsius (1.7° C)).

TABLE 3

	Ohio River Main Stem °F.(°C.)	St. Joseph River Tributary to Lake Michigan Upstream of the Twin Branch Dam °F.(°C.)	Other Indiana Streams °F.(°C.)
January	50 (10.0)	50 (10.0)	50 (10.0)
February	50 (10.0)	50 (10.0)	50 (10.0)
March	60 (15.6)	55 (12.8)	60 (15.6)
April	70 (21.1)	65 (18.3)	70 (21.1)
May	80 (26.7)	75 (23.9)	80 (26.7)
June	87 (30.6)	85 (29.4)	90 (32.2)
July	89 (31.7)	85 (29.4)	90 (32.2)
August	89 (31.7)	85 (29.4)	90 (32.2)

TABLE 3—Con't

	Ohio River Main Stem °F.(°C.)	St. Joseph River Tributary to Lake Michigan Upstream of the Twin Branch Dam °F.(°C.)	Other Indiana Streams °F.(°C.)
September	87 (30.7)	84 (29.4)	90 (32.2)
October	78 (25.6)	70 (21.1)	78 (25.5)
November	70 (21.1)	60 (15.6)	70 (21.1)
December	57 (14.0)	50 (10.0)	57 (14.0)

(5) The following criteria will be used to regulate ammonia:

(A) Except for waters covered in clauses (B) through (D), at all times, all waters outside of mixing zones shall be free of substances in concentrations which, on the basis of available scientific data, are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants.

(B) For the Grand Calumet River and Indiana Harbor Ship Canal the following ammonia criteria will apply outside the mixing zone:

(i) East Branch of Grand Calumet River and Indiana Harbor Ship Canal: two-hundredths (0.02) milligrams per liter unionized ammonia.

(ii) West Branch of Grand Calumet River: five-hundredths (0.05) milligrams per liter unionized ammonia.

(iii) For purposes of this subdivision, the West Branch of the Calumet River is defined to be from the Indianapolis Boulevard Bridge (mile point 4.6) to the Indiana-Illinois State Line, and the Indiana Harbor Ship Canal shall be considered to end at the flashing white light (day marker number 2) located at the mouth of the canal.

(C) For waters of Lake Michigan, the following ammonia criteria will apply outside the mixing zone:

(i) For the Inner Harbor Basin, Gary Harbor, and Burns Harbor, unionized ammonia will not exceed three-hundredths (0.03) milligram per liter as a monthly average nor ten-hundredths (0.10) milligram per liter as a daily maximum.

(ii) For all other Lake Michigan waters, unionized ammonia shall not exceed two-hundredths (0.02) milligram per liter as a monthly average nor five-hundredths (0.05) milligram per liter as a daily maximum.

(iii) For purposes of this subdivision, the Inner Harbor Basin shall be defined as the area within an inscribed arc of six thousand (6,000) feet radius drawn from the flashing white light (day marker number 2) located at the mouth of the Indiana Harbor, and Gary Harbor and Burns Harbor shall be the waters enclosed by the Gary Harbor and Burns Harbor breakwaters.

(D) For those waters listed in subsection (c), the following ammonia criteria will apply outside the mixing zone:

Maximum Ammonia Concentrations
(Unionized Ammonia as N)***
(mg/l)

Temperature (°C)

pH	0	5	10	15	20	25	30
6.5	0.0075	0.0106	0.0150	0.0211	0.0299	0.0299	0.0299
6.6	0.0092	0.0130	0.0183	0.0259	0.0365	0.0365	0.0365
6.7	0.0112	0.0158	0.0223	0.0315	0.0444	0.0444	0.0444

Maximum Ammonia Concentrations—Con't
(Unionized Ammonia as N)***
(mg/l)

Temperature (°C)

pH	0	5	10	15	20	25	30
6.8	0.0135	0.0190	0.0269	0.0380	0.0536	0.0536	0.0536
6.9	0.0161	0.0228	0.0322	0.0454	0.0642	0.0642	0.0642
7.0	0.0191	0.0270	0.0381	0.0539	0.0761	0.0761	0.0761
7.1	0.0244	0.0316	0.0447	0.0631	0.0892	0.0892	0.0892
7.2	0.0260	0.0367	0.0518	0.0732	0.1034	0.1034	0.1034
7.3	0.0297	0.0420	0.0593	0.0837	0.1183	0.1183	0.1183
7.4	0.0336	0.0474	0.0669	0.0946	0.1336	0.1336	0.1336
7.5	0.0374	0.0528	0.0746	0.1054	0.1489	0.1489	0.1489
7.6	0.0411	0.0581	0.0821	0.1160	0.1638	0.1638	0.1638
7.7	0.0447	0.0631	0.0892	0.1260	0.1780	0.1780	0.1780
7.8	0.0480	0.0678	0.0958	0.1353	0.1911	0.1911	0.1911
7.9	0.0510	0.0720	0.1017	0.1437	0.2030	0.2030	0.2030
8.0	0.0536	0.0758	0.1070	0.1512	0.2135	0.2135	0.2135
8.1	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.2	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.3	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.4	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.5	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.6	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.7	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.8	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
8.9	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137
9.0	0.0537	0.0758	0.1071	0.1513	0.2137	0.2137	0.2137

*****To calculate total ammonia, divide the number in the table by the value determined by: $1/(10^{pka-pH} + 1)$.**

Where:
- **pka = 0.09018 + (2729.92/(T + 273.2))**
- **pH = pH of water**
- **T = °C**

24-Hour Average Ammonia Concentrations
(Unionized Ammonia as N)***
(mg/l)

Temperature (°C)

pH	0	5	10	15	20	25	30
6.5	0.0005	0.0008	0.0011	0.0015	0.0015	0.0015	0.0015
6.6	0.0007	0.0010	0.0014	0.0019	0.0019	0.0019	0.0019
6.7	0.0009	0.0012	0.0017	0.0024	0.0024	0.0024	0.0024
6.8	0.0011	0.0015	0.0022	0.0031	0.0031	0.0031	0.0031
6.9	0.0014	0.0019	0.0027	0.0038	0.0038	0.0038	0.0038
7.0	0.0017	0.0024	0.0034	0.0048	0.0048	0.0048	0.0048

(2) In the waters listed in subdivision (1), dissolved oxygen concentrations shall not be less than six (6.0) milligrams per liter at any time and shall not be less than seven (7.0) milligrams per liter in areas where spawning occurs during the spawning season, and in areas used for imprinting during the time salmonids are being imprinted.

(3) In those waters listed in subdivision (1), the maximum temperature rise above natural shall not exceed two degrees Fahrenheit (2° F) (one and one-tenth degree Celsius (1.1° C)) at any time or place nor shall the temperature exceed seventy degrees Fahrenheit (70° F) (twenty-one and one-tenth degrees Celsius (21.1° C)) (sixty-five degrees Fahrenheit (65° F) (eighteen and three-tenths degrees Celsius (18.3° C)) during spawning and imprinting periods), whichever is more stringent, unless the temperature rise above these limits is due to natural causes.

(d) This subsection establishes bacteriological quality for recreational uses. In addition to subsection (a), the criteria in this subsection are to be used to evaluate waters for full body contact recreational uses, to establish wastewater treatment requirements, and to establish effluent limits during the recreational season, which is defined as the months of April through October, inclusive. E. coli bacteria, using membrane filter (MF) count, shall not exceed one hundred twenty-five (125) per one hundred (100) milliliters as a geometric mean based on not less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty-five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period.

(e) This subsection establishes surface water quality for public water supply. In addition to subsections (a) and (d), the following standards are established to protect the surface water quality at the point at which water is withdrawn for treatment for public supply:

(1) The coliform bacteria group shall not exceed five thousand (5,000) per one hundred (100) milliliters a monthly average value (either MPN or MF count); nor exceed this number in more than twenty percent (20%) of the samples examined during any month; nor exceed twenty thousand (20,000) per one hundred (100) milliliter in more than five percent (5%) of such samples.

(2) Taste and odor producing substances, other than naturally occurring, shall not interfere with the production of a finished water by conventional treatment consisting of coagulation, sedimentation, filtration, and disinfection.

(3) The concentrations of either chlorides or sulfates shall not exceed two hundred fifty (250) milligrams per liter other than due to naturally occurring sources.

(4) Surface waters shall be considered acceptable for public supplies if Radium-226 and Strontium-90 are present in amounts not exceeding three (3) and ten (10) picocuries per liter, respectively. In the known absence of Strontium-90 and alpha emitters, the water supply is acceptable when the gross beta concentrations do not exceed one thousand (1,000) picocuries per liter.

(5) Chemical constituents in the waters shall not be present in such levels as to prevent, after conventional treatment, meeting the drinking water standards contained in 327 IAC 8-2, due to other than natural causes.

(f) This subsection establishes water quality for industrial water supply. In addition to subsection (a), the standard to ensure protection of water quality at the point at which water is withdrawn for use (either with or without treatment) for industrial cooling and processing is that, other than from naturally occurring sources, the dissolved solids shall not exceed seven hundred fifty (750) milligrams per liter at any time. A specific conductance of one thousand two hundred (1,200) micromhos per centi-

24-Hour Average Ammonia Concentrations—Con't
(Unionized Ammonia as N)***
(mg/l)

Temperature (°C)

pH	0	5	10	15	20	25	30
7.1	0.0022	0.0031	0.0043	0.0061	0.0061	0.0061	0.0061
7.2	0.0027	0.0038	0.0054	0.0077	0.0077	0.0077	0.0077
7.3	0.0034	0.0048	0.0068	0.0097	0.0097	0.0097	0.0097
7.4	0.0043	0.0061	0.0086	0.0122	0.0122	0.0122	0.0122
7.5	0.0054	0.0077	0.0108	0.0153	0.0153	0.0153	0.0153
7.6	0.0068	0.0097	0.0136	0.0193	0.0193	0.0193	0.0193
7.7	0.0086	0.0122	0.0172	0.0242	0.0242	0.0242	0.0242
7.8	0.0092	0.0130	0.0184	0.0260	0.0260	0.0260	0.0260
7.9	0.0098	0.0138	0.0196	0.0276	0.0276	0.0276	0.0276
8.0	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.1	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.2	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.3	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.4	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.5	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.6	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.7	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.8	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
8.9	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294
9.0	0.0103	0.0146	0.0206	0.0294	0.0294	0.0294	0.0294

***To calculate total ammonia, divide the number in the table by the value determined by: $1/(10^{pka-pH} + 1)$.

Where:
pka = 0.09018 + (2729.92/(T + 273.2))
pH = pH of water
T = °C

(c) This subsection establishes water quality for cold water fish. In addition to subsections (a) through (b), the following standards are established to ensure conditions necessary for the maintenance of a well-balanced, cold water fish community and are applicable at any point in the waters outside of the mixing zone:

(1) The following waters are designated as salmonid waters and shall be protected for cold water fish:

(A) Trail Creek and its tributaries downstream to Lake Michigan.

(B) East Branch of the Little Calumet River and its tributaries downstream to Lake Michigan via Burns Ditch.

(C) Salt Creek above its confluence with the Little Calumet River.

(D) Kintzele Ditch (Black Ditch) from Beverly Drive downstream to Lake Michigan.

(E) The Galena River and its tributaries in LaPorte County.

(F) The St. Joseph River and its tributaries in St. Joseph County from the Twin Branch Dam in Mishawaka downstream to the Indiana/Michigan State Line.

(G) Those waters designated by the Indiana department of natural resources for put-and-take trout fishing.

meters (at twenty-five degrees Celsius (25° C)) may be considered equivalent to a dissolved solids concentration of seven hundred fifty (750) milligrams per liter.

(g) This subsection establishes water quality for agricultural uses. The standards to ensure water quality conditions necessary for agricultural use are the same as those in subsection (a).

(h) This subsection establishes water quality for limited uses. The quality of waters classified for limited uses pursuant to section 3(a)(5) of this rule shall, at a minimum, meet the following standards:

(1) The standards contained in subsection (a).

(2) The standards contained in subsection (d).

(3) The standards contained in subsection (f), where applicable.

(4) The waters must be aerobic at all times.

(5) Notwithstanding the preceding subdivisions, the quality of a limited use stream at the point where it becomes physically or chemically capable of supporting a higher use or at its interface with a higher use water segment shall meet the standards which are applicable to the higher use water.

(i) This subsection establishes water quality for exceptional uses. Waters classified for exceptional uses warrant extraordinary protection. Unless standards are otherwise specified on a case-by-case basis, the quality of all waters designated for exceptional use shall be maintained without degradation.

(j) In addition to complying with all other applicable subsections of this section, waters in Lake Michigan shall meet the following limits:

Dissolved oxygen	7.0 mg/l
pH	7.5-8.5 s.u.
Chlorides	
Monthly average	15 mg/l
Daily maximum	20 mg/l
Phenols	
Monthly average	0.001 mg/l
Daily maximum	0.003 mg/l
Sulfates	
Monthly average	26 mg/l
Daily maximum	50 mg/l
Total phosphorus	
Monthly average	0.03 mg/l
Daily maximum	0.04 mg/l
Filtrable residues (Total dissolved solids)	
Monthly average	172 mg/l
Daily maximum	200 mg/l
Fluorides	
Daily maximum	1.0 mg/l
Dissolved iron	
Daily maximum	300 μg/l

(k) The following temperature standards and criteria shall apply to Lake Michigan:

(1) All temperatures are expressed both in degrees Fahrenheit and degrees Celsius. In all receiving waters the points of measurement shall normally be in the first meter below the surface at such depths as to avoid thin layer surface warming due to extreme ambient air temperatures, but where required to determine the true distribution of heated wastes and natural variations in water temperatures, measurements shall be at a greater depth and at several depths as a thermal profile.

(2) There shall be no abnormal temperature changes so as to be injurious to fish, wildlife, or other aquatic life, or the growth or propagation thereof. In addition, plume interaction with the bottom shall be minimized and shall not injuriously affect fish, shellfish, and wildlife spawning or nursery areas.

(3) The normal daily and seasonal temperature fluctuations that existed before the addition of heat shall be maintained.

(4) At any time and at a maximum distance of a one thousand (1,000) feet arc inscribed from a fixed point adjacent to the discharge and/or as agreed upon by the commissioner and fed-

eral regulatory agencies, the receiving water temperature shall not be more than three degrees Fahrenheit (3° F) (one and seven-tenths degrees Celsius (1.7° C)) above the existing natural water temperature nor shall the maximum temperature exceed those listed below, whichever is lower:

	°F	°C
January	45	7.0
February	45	7.0
March	45	7.0
April	45	7.0
May	55	13.0
June	60	15.5
July	70	21.0
August	80	26.5
September	80	26.5
October	65	18.5
November	60	15.5
December	50	10.0

(5) All new waste heat discharges or enlargements of existing facilities exceeding a daily average of five-tenths (0.5) billion British thermal units per hour, which had not begun operations as of February 11, 1972, and which plan to use Lake Michigan waters for cooling, shall be limited to the amount essential for blowdown in the operation of a closed cycle cooling facility.

(6) Water intakes shall be designed and located to minimize entrainment and damage to desirable organisms. Requirements may vary depending upon local conditions but, in general, intakes are to have minimum water velocity and shall not be located in spawning or nursery areas of important fishes. Water velocity at screens and other exclusion devices shall also be at a minimum.

(7) Discharges other than those now in existence shall be such that the thermal plumes do not overlap or intersect.

(8) Facilities discharging more than a daily average of five-tenths (0.5) billion British thermal units of waste heat shall continuously record intake and discharge temperature and flow and make those records available to regulatory agencies upon request.

(l) Notwithstanding section 7 of this rule, the acute aquatic and chronic aquatic criteria (AAC and CAC) established in subsection (a) shall apply to the underground portion of the Lost River system and other underground streams and their tributaries that support fish or other higher aquatic life forms. *(Water Pollution Control Board; 327 IAC 2-1-6; filed Sep 24, 1987, 3:00 p.m.: 11 IR 581; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1020; errata, 13 IR 1861; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003)*

Cited in: 327 IAC 2-1-3; 327 IAC 2-1-4; 327 IAC 2-1-5; 327 IAC 2-1-8.2; 327 IAC 2-1-8.3; 327 IAC 5-2-11.1.

327 IAC 2-1-7 Interim ground water quality standards

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-8; IC 13-7-4-1

Sec. 7. (a) All ground waters of the state which are a present or probable future source for public or industrial water supply shall meet the water quality standards set forth in subsection (b) and either subsection (c) or (d), or both, depending upon the use being or expected to be made, at the point at which such waters are withdrawn for use, except due to natural causes.

(b) This subsection establishes the following conditions for minimum ground water quality conditions:

(1) All ground waters at all times and at all places shall meet the minimum conditions of being free from substances, materials floating debris, oil, or scum attributable to municipal, industrial, agricultural, and other land use practices or other discharges:

(A) that will settle to form putrescent or otherwise objectionable deposits;

(B) that are in amounts sufficient to be unsightly or deleterious;

(C) that produce color, odor, or other conditions in such degree as to create a nuisance;

(D) which are in amounts sufficient to injure, be acutely toxic to, or otherwise produce serious adverse physiological responses in humans, animals, aquatic life, or plants; and

(E) which are in concentrations or combinations that will cause or contribute to the growth of aquatic plants or algae to such a degree as to create a nuisance, be unsightly, or otherwise impair the designated uses.

(2) At all times, all ground waters shall be free of substances in concentrations which on the basis of available scientific data are believed to be sufficient to injure, be chronically toxic to, or be carcinogenic, mutagenic, or teratogenic to humans, animals, aquatic life, or plants.

(c) This subsection establishes ground water quality for public supply. In addition to subsection (b), the following standards are established to protect the water quality at the point at which water is withdrawn for treatment for a public supply:

(1) The coliform bacteria group shall not exceed four (4) per one hundred (100) milliliters (MF count).

(2) Taste and odor producing substances, other than naturally occurring, shall not interfere with the production of a finished water by conventional treatment consisting of coagulation, sedimentation, filtration, and disinfection.

(3) The concentration of either chlorides or sulfates shall not exceed two hundred fifty (250) milligrams per liter other than due to naturally occurring sources.

(4) Ground waters shall be considered acceptable for public supplies if Radium-226 and Strontium-90 are present in amounts not exceeding three (3) and ten (10) picocuries per liter, respectively. In the known absence of Strontium-90 and alpha emitters, the water supply is acceptable when the gross beta concentrations do not exceed one thousand (1,000) picocuries per liter.

(5) Chemical constituents in ground waters shall not be present in such levels as to prevent, after conventional treatment, meeting and drinking water standards contained in 327 IAC 8-2, due to other than natural causes.

(d) This subsection establishes water quality for industrial water supply. In addition to subsection (b), the standard to ensure protection of water quality at the point at which water is withdrawn for use (either with or without treatment) for industrial cooling and processing is that, other than from naturally occurring sources, the dissolved solids shall not exceed seven hundred fifty (750) milligrams per liter at any time. A specific conductance of one thousand two hundred (1,200) micromhos per centimeter (at twenty-five degrees Celsius (25° C)) may be considered equivalent to a dissolved solids concentration of seven hundred fifty (750) milligrams per liter. *(Water Pollution Control Board; 327 IAC 2-1-7; filed Sep 24, 1987, 3:00 p.m.: 11 IR 583; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1032; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003)*

Cited in: 327 IAC 2-1-6.

327 IAC 2-1-8 Methods of analysis

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8. The analytical procedures used as methods of analysis to determine the chemical, bacteriological, biological, and radiological quality of waters sampled shall be in accordance with 40 C.F.R. 136, the sixteenth edition of Standard Methods for the Examination of Water and Wastewater, or methods approved by the commissioner and the Environmental Protection Agency. *(Water Pollution Control Board; 327 IAC 2-1-8; filed Sep 24, 1987, 3:00 p.m.: 11 IR 583; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1033)*

327 IAC 2-1-8.1 Calculation of criteria for toxic substances; general

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8.1. Water quality standards for the state of Indiana indicate that all waters at all times and at all places, including the mixing zone, shall be free of substances or combinations of substances which are in amounts sufficient to be acutely toxic to humans, other animals, plants, or aquatic life. Toxic substances include, but are not limited to, those substances identified under Section 307(a) of the Clean Water Act. The allowable concentration of a toxic substance in surface water shall be determined for that substance by the procedures in sections 8.2 through 8.8 of this rule. *(Water Pollution Control Board; 327 IAC 2-1-8.1; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1033; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2003)*

327 IAC 2-1-8.2 Determination of acute aquatic criteria (AAC)

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8.2. In order to ensure that the concentration of a substance or combination of substances does not become acutely toxic to aquatic organisms, an acute aquatic criterion (AAC) will be determined by one (1) of the following methods:

(1) The following for Method 1:

(A) If no AAC is available in section 6(a)(2) Table 1 of this rule for the substance, or if a different AAC can be scientifically justified based on new toxicological data, or site-specific conditions concerning water quality characteristics, or species present, an AAC can be calculated using the procedures in subdivision (2).

(B) Alternatively, or in addition to those criteria in section 6(a)(1)(D) of this rule, a site-specific acute aquatic criterion based on whole effluent toxicity can be utilized. This criterion shall not exceed ten percent (10%) mortality above control mortality, as measured by the most sensitive species tested, in one hundred percent (100%) effluent. The toxicity of the whole effluent shall be determined as follows:

(i) Three (3) species will be tested initially, and these will represent species from ecologically diverse taxa to the extent possible. The exact species to be tested will be determined by the commissioner on a case-by-case basis with the objective of using resident or representative species. Once the toxicity of the effluent has been characterized, only the most sensitive of the species tested need to be used in such further testing as may be required.

(ii) Whole effluent toxicity testing will be required on up to three (3) sets of composite effluent samples to determine the variability of the effluent.

(2) The following for Method 2:

(A) An acute criterion can be calculated using modified U.S. EPA procedures when acute toxicity data are available for at least five (5) North American genera of freshwater organisms including representatives of the following families:

(i) The family Salmonidae.

(ii) The family Cyprinidae or Centrarchidae.

(iii) Another family, not represented above, in the Class Osteichthyes.

(iv) The family Daphnidae.

(v) Another aquatic macroinvertebrate family.

(B) Resident species data are preferred for the above required data set. If one (1) or more of the required families are not a site resident, the requirement may be waived and appropriate substitution will be made. If data are not available for resident species, data for nonresident species may be substituted and will be assumed to be representative of resident species.

(i) If the acute toxicity of the chemical has not been adequately shown to be related to a water quality characteristic, i.e., hardness, pH, temperature, etc., the AAC is calculated using the following procedures:

(AA) For each species for which at least one (1) acute value is available, the species mean acute value (SMAV) is calculated as the geometric mean of the results of all tests in which the concentrations of test material were stable as shown by measured values. For a species for which no such result is available, the SMAV should be calculated as the geometric mean of all available acute values, i.e., results of flow-through tests in which the concentrations were not measured and results of static and renewal tests based on initial concentrations of test material.

(BB) For each genus for which one (1) or more SMAVs are available, the genus mean acute value (GMAV) is calculated as the geometric mean of the SMAVs available for the genus.

(CC) The GMAVs are ordered from high to low.

(DD) Ranks (R) are assigned to the GMAVs from "1" for the lowest to "N" for the highest. If two (2) or more GMAVs are identical, successive ranks are arbitrarily assigned.

(EE) The cumulative probability, P, is calculated for each GMAV as R/(N + 1).

(FF) The (T) GMAVs (T = 2 for N = 5; T = 3 for N = 6 or 7; T = 4 for N = 8 or greater) are selected which have cumulative probabilities closest to five-hundredths (0.05). If there are less than fifty-nine (59) GMAVs, these will always be the two (2) (for N = 5), three (3) (for N = 6 or 7), or four (4) (for N = 8 or greater) lowest GMAVs.

(GG) Using the selected GMAVs and Ps, the final acute value (FAV) is calculated as:

$$S^2 = \frac{E((\ln GMAV)^2) - ((E(\ln GMAV))^2/T)}{E(P) - ((E(\sqrt{P}))^2/T)}$$

$$L = (E(\ln GMAV) - S(E(\sqrt{P})))/T$$

$$A = S(\sqrt{0.05}) + L$$

$$FAV = e^A$$

$$AAC = FAV/2$$

$$E = \text{Summation}$$

(HH) If, for a commercially, recreationally, or ecologically important species, the geometric mean of the acute values from flow-through tests in which the concentrations of test material were measured is lower than the calculated FAV, then that geometric mean is used as the FAV instead of the calculated FAV.

(ii) If data are available to show that acute toxicity to two (2) or more species is similarly related to a water quality characteristic, the AAC is calculated using the procedures as follows:

(AA) For each species for which comparable acute toxicity values are available at two (2) or more different values of the water quality characteristic, a least squares regression of the acute toxicity values on the corresponding values of the water quality characteristic is performed to obtain the slope of the curve that describes the relationship. Because the best documented relationship is that between hardness and acute toxicity of metals and a log-log relationship fits these data, geometric means and natural logarithms of both toxicity and water quality are used in the rest of this procedure to illustrate the method. For relationships based on other water quality characteristics, such as pH or temperature, no transformation or a different transformation might fit the data better, and appropriate changes will be made as necessary throughout this method.

(BB) Each acute slope is evaluated as to whether or not it is meaningful, taking into account the range and number of tested values of the water quality characteristic and the degree of agreement within and between species. If meaningful slopes are not available for at least one (1) fish and one (1) invertebrate, or if the available slopes are too dissimilar, or if too few data are available to adequately define the relationship between acute toxicity and the water quality characteristic, the AAC is calculated using the procedures in item (i).

(CC) Individually, for each species, the geometric mean of the available acute values is calculated and then each of the acute values for a species is divided by the mean for the species. This normalizes the acute values so that the geometric mean of the normalized values for each species individually and for any combination of species is one (1.0).

(DD) The values of the water quality characteristic are similarly normalized for each species individually.

(EE) All the normalized data are treated as if they were for the same species and a least squares regression of all the normalized acute values on the corresponding normalized values of the water quality characteristic is performed to obtain the pooled acute slope, V.

(FF) For each species the geometric mean, W, of the acute toxicity values and the geometric mean, X, of the water quality characteristic are calculated. (These were calculated in subitems (CC) through (DD).)

(GG) For each species the logarithmic intercept, Y, is calculated using the equation:

$$Y = \ln W - V(\ln X - \ln Y).$$

(HH) For each species calculate the SMAV at Z using the equation:

$$SMAV = e^{Y}.$$

(II) Obtain the FAV at Z by using the procedures described in subitems (BB) through (HH), replacing "value" with "intercept".

(JJ) The final acute equation is written as:

$$\text{final acute value (FAV)} = e^{(V\,(\ln\,(\text{water quality characteristic}))\,+\,\ln A - V\,(\ln Z))}$$

Where:

V = pooled acute slope (from subitem (EE))

A = FAV at Z (from subitem (II))

Since V, A, and Z are known, the FAV can be calculated for any selected value of the water quality characteristic.

(KK) The AAC is equal to the FAV/2.

(C) If data are not available for at least five (5) North American freshwater genera meeting the requirements in clause (A), go to subdivision (3).

(3) The following for Method 3:

(A) If the required data to derive the AAC in subdivision (2)(B) are not present in the acute toxicity data base and at least one (1) LC_{50} value is available for a daphnid species and either fathead minnow, bluegill, or rainbow trout, a FAV is calculated by dividing the lowest SMAV for the daphnid species, fathead minnow, bluegill, and rainbow trout by five (5) if rainbow trout are represented or ten (10) if rainbow trout are not represented. The AAC equals the FAV divided by two (2). If appropriate, the AAC will be made a function of a water quality characteristic in a manner similar to that described in subdivision (2)(B)(ii).

(B) If the data required in clause (A) are not available, no AAC can be calculated and the discharger will be required to develop the minimum data base (ninety-six (96) hour LC_{50} for rainbow trout, fathead minnow, or bluegill and a forty-eight (48) hour LC_{50} for a daphnid) needed to calculate the AAC.

(Water Pollution Control Board; 327 IAC 2-1-8.2; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1033; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004)

Cited in: 327 IAC 2-1-6; 327 IAC 2-1-8.1; 327 IAC 2-1-8.3; 327 IAC 5-2-11.1.

327 IAC 2-1-8.3 Determination of chronic aquatic criterion (CAC)

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8.3. In order to ensure that the concentration of a substance or combination of substances does not produce chronic effects on aquatic organisms, a chronic aquatic criterion (CAC) will be determined by one (1) of the following methods:

(1) The following for Method 1:

(A) If no CAC is given for the substance in section 6(a)(2) Table 1 of this rule, or if different CAC can be scientifically justified based on new toxicological data, or site-specific conditions concerning water quality characteristics or species present, a CAC can be calculated using the procedures in subdivision (2).

(B) Alternatively, or in addition to the CAC in section 6(a)(2) of this rule, a site-specific CAC based on whole effluent toxicity can be utilized. This criterion shall not exceed the no observable effect level (NOEL) based on an appropriate chronic toxicity test, as measured by the most sensitive species tested, at an effluent dilution equal to that provided by no more than one-fourth (1/4) of the $Q_{7,10}$ flow of the receiving stream. The toxicity of the whole effluent shall be determined as follows:

(i) Three (3) species will be tested initially, and these will represent species from ecologically diverse taxa to the extent possible. The exact species to be tested will be determined by the commissioner on a case-by-case basis with the objective of using resident or representative species. Once the toxicity of the effluent has been characterized, only the most sensitive of the species tested need be used in such further testing as may be required.

(ii) Whole effluent toxicity testing will be required on up to three (3) sets of composite effluent samples to determine the variability of the effluent.

(2) The following for Method 2:

(A) The CAC is derived in the same manner as the FAV in section 8.2(2) of this rule by substituting CAC for FAV, chronic for acute, MATC (Maximum Acceptable Toxicant Concentration) for LC_{50}, SMCV (Species Mean Chronic Value) for SMAV, and GMCV (Genus Mean Chronic Value) for GMAV.

(B) If chronic toxicity data are not available for at least five (5) North American freshwater genera meeting the requirements in section 8.2(2)(A) of this rule, go to subdivision (3).

(3) The following for Method 3:

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(A) The CAC can be calculated by dividing the FAV by an acute-chronic ratio (or geometric mean of the acute-chronic ratios if more than one (1) is available) for at least one (1) North American freshwater species.

(B) If no acute-chronic ratio is available for at least one (1) North American freshwater species, go to subdivision (4).

(4) The following for Method 4:

(A) The CAC can be calculated by dividing the FAV by a factor of forty-five (45). If, for a commercially, recreationally, or ecologically important species, the geometric mean of the chronic values is lower than the calculated CAC, then that geometric mean is used as the CAC instead of the calculated CAC.

(B) If the data needed in clause (A) are not available, no CAC can be calculated and the discharger will be required to develop the minimum data base necessary to calculate the CAC (ninety-six (96) hour LC_{50} for rainbow trout, fathead minnow, or bluegill and a forty-eight (48) hour LC_{50} for a daphnid).

(Water Pollution Control Board; 327 IAC 2-1-8.3; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1035; errata, 13 IR 1861; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004; errata filed Jul 24, 1990, 4:55 p.m.: 13 IR 2138)

Cited in: 327 IAC 2-1-6; 327 IAC 2-1-8.1; 327 IAC 5-2-11.1.

327 IAC 2-1-8.4 Determination of the terrestrial life cycle safe concentration (TLSC)

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8.4. The concentration to protect wildlife is the terrestrial life cycle safe concentration (TLSC). The minimum toxicity data requirement for derivation of a TLSC shall consist of an acute oral LD_{50} for rats. When mammalian and avian toxicity data are available, a TLSC shall be calculated for both groups. The final TLSC is the lowest of the two (2) values. The TLSC shall be derived by one (1) of the following methods, depending on the type and quality of the toxicity data base:

(1) If a chronic, subchronic, or subacute no observable adverse effect level (NOAEL) from mammalian or avian species exposed to toxicant contaminated water is available:

$$TLSC = \frac{NOAEL\ (mg/l)}{U}$$

Where: U = uncertainty factor (U = 10-100 depending on quality of study)

(2) If a chronic, subchronic, or subacute NOAEL from mammalian or avian species exposed to toxicant contaminated feed is available:

$$TLSC = \frac{NOAEL\ (ppm) \times C \times \frac{W_a}{V_w}}{U}$$

Where: C = weight of feed consumed daily expressed as a fraction of test animal's body weight

W_a = weight of test animal (kg)

V_w = volume of water consumed daily by the test animal

(3) If a chronic, subchronic, or subacute NOAEL from mammalian or avian species exposed to toxicant by gavage is available:

$$TLSC = \frac{NOAEL\ (mg/kg/day) \times \frac{W_a}{V_w} \times Fw}{U}$$

Where: Fw = fraction of days dosed per week

(4) If an oral rat LD_{50} is available:

$$TLSC = \frac{LD_{50}\,(mg/kg) \times \frac{W_a}{V_w} \times M}{10}$$

Where: M = one ten-thousandth (0.0001), acute to chronic application factor

(5) TLSCs are best de-ived from data involving oral exposure. How -ver, if available oral data are insufficient, it may be useful to use data from other exposure routes. Use of such data will depend on the specific pharmacokinetic and toxicological properties of each chemical.

(6) If an acceptable NOAEL is lacking, the lowest observable adverse effect level (LOAEL) may be substituted in some cases for NOAEL, with an additional uncertainty factor of one (1) to ten (10).

(7) On the basis of available information, the TLSC is evaluated as to whether it is consistent with sound scientific judgment. If not, the commissioner will direct the evaluation of app-opriate modifications of these procedures.

(Water Pollution Control Board; 327 IAC 2-1-8.4; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1036; errata, 13 IR 1861; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004)

Cited in: 327 IAC 2-1-6; 327 IAC 2-1-8.1; 327 IAC 5-2-11.1.

327 IAC 2-1-8.5 Determination of the human life cycle safe concentration (HLSC)

Authority: IC 13-1 IC 13-7-7-5
Affected: IC 13- IC 13-7-7-5

Sec. 8.5. The c -ration to protect public health from thr effect toxicants is the human life cycle concentration (HLSC). The minimum to-icity data requirement for derivation of an HLSC shall consist of an acute oral LD_{50} for rats. The HLSC shall be derived in the following manner:

(1) The HLSC shall be derived from appropriate toxicological data using the following formula:

$$HLSC = \frac{MgT\,(mg/day)}{WC + (F \times BCF)}$$

Where:
MgT = maximum milligrams of toxicant per day causing no adverse effects to humans when ingested daily for lifetime
WC = volume of water consumed daily in liters (two (2) liters per day for surface water protected for drinking water supply; one-hundredth (0.01) liter per day for surface water not protected for drinking water supply)
F = sixty-five ten-thousandths (0.0065) kilograms per day, daily consumption of fish by humans
BCF = bioconcentration factor in $\frac{mg/kg}{mg/l}$ as determined in section 8.7 of this rule

(2) The MgT shall be derived by one (1) of the following methods depending on the type and quality of the toxicity data base:

(A) If a scientifically valid maximum contaminant level (MCL) from the national interim primary drinking water regulations is available:

$$MgT = MCL\,(mg/l) \times V_h$$

Where: V_h = two (2) liters per day, volume of water consumed daily by humans

(B) If a chronic, subchronic, or subacute no observable adverse effect level (NOAEL) for humans exposed to toxicant contaminated drinking water is available:

$$MgT = \frac{NOAEL\,(mg/l) \times V_h}{U}\ (1/day)$$

Where: U = uncertainty factor (U=10-100)

(C) If a scientifically valid acceptable daily intake (ADI) is available from the federal

Food and Drug Administration regulations: MgT = ADI.

(D) If a chronic, subchronic, or subacute NOAEL from mammalian test species exposed to toxicant contaminated drinking water is available:

$$MgT = \frac{NOAEL\ (mg/l) \times \frac{V_w}{W_a} \times W_h}{B}$$

Where:

V_w = volume of water consumed daily by test animal (liters per day)

W_a = weight of test animal (kg)

W_h = seventy (70) kilograms, weight of human

B = uncertainty factor (B = 100-1,000 depending on quality of study)

(E) If a chronic, subchronic, or subacute NOAEL from mammalian test species exposed to toxicant contaminated food is available:

$$MgT = \frac{NOAEL\ (ppm) \times C \times W_h}{B}$$

Where:

C = daily food consumption expressed as a fraction of the animal's body weight

(F) If a chronic, subchronic, or subacute NOAEL from mammalian test species exposed to toxicant by gavage is available:

$$MgT = \frac{NOAEL\ (mg/kg/day) \times F_w \times W_h}{B}$$

Where: F_w = fraction of days dosed per week

(G) If an oral rat LD_{50} is available:

$$MgT = \frac{LD_{50}(mg/kg) \times M \times W_h}{100}$$

Where:

M = one-ten thousandth (0.0001), acute to chronic application factor

(H) If an acceptable NOAEL is lacking, the lowest observable adverse effect level (LOAEL) may be substituted in some cases for NOAEL, with an additional uncertainty factor of one (1) to ten (10).

(I) HLSCs are best derived from data involving oral exposure. However, if available oral data are insufficient, it may be useful to use data from other exposure routes. Use of such data will depend on the specific pharmacokinetic and toxicological properties of each chemical.

(J) On the basis of available information, the HLSC is evaluated as to whether it is consistent with sound scientific judgment. If not, the commissioner will direct the evaluation of appropriate modifications of these procedures.

(Water Pollution Control Board; 327 IAC 2-1-8.5; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1037; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004)
Cited in: 327 IAC 2-1-6; 327 IAC 2-1-8.1; 327 IAC 5-2-11.1.

327 IAC 2-1-8.6 Determination of concentration providing an acceptable degree of protection to public health for cancer

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8.6. (a) The concentration providing an acceptable degree of protection to public health for cancer shall be derived as provided in subsection (b)(1). For carcinogens that are assumed to cause cancer by a nonthreshold mechanism, a greater degree of protection than that derived in subsection (b)(1) may be proposed where this greater protection is achievable through utilization of control measures already in place.

(b) Initially, any chemical for which at least one (1) published mammalian carcinogenicity study of suitable quality demonstrates an association between exposure to the chemical and a statistically or biologically significant increase in the incidence of malignant or benign tumors shall be considered a carcinogen. With respect to "suitable quality," the only type of carcinogenicity study which will be automatically excluded from consideration as sole evidence of the carcinogenic properties of a particular chemical will be studies in which the tested chemical was administered via an injection route of exposure and an increase in malignant or benign tumors was produced only at the site of injection. Not included in this category are studies in which an injection dosing was administered intratracheally or by gavage. The commissioner shall reevaluate the carcinogenic potential of substances when new data of suitable quality become available.

(1) A water concentration of the carcinogen shall be derived from human epidemiological data or from appropriate animal research data using the following formula:

$$C = \frac{D \times W_h}{WC + (F \times BCF)}$$

Where:

C	=	concentration of the carcinogen (mg/l)
D	=	dose derived in clause (A), (B), or (C) (mg/kg/day)
W_h	=	seventy (70) kilograms, weight of an average human
WC	=	daily water consumption (0.01 liters per day for surface water not protected for drinking water supply; 2.0 liters per day for surface waters protected for drinking water supply)
F	=	sixty-five ten-thousandths (0.0065) kilograms per day, daily fish consumption
BCF	=	bioconcentration factor in $\frac{mg/kg}{mg/l}$ as determined in section 8.7 of this rule

(A) The dose (D) may be derived from appropriate human epidemiological data on a case-by-case basis by the commissioner.

(B) Whenever appropriate human epidemiological data are not available, a non-threshold mechanism shall be assumed for carcinogens which have not been adequately demonstrated to cause cancer by a threshold mechanism. The dose (D) shall be the concentration estimated to cause one (1) additional cancer over the background rate in one hundred thousand (100,000) individuals exposed to that concentration calculated using the following method:

(i) All carcinogenesis bioassay data are reviewed and data of appropriate quality are used for the quantitative risk estimations. The data are fitted into the multistage model using the computer model GLOBAL 82 developed by Howe and Crump (1982). The upper ninety-five percent (95%) confidence limit on risk at the one (1) in one hundred (100) risk level is divided by the maximum likelihood dose at the same level of risk which determines the slope, q_1^*. This is taken as an upper bound of the potency of the chemical in inducing cancer at low doses. Whenever the multistage model does not fit the data, as determined by the Chi-square goodness of fit statistical test, the model is refitted to the data omitting the highest dose. This is continued until an acceptable fit is determined as described in the U.S. EPA 1980 water quality criteria documents (45 Fed. Reg. 79316-79379). If a single study in which a chemical induces more than one (1) type of tumor is available, then the response for the tumor type predicting the highest estimate of q_1^* is generally used for the risk assessment. If two (2) or more studies of equal quality are available, but vary in any of the following: species, strain, sex, or tumor type, then the data set giving the highest estimate of q_1^* is generally used for the risk assessment. If two (2) or more studies exist which are identical regarding species, strain, sex, tumor type, and are of equal quality, then the geometric mean of the q_1^* values from these data sets is used.

(ii) The dose corresponding to an estimated one (1) additional cancer in one hundred thousand (100,000) exposed test organisms is determined by dividing 10^{-5} by the value for q_1^*.

(iii) A species sensitivity factor is used to account for differences between test species and man. It is assumed that milligrams per surface area per day is an equivalent dose between species. The value may be calculated by dividing the average weight of a human seventy (70) kilograms by the weight of the test species and taking the cube root of this value; the slope q_1^* is multiplied by this factor. However, if adequate pharmacokinetic and metabolism studies are available, this data may be factored into the adjustment for species differences on a case-by-case basis.

(iv) All doses are adjusted to give a lifetime average daily dose. If dosing was only for a fraction of a lifetime, then the total dose is averaged over the entire life span.

(v) If the duration of experiment (L_e) is less than the natural life span of the test animal (L), the slope, q_1^*, is multiplied by the factor

$$\left(\frac{L}{L_e}\right)^3.$$

(C) Whenever appropriate human epidemiological data are not available, and the preponderance of data suggests that the chemical causes cancer by a threshold mechanism and does not interact with DNA, the dose (D) for chemicals shall be calculated from animal research data by applying a safety factor to an appropriate toxicity end point.

(i) The appropriate toxicity end point shall be determined by the commissioner on a case-by-case basis.

(ii) The safety factor shall be determined by the commissioner based on an evaluation of appropriate toxicological and pharmacological considerations including, mechanism of carcinogenesis, number and type of tumors induced, the spontaneous incidence of tumors, the number of animal species tested and affected, metabolic considerations, epidemiologic observation on exposed humans, extent of the data supporting a nongenetic mechanism, and other pertinent information.

(iii) A species sensitivity factor may be used to account for differences between test species and man.

(2) On the basis of available information, the concentration providing an acceptable degree of protection to public health for cancer is evaluated as to whether it is consistent with sound scientific judgment. If not, the commissioner will direct the evaluation of appropriate modifications of these procedures.

(Water Pollution Control Board; 327 IAC 2-1-8.6; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1038; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004)

Cited in: 327 IAC 2-1-6; 327 IAC 2-1-8.1; 327 IAC 5-2-11.1.

327 IAC 2-1-8.7 Determination of bioconcentration factor

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 8.7. The final bioconcentration factor (BCF_f) standardized to reflect the value for fresh fish tissue having a lipid content of nine and six-tenths percent (9.6%) shall be determined as follows in order of preference:

(1) Measured, steady-state bioconcentration factors from standardized laboratory tests shall be recorded as BCF_m. If more than a single value is available, the BCF_m shall be equal to the geometric mean of the reported values.

(2) If bioconcentration factors are available from other laboratory tests, the BCF_m will be the projected steady-state BCF as extrapolated from the test data.

(3) If measured bioconcentration factors (BCF_m) are not available from laboratory studies, a calculated bioconcentration factor (BCF_c) will be determined by the following equation:

$$\log BCF_c = 0.847 \log Kow - 0.628$$

(A) If a measured Kow is not available for the chemical of interest the Kow may be calculated according to standard references and used in the regression equation in this subdivision.

(B) If a Kow cannot be calculated, BCF_c may be estimated on a case-by-case basis using other regression equations or correlations as appropriate.

(4) The final bioconcentration factor (BCF_f) will be obtained by normalization to nine and six-tenths percent (9.6%) lipids as follows:

(A) For measured bioconcentration factors:

$$BCF_f = BCF_m \frac{(9.6)}{L}$$

Where:

BCF_m = measured bioconcentration factor

L = percent lipid content of fish used in the test

(B) For bioconcentration factors calculated from Kow:

$$BCF_f = BCF_c \frac{(9.6)}{4.8}$$

Where:

BCF_c = calculated bioconcentration factor from log Kow or other regression equations

4.8 = average percent lipid for test fish used to develop the regression equation in subdivision (3)

(5) The commissioner shall direct the evaluation of the final bioconcentration factor (BCF_f) calculated above to determine if a trophic level adjustment is warranted.

(Water Pollution Control Board; 327 IAC 2-1-8.7; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1039)

Cited in: 327 IAC 2-1-8.1; 327 IAC 2-1-8.5; 327 IAC 2-1-8.6.

327 IAC 2-1-8.8 Variances from water quality standards

Authority: IC 13-1-3-7; IC 13-7-7-5; IC 13-7-7-6
Affected: IC 4-22-2; IC 13-1-3; IC 13-7-4-1

Sec. 8.8. (a) When the commissioner proposes to issue, reissue, or modify a NPDES permit to include a water quality-based effluent limitation pursuant to 327 IAC 5, the permit applicant or permittee may apply for a variance from the water quality standard used to derive the limitation. The application for such a variance shall be submitted in accordance with the requirements specified in 327 IAC 5-3-4.1. The commissioner may propose a variance, concurrently with the proposed issuance, reissuance, or modification of a NPDES permit, if the variance is based solely on subsection (b)(1)(C).

(b) This subsection establishes decisional criteria as follows:

(1) The commissioner may approve all or part of a requested variance, or modify and approve a requested variance, if the permit applicant demonstrates to the satisfaction of the commissioner that attaining the water quality standard is not feasible because:

(A) concentrations of a naturally occurring substance in the receiving waters prevent attainment of the standard for that substance;

(B) the standard, as applied to the permit applicant in deriving a water quality-based effluent limitation, will cause substantial adverse social and economic impacts in the area where the permit applicant's discharging facility is located after showing that:

(i) there is no practicable technology available for attaining the water quality standard by means of changes in the production process which reduce or eliminate the substance; and

(ii) there is no practicable technology available for attaining the water quality standard by means of treating the substance; or

(C) the standard, as applied to the permit applicant, results in a water quality-based effluent limitation that is less than the limit of quantification.

(2) The commissioner shall deny a requested variance if the permit applicant fails to make the demonstration specified in subdivision (1).

(3) A determination to grant or deny a requested variance shall be made in accordance with the procedures specified in 327 IAC 5-3-4.1.

(c) A variance applies only to the permit applicant requesting the variance and only to the substance specified in the variance. The granting of a variance does not imply or require that the water quality standard corresponding to the variance shall be modified through a rulemaking in accordance with IC 4-22-2.

(d) A variance shall not be granted for a term greater than that allowed by IC 13-7-7-6. The total combined term of the initial variance and any renewals thereof may not exceed the time determined by the commissioner to be necessary for the permittee to achieve the effluent limitation derived from the water quality standard.

(e) This section shall not be severable from this rule. *(Water Pollution Control Board; 327 IAC 2-1-8.8; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1040; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004)*

Cited in: 327 IAC 2-1-8.1; 327 IAC 5-2-11.1; 327 IAC 5-3-4.1.

327 IAC 2-1-9 Definitions

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-1.5; IC 13-1-3-16; IC 13-7-1-2

Sec. 9. In addition to the definitions contained in IC 13-7-1 and IC 13-1-3-1.5 and in 327 IAC 1, the following definitions apply throughout this title:

"Acceptable daily intake" or "ADI" represents the maximum amount of a substance which if ingested daily for a lifetime results in no adverse effects to humans.

"Acute aquatic criterion" or "AAC" means the highest concentration of chemical that, if met instream will protect the aquatic life present from mortality or other irreversible effects due to short term exposure. The AAC is equal to one-half (1/2) the final acute value (FAV).

"Acute toxicity" means the ability of a chemical to cause a debilitating or injurious change in an organism which results from a single or short term exposure to the chemical.

"Bioconcentration" is the increase in concentration of the chemical of concern and its metabolites in or on the target organisms (or specified tissues thereof) relative to the concentration of the chemical of concern in the ambient water.

"Bioconcentration factor" or "BCF" is the number used to relate substance residue in aquatic organisms to the concentration of the substance in the waters in which the organisms reside.

"Carcinogen" means a chemical which causes an increased incidence of benign or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasms through oral or dermal exposure, or through inhalation exposure when the cancer occurs at nonrespiratory sites in at least one (1) mammalian species or man through epidemiological and/or clinical studies.

"Chronic aquatic criterion" or "CAC" means the highest concentration of chemical that, if met instream will protect the aquatic life present from toxic effects due to long term exposure, e.g., adverse effects on growth and reproduction.

"Chronic toxicity" means the ability of a chemical to cause an injurious or debilitating effect in an organism which results from repeated exposure to a chemical for a time period representing a substantial portion of the natural life expectancy of that organism.

"Coliform bacteria" means all the aerobic and facultatively anaerobic, gram-negative, nonsporeforming bacilli that produce acid and gas from the fermentation of lactose.

"Community" means a general collective term to describe the varieties of aquatic species and associated organisms living together in a water body.

"Discharge-induced mixing" or "DIM" means mixing initiated by the use of submerged, high rate diffuser outfall structures which provide turbulent initial mixing and will minimize organism exposure time.

"Effluent" means a wastewater discharge from a point source to the waters of the state.

"Final acute value" or "FAV" means the concentration of a substance that is lower than all but five percent (5%) of the mean acute values (MAVs) that cause a specific level of acute toxicity to an aquatic taxon in laboratory test.

"Full body contact" means direct contact with the water to the point of complete submergence.

"Geometric mean" means the Nth root of the product of N quantities. Alternatively, the geometric mean can be calculated by adding the logarithms of the N numbers, dividing the sum by N, and taking the antilog of the quotient.

"Ground water" means such accumulations of underground water, natural and artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state, but excluding manmade underground storage or conveyance structures.

"Human life cycle safe concentration" or "HLSC" is the highest concentration of a chemical to which a human is exposed continuously for a lifetime, and which results in no observable adverse effects to human and its progeny.

"Indigenous" means generally, an organism native to and growing and reproducing in a particular region. For purposes of this rule this term also includes historically nonnative species introduced by the Indiana department of natural resources as part of a program of wildlife management whether such species reproduce or not.

"LC_{50}" means the median lethal concentration which is the concentration of a test material in a suitable diluent at which fifty percent (50%) of the exposed organisms die during a specified time period.

"LD_{50}" means the median lethal dose of a chemical which is the amount of a test material per body weight which, when administered, results in fifty percent (50%) mortality to the organisms during a specified time period.

"Life cycle safe concentration" means the highest concentration of a chemical to which an organism is exposed continuously for a lifetime, and which results in no observable adverse effects to the organism and its progeny.

"Limit of quantification" means a concentration of an analyte at which one can state with a degree of confidence, using the most sensitive analytical test method approved by EPA, for

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"Log Kow" means the log (base 10) of the n-octanol/water partition coefficient.

"Lowest observable adverse effect level" or "LOAEL" means the lowest tested concentration causing the occurrence of an injurious or debilitating effect.

"MATC" means the maximum acceptable toxicant concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration which did not cause the occurrence of a specified adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specified adverse effect and above which all tested concentrations caused such an occurrence.

"Maximum contaminant level" or "MCL" means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water supply system.

"Mean acute value" or "MAV" means the concentration of a substance that causes a specific level of acute toxicity to aquatic organisms in some taxonomic group.

"Mixing zone" means an area contiguous to a discharge where the discharged wastewater mixes with the receiving waters. Where the quality of the effluent is lower than that of the receiving waters, it may not be possible to attain within the mixing zone all beneficial uses which are attained outside the zone. The mixing zone should not be considered a place where effluents are treated.

"NOAEL" means the highest level of toxicant which results in no observable adverse effects to exposed test organisms.

"n-octanol/water partition coefficient (Kow)" means the ratio of the octanol to water equilibrium concentrations of a compound.

"Nonthreshold mechanism" means a process which results in some possible effect no matter what level is present. There is no level which may not produce an effect.

"Persistent substance" means a chemical that is long-lived in soil, aquatic environments, and animal and plant tissues and is not readily broken down by biological or physiochemical processes.

"Point source" means a discernible, confined, and discrete conveyance, from which wastewater is or may be discharged to the waters of the state.

"Policy", as employed herein, means a statement of administrative practice or decision-making guidelines to be followed or implemented to the maximum extent feasible with respect to an identified problematic situation but to be less than strictly enforceable in contrast to a standard or rule of law.

"Public water supply" means any wells, reservoirs, lakes, rivers, sources of supply, pumps, mains, pipes, facilities, and structures through which water is obtained, treated as may be required, and supplied through a water distribution system for sale to or consumption by the public for drinking, domestic, or other purposes, including state-owned facilities even though the water may not be sold to the public.

"Risk" means the probability that a substance, when released to the environment, will cause an adverse effect in exposed humans or other living organisms.

"Risk assessment" means the analytical process used to determine the level of risk.

"Standard" means a definite numerical value or narrative statement promulgated by the board to maintain or enhance water quality to provide for and fully protect designated use of the waters of the state.

"Steady-state" means an equilibrium condition has been achieved in the body burden of a substance in an organism. This is assumed when the rate of loss of a substance matches its rate of uptake.

"Surface waters of the state" or "surface water" means such accumulations of water on the land surface, natural and artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state, but the term does not include any private pond or any pond, reservoir, or facility built for reduction or control of pollution or cooling water prior to discharge unless the discharge therefrom causes or threatens to cause water pollution.

"Terrestrial life cycle safe concentration" or "TLSC" is the highest concentration of chemical to which wildlife is exposed continuously for a lifetime and which results in no observable adverse effects to wildlife and its progeny.

"Threshold mechanism" means a process which results in some effect if a certain level is exceeded, but which produces no effect below that level.

"Toxic substances" means substances which are or may become harmful to plant or animal life, or to food chains when present in sufficient concentrations or combinations. Toxic substances include, but are not limited to, those pollutants identified as toxic under Section 307(a)(1) of the Clean Water Act.

"Variance" means a deviation from a water quality standard.

"Waters of the state" means such accumulations of water, surface and underground, natural and artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state, but the term does not include any private pond, or any pond, reservoir, or facility built for reduction or control of pollution or cooling of water prior to discharge unless the discharge therefrom causes or threatens to cause water pollution.

"Water use designations" means a use of the waters of the state as established by this rule, including but not limited to industrial water supply, agricultural use, public water supply, full body contact, aquatic life, limited use, and exceptional use.

"Well-balanced aquatic community" means an aquatic community which is diverse in species composition, contains several different trophic levels, and is not composed mainly of strictly pollution tolerant species.

"Zone of initial dilution" or "ZID" means that area of the receiving stream after the end of the pipe where an instantaneous volume of water gives a one-to-one dilution of the discharge. *(Water Pollution Control Board; 327 IAC 2-1-9; filed Sep 24, 1987, 3:00 p.m.: 11 IR 584; filed Feb 1, 1990, 4:30 p.m.: 13 IR 1041; errata filed Jul 6, 1990, 5:00 p.m.: 13 IR 2004)*

327 IAC 2-1-10 Reclassification proposals for limited or exceptional use designation

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 10. (a) A person who wishes to propose that a particular body of the waters of the state be considered by the commissioner for limited use or exceptional use classification must submit to the commissioner a written proposal identifying the water body and the proposed classification, stating the rationale for the proposal, and including any other supporting documentation. After receiving the commissioner's recommendation on a proposal, if the board determines that a water body is appropriate for reclassification for limited use or exceptional use, it will initiate a rulemaking for that purpose.

(b) The commissioner will consider factors such as the following in making recommendations to the board with regard to proposals for

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the reclassification of a water body for limited use or exceptional use. These factors are listed as guidelines to provide some insight into the way the commissioner's recommendations may be made, but are not intended to be all encompassing. Irrespective of these factors, the commissioner's recommendations generally will be case-by-case determinations based on professional judgment after on-site evaluations.

(1) Factors relating to limited use designations:

(A) the waterway has a Q(7),(10) low flow upstream of any existing or proposed discharge of 0.1 cubic feet per second or less;

(B) suitable habitat to support a well-balanced fish community is severely limited or absent;

(C) the waterway is affected by irreversible conditions, natural or man-induced which came into existence prior to January 1, 1983, which are not practicably controllable and prevent establishment of a well-balanced fish community;

(D) the water body has no unique or exceptional features; and/or

(E) potential or existing uses made of the water body by people in the immediate area would not be adversely affected by a limited use designation.

(2) Factors relating to exceptional use designations:

(A) the presence of a unique or exceptional habitat or species in the water body;

(B) the presence of a rare or endangered species in the water body;

(C) the presence of exceptional aesthetic quality in the immediate environs of the water body;

(D) the water body is within the boundaries of or flows through a designated natural area, nature preserve, or state or national park or forest;

(E) the water body supports an excellent sports fishery;

(F) the water body possesses exceptional quality; or

(G) intensive recreational use is made of the water body.

(Water Pollution Control Board; 327 IAC 2-1-10; filed Sep 24, 1987, 3:00 pm: 11 IR 585)

327 IAC 2-1-11 Limited and exceptional use; designated waters

Authority: IC 13-1-3-7; IC 13-7-7-5
Affected: IC 13-1-3-7; IC 13-7-7-5

Sec. 11. (a) The following waters of the state are designated for limited use pursuant to 327 IAC 2-1-3(a)(5):

(1) Prides Creek in Pike County upstream from its confluence with White River.

(2) Hoffman Ditch in St. Joseph County upstream from its confluence with Yellow River.

(3) Redkey Run and Halfway Creek in Jay County from the Redkey STP to two (2) miles downstream.

(4) Kentland STP receiving stream along NYC railroad upstream from its confluence with Montgomery Ditch in Newton County.

(5) Buck Creek in Sullivan County from the Sullivan South STP to two and one-fourth (2.25) miles downstream.

(6) Arbogast Ditch upstream from its confluence with West Fork of White River in Randolph County.

(7) Jefferson Ditch in Grant County from the Upland STP to its confluence with Lake Branch.

(8) Vinson Drain and Mud Creek in Madison County from the Summitville STP to the confluence of Mud Creek and Star Creek.

(9) Berlin Court Ditch in Elkhart County from the Nappanee STP to two (2) miles downstream.

(10) Ackerman Branch and Mill Creek in Dubois County to the confluence of Mill Creek and Little Creek.

(11) North Prong of Stotts Creek in Johnson County from the Bargersville STP to one and one-fourth (1.25) miles downstream.

(12) An unnamed tributary of Four Mile Creek in Greene County from the Lyons STP to its confluence with Four Mile Creek.

(13) An unnamed stream in Dubois County, which is the outlet of Huntingburg City Lake, from the City Lake Dam downstream to its confluence with Ell Creek.

(14) Leavell Ditch in Tipton County upstream from its confluence with Buck Creek.

(15) Buck Creek in Tipton County upstream from its confluence with Cicero Creek.

(16) Schlatter Ditch which becomes Bacon Prairie Creek in Tipton County upstream from a point one mile upstream of the confluence of Bacon Prairie Creek and Cicero Creek.

(17) An unnamed ditch in Posey County flowing north out of the town of Cynthiana along the Chicago and Eastern Illinois Railroad then west along the Posey-Gibson County Line to its confluence with Black River.

(18) Laughery Creek in Ripley county from the Napoleon STP to a point three (3.0) miles downstream. (County Road 300 West Extended.)

(19) An unnamed tributary and Hurricane Creek in Gibson County from the Haubstadt STP to the confluence of Hurricane Creek and the West Fork of Pigeon Creek.

(20) Plasterers Creek in Martin County from the Loogootee STP downstream to the confluence with Friends Creek.

(21) An unnamed tributary and Werntz Ditch in Elkhart County from the Wakarusa STP to the confluence of Werntz Ditch and Baugo Creek.

(22) Montgomery Ditch and Black River in Gibson County from the Owensville STP to the Antioch Road Bridge.

(23) Brewer Ditch in Johnson County from the Whiteland STP to the County Road 250 N bridge.

(24) An unnamed tributary of Little Otter Creek in Ripley County from the Holton STP to its confluence with Little Otter Creek.

(25) The Silverthorn Branch of Wildcat Creek in Clinton County from the Rossville STP to its confluence with the Middle Fork of Wildcat Creek.

(26) An unnamed tributary of the West Fork of White River in Randolph County from the Farmland STP to its confluence with the West Fork of White River.

(27) Hawk Run and Blackhawk Creek in Dubois and Spencer counties from the Schuler Packing Company discharge downstream to the Anderson River.

(28) Spring Creek in Vigo County from the Hercules, Inc., outfall downstream to the Wabash River.

(29) Hilkey Ditch in DeKalb County from the County Line Cheese Company outfall to North County Line Road one and one-half (1.5) miles downstream.

(30) Little Buck Creek in Henry County to its confluence with Hillside Brook.

(31) Hindman Ditch in DeKalb County from the Ralph Sechler Company outfall downstream to its confluence with Bear Creek.

(32) Francis Dutro Ditch in Blackford County from the Blackford Canning Company discharge downstream to its confluence with Prairie Creek.

(33) The unnamed ditch receiving the Sperry Rubber Company discharge and Richland Creek in Franklin County from the confluence of the unnamed tributary downstream to the Whitewater River.

(34) Eight Mile Creek in Wells County to the confluence of Eight Mile Creek and Maple Creek.

(b) The following waters of the state are designated for exceptional use pursuant to 327 IAC 2-1-3(a)(6):

(1) Big Pine Creek in Warren County downstream of the State Road 55 bridge near the town of Pine Village to its confluence with the Wabash River.

(2) Mud Pine Creek in Warren County from the bridge on the County Road between Brisco and Rainsville to its confluence with Big Pine Creek.

(3) Fall Creek in Warren County from the old C.R. 119 bridge in the NW quarter of Section 21, Township 22N, Range 8W downstream to its confluence with Big Pine Creek.

(4) Indian Creek in Montgomery County from the County Road 650 West bridge downstream to its confluence with Sugar Creek.

(5) Clifty Creek in Montgomery County within the boundaries of Pine Hills Nature Preserve.

(6) Bear Creek in Fountain County from the bridge on County Road 450 North to its confluence with the Wabash River.

(7) Rattlesnake Creek in Fountain County from the bridge on County Road 450 North to its confluence with Bear Creek.

(8) The small tributary to Bear Creek in Fountain County within the Portland Arch Nature Preserve which enters Bear Creek at the sharpest bend and has formed the small natural bridge called Portland Arch.

(9) Blue River from the confluence of the West and Middle Forks of the Blue River in Washington County downstream to its confluence with the Ohio River.

(10) The South Fork of Blue River in Washington County from the Horner's Chapel Road bridge downstream to its confluence with Blue River.

(11) Lost River and all surface and underground tributaries upstream from the Orangeville Rise (T2N, R1W, Section 6) and the Rise of Lost River (T2N, R1W, Section 7) and the mainstem of the Lost River from the Orangeville Rise downstream to its confluence with the East Fork of White River.

(Water Pollution Control Board; 327 IAC 2-1-11; filed Sep 24, 1987, 3:00 pm: 11 IR 585)

Cited in: 327 IAC 2-1-3.

Rule 2. Cyanides and Cyanogen Compounds; Drainage into Sewer Systems or Watercourses Prohibited; Exception

327 IAC 2-2-1 Cyanides or cyanogen compounds; drainage prohibition

Authority: IC 13-1-3-7
Affected: IC 13-1-3-7; IC 13-7-4-1

Sec. 1. Any person, firm, or corporation engaged in manufacture or other process in which cyanides or cyanogen compounds are used shall have each and every room, where said compounds are used or stored, so constructed that none of said compounds can escape therefrom by means of building sewer, drain or otherwise directly or indirectly into any sewer system or water-course. However, on application to and prior approval by the commissioner, limited

APPENDIX

Y

FINAL
Engineering Review Sheet
New Sanitary Landfills and Modifications

Name of Facility:__________________ County:__________________

Date(s) Application Rec'ved:____________________________

Engineer:_______________ Date of Review:_______________

This review sheet lists items commonly needing to be checked for solid waste landfill reviews. Other items not shown here may need to be checked on a site-specific basis. For modifications other than added acreage, only items that are changed by the modification need to be checked.

Different types of facilities have different requirements. Applicability of the requirements below is indicated by the following: SLF - sanitary landfill; C/D - construction/demolition site; RWS I, II, III - restricted waste site types I, II, & III; All - all types of sites.

A) Legal Descriptions

-(All) Compare the legal descriptions and acreages with the areas delineated on the facility maps. If there are any discrepancies noted, the discrepancies should be resolved. Please write down the legal description of the facility.

B) Type of Waste

-(All) Is the type of waste specified in the application appropriate to the type of site applied for? Note that under 329 IAC 2-21-3(c), all new sanitary landfills permitted under 329 IAC 2 shall be acceptable sites for disposal of waste which have been certified as special waste under 329 IAC 2-21-11.

C) Setbacks & Restrictions of Rule 10

1) (All) Wetlands Are any wetlands apparent? If so, have proper approvals been obtained from the following agencies:

a) Corps of Engineers (COE) 404 Permit/Environmental Protection Agency (EPA);

b) Indiana Department of Environmental Management (IDEM);

c) Department of Natural Resources (DNR).

2) (All) Endangered Species Is the fill area in the critical habitat of any endangered species? There are two areas in Indiana designated as "critical habitat". These are Wyandotte Cave, Crawford County, and Ray's Cave in Green County.

3) (All) Floodways If the site is in the floodway, does it have provisions to prevent washout of waste? If the floodway has a drainage area greater than one square mile, has DNR approval been obtained?

4) (All) Karst Topography If the geologists indicate that the fill area is within an area of karst, are there provisions to collect all leachate generated, and is there an adequate demonstration that the integrity of the landfill will not be damaged by subsidence?

5) (All) Mines If the geologists indicate that the facility is over a mine, is there an adequate demonstration that the integrity of the landfill will not be damaged by subsidence?

6) (All except RWS III) Dwellings Is the fill area at least 600 feet away from any dwelling as described in the regulation?

7) (All except RWS III) Water Bodies Is the fill area at least 100 feet away from the normal water line of any lake, reservoir, or continuously-flowing stream?

8) (All except RWS III) Floodplains If the facility is within the floodplain, is the waste protected by a dike with a top elevation not less than 3 feet above the 100 year flood level?

9) (SLF) Property Boundaries - 100 feet Is the fill area at least 100 feet away from the property boundaries?

10)(All except SLF) Property Boundaries - 50 feet Is the fill area at least 50 feet away from the property boundaries?

D) (SLF) Height Increases for Previously Approved Areas

-If a leachate collection system is necessary to meet the interface requirement, is a system proposed that will remove an adequate fraction of the leachate?

E) (SLF) Design for New Landfills and Areas

1) Collection Layer Does a drainage layer overlie the entire base (including sidewalls) of the landfill with a minimum thickness of 1 foot and hydraulic conductivity of 1×10^{-3} cm/sec? Are adequate specifications and testing procedures specified? Alternative drainage material such as filter fabric (geotextile) or others may be used on the side slopes.

2) Collection Layer Slope Does the base of the drainage layer have a minimum slope of 2% to the leachate collection lines? Are adequate specifications and testing procedures specified?

3) Liner Recompaction Will the upper 3 feet of material beneath the drainage blanket and piping be recompacted to a hydraulic conductivity of not more than 1×10^{-7} cm/sec? Are adequate specifications and testing procedures specified?

4) Leachate Level Is the design adequate to limit the leachate level to a maximum of 1 foot?

5) Piping Slope & Diameter Does the piping system have a minimum slope of 0.5% and a minimum diameter of 6 inches?

6) Piping Length Is the maximum length of leachate lines within the capability of clean-out equipment?

7) Crushing & Clogging Is the design adequate to avoid crushing and clogging of the collection system?

8) Uplift Is the design adequate to protect the liner and collection system from damage due to uplift from hydrostatic forces?

9) Phasing Is phasing adequate to provide for disposal capacity during periods of inclement weather?

10) Freeze/Thaw/Wet/Dry Is the design adequate to prevent damage of the system due to freeze/thaw and wet/dry cycles?

11) Leachate Storage Is leachate storage adequate to prevent leachate releases to the environment?

12) Leachate Disposal Are there feasible provisions for leachate disposal? The permittee must submit a letter from a Treatment Plant indicating that they are willing to accept leachate from their facility.

13) Certification Does the application or the permit provide for the required certifications (including delineation of the boundaries of the area being certified and test results) prior to waste placement?

F) Design for Non-Sanitary Landfills

-(All except SLF) If any barrier construction or alternate technology is required, is it adequate?

G) Drainage

-(SLF) Are permanent surface water diversion structures able to accommodate the 25-year precipitation event? Is surface water diverted from the active fill area? Are sedimentation and erosion control systems provided as necessary to minimize erosion and sedimentation of surface waters?

H) Erosion

-(All) Is the projected erosion rate less than or equal to 5 tons per acre per year? If not, either the final contour elevations must be revised to reflect an acceptable erosion rate or other measures such as interception drainage ditches, terraces, etc., shall be provided as necessary to reduce the erosion rate less than or equal to 5 tons per acre per year.

I) Final Contours

-(All) Are final cover slopes in compliance with the regulation? If not, note the discrepancies. The regulation requires the following:

1) For sanitary landfills, the final cover shall have a slope of not less than four percent (4%) and not greater than thirty-three percent (33%).

2) For restricted waste sites, Types I, II, III, and construction/demolition sites, the final cover shall have a slope of not less than two percent (2%) and not greater than thirty-three percent (33%).

J) Cover Frequency, Thickness, & Quality

-(All) Are cover frequency, thickness, and quality acceptable? If not, when the permit is issued, make a permit condition that would incorporate this requirement.

1) Landfills and restricted waste sites, Type I, shall apply and compact no less than six (6) inches of daily cover over all exposed solid waste.

2) Restricted waste sites, Type II, shall apply and compact no less than six (6) inches of cover on a monthly or annual basis. Check the regulation for specific information.

3) Restricted waste sites, Type III, shall apply and compact no less than six (6) inches of intermediate cover annually.

4) Construction/demolition sites shall apply no less than six (6) inches of cover on a weekly basis.

K) Access Control

-(All) Is access control adequate?

L) Power Lines, Pipelines, Buried Cables, & Drainage Tiles

-(All) Are measures adequate to avoid hazards?

M) Benchmark(s)

-(All except RWS III) Is the site benchmark(s) adequate? If yes, please describe the locations and elevation by referring to the date the plan was received, sheet number, etc. If there is no benchmark proposed, make su: when the permit is issued, it will be included in the permit pre-operational requirements.

N) Boundary Markers

-(All) Are adequate boundary markers provided for? If this is a new site, usually the answer is no; however, when the permit is issued, make sure that this will be included in the permit pre-operational requirements.

O) Safety

-(All) Are fire extinguishers and roll bars provided on equipment?
-(SLF & C/D) Is a first-aid kit and communication system provided on-site?

P) Airports

-(SLF) Are there provisions to prevent a bird hazard for any public use or military airports within 10,000 feet for turbojet aircraft or 5,000 feet for piston-type?

Q) On-Site Roads

-(All) Are on-site roads reasonable to provide access to the disposal area? Are on-site roads adequate to minimize tracking of mud onto public highways or is equipment provided to remove any such mud?

R) Sign

-(All except facilities disposing of only waste generated on-site) Is an adequate sign proposed?

S) Facility Life

-(All) Are facility lifetimes shown on the application form, in the closure plan, and in post-closure funding consistent and reasonable?

T) (All) Closure

1) Steps Are closure steps adequate?

2) <u>Timing</u> Is the timing of closure acceptable?

3) <u>Costs</u> Are costs acceptable?

U) (All) <u>Post-Closure</u>

1) <u>Steps</u> Are post-closure steps adequate?

2) <u>Costs</u> Are costs acceptable?

GENERAL INFORMATION

1) Approximate Location of Facility

2) Type of Operation

3) Total Acreage of the Facility

4) Total Acreage for Filling

5) Type of Waste

6) Planned Life of Facility in Years

7) Expected Volume of Waste Per Day (C.Y. or Tons)

8) Has proper zoning been obtained? If not, note the discrepancies.

9) Is the information required by Rule 329 IAC 2-11-7 (descriptive narrative) satisfactory? If not, note the deficiencies.

10) Estimate the total volume of waste that would be placed in the facility. The following assumptions may be used in the calculation:

   a) A 2:1 ratio of in-place to incoming density;

   b) A 10% to 20% allowance for cover soils (daily, intermediate and final);

   c) A 1:4 ratio of 1 ton of waste to 4 cy of incoming waste density.

11) Identify the approved final contour map by specifying sheet number, date plan was received, etc.

12) Coordinate other staff comments and describe additional information needed any/or permit conditions recommended.

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Engineering Review Sheet Reference
New Sanitary Landfills and Modifications

This document was put together to go along with the Engineering Review Sheet. Hopefully, we can add to it and make it a good reference for staff, particularly newer staff.

A) Legal Descriptions (329 IAC 2-8-2(a)(4))

B) Type of Waste (329 IAC 2-9)

C) Setbacks & Restrictions of Rule 10 (329 IAC 2-10-1)

1) Wetlands (Wetland Regulations in Indiana) - The following agencies regulate the wetlands and administer various permit programs:

a) Corps of Engineers (COE/Environmental Protection Agency (EPA);
b) Indiana Department of Environmental Management;
c) Indiana Department of Natural Resources (IDNR).

Each agency has a specific role in the protecton of wetlands, These roles are as follows:

a) Corps of Engineers (COE)/Environmental Protection Agency (EPA)

Section 404 of the Federal Clean Water Act requires a permit from the COE for dredging and filling in water bodies including wetlands. The EPA has developed guidelines for COE to use in evaluating dredge spoil disposal sites and has the authority to prohibit use of particular sites.

b) Indiana Department of Environmental Management

The Indiana Water Pollution Control Law gives IDEM authority to protect wetlands. Also, Section 401 of the Federal Clean Water Act authorizes the IDEM water quality certification program. IDEM reviews all the Corps of Engineers' Section 404 dredge-and-fill applications to ensure that the proposed activities will not adversely affect water quality. The Corps of Engineers cannot grant a Section 404 dredge-and-fill permit without first obtaining a water quality certification or waiver from IDEM.

C) Indiana Department of Natural Resources

The Indiana Flood Control Act requires a "Construction in the Floodway" Permit from IDNR in order to construct within the floodway of a river or stream and its adjacent wetlands.

A nationwide permit can be obtained from COE according to 33 CFR 330.5 (a) (26).

2) Endangered Species According to the Fish and Wildlife Service in Bloomington, the Indiana bat (Myotis Sodalis) has two areas that are specifically designated as "critical habitat" in Indiana. These are the Wyandotte Cave, Crawford County, and Ray's Cave, Green County.

3) Floodways For protection from washout at larger streams, "River Engineering" by M. S. Petersen, 1986, at the Marion County Public Library is a good reference. Get DNR approval up-front.

4) Karst Topography Check with Geologist.

5) Mines Check with Geologist.

6) Dwellings Be sure to see the extended definition of dwelling in the regulation, 329 IAC 2-2-1(b)(15).

7) Water Bodies "Normal water line" is defined in 329 IAC 2-2-1(b)(33).

8) Floodplains It may be good to have the floodplain dike be a part of the landfill cover, otherwise you may end up with an area that ponds in between the dike and the landfill.

9) Property Boundaries - 100 feet

10) Property Boundaries - 50 feet

D) Height Increases for Previously Approved Areas (329 IAC 2-10-2)
The HELP model or our other in-house program can be used to calculate the amount of leachate that will escape through the liner.

E) Design for New Landfills and Areas (329 IAC 2-10-3)
A description of specifications and testing procedures can be required for applications received after July 1, 1988, pursuant to 329 IAC 2-11-7(a)(17). The language of 329 IAC 2-8-5(b)(2) can be used for requesting information in any case. For evaluation of a leachate collection system, a good reference is, "Permit Writer's Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities, Volume II".

1)Collection Layer Kmet (1986) recommends extending the collection system up the sidewalls - a maximum 3:1 slope is recommended for the sidewalls. Page 5-98 of U.S. EPA (1986) lists Wisconsin's standards for testing.

2)Collection Layer Slope Page 5-99 of U.S. EPA (1986) lists Wisconsin's standards for elevation checking.

3)Liner Recompaction Page 5-98 of U.S. EPA (1986) lists Wisconsin's standards for testing and also discusses recompaction extensively. Daniel (1987) and Trautwein discuss field permeability tests.

4)Leachate Level See the memo of 12-12-88 from Daniela Klesmith to the Solid Waste Engineers and run the EPA Hydrological Evaluation of Landfill Performance (HELP) model, Version 2, for at least 10 years' output. If you use default data, it is recommended that the following data be used for fair grass:

LAYERS Starting From Top to Bottom	SOIL TEXTURE HELP	USCS	SAT. HYD. CONDUCTIVITY (Cm/Sec)
Top Soil	#14	CH	$2.5x10^{-5}$
Final Cover	#15	CH	$1.7x10^{-5}$
Waste Layer	#18	--	$2.0x10^{-4}$
Drainage Layer	# 5	SM	$1.0x10^{-3}$
Soil Liner (Upper 3 Feet)	#16	--	$1.0x10^{-7}$

5)Piping Slope & Diameter Kmet (1986, page 570) recommends 6" diameter piping. A rough justification of our 0.5% slope can be found on page 20-3 of GLUMRB (1978) although sewers have to carry a heavier load of solid material than leachate pipes. The 0.5% also allows for differential settlement of the base of the landfill.

6)Piping Length GLUMRB (1978, p. 20-6) contains recommendations on the distance between manholes - generally, documentation of available clean-out equipment should be provided for distances greater than 400 feet.

7)Crushing & Clogging Some references on crushing and clogging are Kmet (1986), Uni-Bell (1982), U.S. EPA (1983, p. 9-73 to 9-105), and Koerner (1986).

8)Uplift Holtz and Kovacs (1981, Pages 244-245) GH Book.

9)Phasing To avoid adverse weather conditions, it is recommended that construction of new cells or phases should be scheduled during spring, summer or early fall no later than December 1.

10)Freeze/Thaw/Wet/Dry Pages 5-108 through 5-109, and pages 6-10 through 6-12 of U.S. EPA (1986) Table 5-11, list potential clay liner design and installation problems and preventive measures.

11)Leachate Storage It is recommended that adequate storage for at least seven to ten days be provided. This is required by most Treatment Stations which require leachate analyses prior to disposal. Where above-ground leachate storage tanks are used, a spill containment area must be provided. Where the leachate storage tank is below ground, it must be equipped with a leak detection system that can be monitored from ground surface. The leachate storage tank shall be fabricated from material compatible with the leachate expected to be generated, and resistant to temperature extremes. In cases where a leachate storage pond is proposed, at a minimum, the following information must be included in the design and be checked:

a) Minimum freeboard of 2 to 3 feet must be provided to prevent any overtopping of the dike by overfilling;

b) The pond bottom as well as side slopes must be constructed of 1 to 3 feet (preferably 3 feet) of recompacted material/soil to achieve an equivalent hydraulic conductivity of not more than 1×10^{-7} centimeters per second covered by synthetic liner.

c) A leak detection system must be designed and constructed underneath the synthetic liner.

d) At a minimum, provide the following information for synthetic liners:

   - Thickness
   - Type
   - Material
   - Brand Name
   - Manufacturer
   - Method of Seaming

e) The pond area shall be enclosed with adequate fencing.

f) An all-weather access road shall be provided to allow year-round maintenance.

g) In the event that there is no direct sewer line from the leachate storage pond to the treatment station, a secondary containment berm should be provided around the leachate storage pond. The secondary containment area shall be large enough to contain a volume of liquid equal to 100% of the storage pond volume, plus the volume of a 25-year, 24-hour rainfall event.

h) Warning signs must be provided along the fence around the pond.

i) Pond level gauges shall be provided.

For more details, the following references may be used.

(1) Recommended Standards for Sewage Works (commonly referred to as, "10 State Standards"), 1978 Edition, Chapter 100 on Wastewater Treatment Ponds (Lagoons), page 100-1 through 100-10.

(2) Hazardous Waste Disposal Regulation 329 IAC 3, Rule on Surface Impoundment.

12) Leachate Disposal

13) Certification

F) Design for Non-Sanitary Landfills (329 IAC 2-10-4)

G) Drainage (329 IAC 2-14-11)

Noble (1976) contains a discussion of drainage design. Daniela has a program on the computer for calculating velocity and depth.

H) Erosion (329 IAC 2-14-19)

See the memo dated 1-3-1986 from Duane Leith to James E. Traylor. There is a program on the computer.

I) Final Contours (329 IAC 2-14-19 & 329 IAC 2-7-4(b))

J) Cover Frequency, Thickness, & Quality (329 IAC 2-14-12 to 329 IAC 2-14-19)

K) <u>Access Control</u> (329 IAC 2-14-1)

L) <u>Power Lines, Pipelines, Buried Cables, & Drainage Tiles</u> (329 IAC 2-4-2)

M) <u>Benchmark(s)</u> (329 IAC 2-11-3(1)(C) & 329 IAC 2-13-2)

The plot plan, required by 329 IAC 2-11-3(1)(C), is a part of the application and a benchmark is one of the items which must be shown on this map. However, 329 IAC 2-13-2 allows establishing benchmarks as a pre-operational requirement.

N) <u>Boundary Markers</u> (329 IAC 2-13-2(a)(1))

O) <u>Safety</u> (329 IAC 2-14-7)

P) <u>Airports</u> (329 IAC 2-14-7)

Q) <u>On-Site Roads</u> (329 IAC 2-14-2)

R) <u>Sign</u> (329 IAC 2-14-3)

S) <u>Facility Life</u> (329 IAC 2-8-2(a)(5)(B), 329 IAC 2-14-3(b), & 329 IAC 2-15-3(b)(3))

T) <u>Closure</u> (329 IAC 2-15-3(b)) The May 1989 Closure & Post-Closure Plan Preparation Guidance Memo may be helpful.

1) <u>Steps</u>

2) <u>Timing</u>

3)Costs In calculating cover soil costs, Means (1989) shows \$2.06/cu.yd. for excavation and movement within 1500 feet (022-246-0300) and \$0.16/cu.yd. for compaction (022-226-5680). This figure of \$2.22/cu.yd. compares well with the range of \$2.20 to \$2.50/cu.yd. noted on page 86 of the March 1988 "Waste Age". This figure does not include soil testing and elevation control.

U) Post-Closure (329 IAC 2-15-8)

1)Steps

2)Costs

References

Daniel, D. E., 1987, "Hydraulic Conductivity Tests for Clay Liners", Ninth Annual Symposium on Geotechnical and Geohydrological Aspects of Waste Management.

GLUMRB, 1978, "Recommended Standards for Sewage Works"

Holtz, D.R., Kovacs, D.W., 1981, "An Introduction to Geotechnical Engineering".

Kmet, et al., 1986, "Leachate Collection System Design and Performance - Wisconsin's Experience", Ninth Annual Madison Waste Conference.

Koerner, Robert, 1986. "Designing with Geosynthetics".

Means, 1989, "Means S. e Work Cost Data".

Noble, G., 1976, "Sanitary Landfill Design Handbook".

Trautwein, S. J., "Field Measurement of Infiltration Rates Using a Sealed Double-Ring Infiltrometer"

U.S. EPA, 1983, "Permit Writers' Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities", Volume 2.

U.S. EPA, 1986, "Design, Construction, and Evaluation of Clay Liners for Waste Management Facilities", EPA/530-SW-86-007.

Uni-Bell, 1982, "Handbook of PVC Pipe"

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APPENDIX Z

This document is provided for informational purposes. It is not an enforceable guidance document.

DRAFT

Closure & Post-Closure Plan Preparation Guidance
for
Solid Waste Land Disposal Facilities
Indiana Department Of Environmental Management
May 1989

This document has been prepared as guidance to the regulated community on the preparation of closure and post-closure plans as required by 329 IAC 2. For new land disposal facilities and additional acreage amendment applications, closure and post-closure plans are required as part of the application package. Existing land disposal facilities are not to remain open after September 1, 1989 unless they submit these plans prior to that date. Closure and post-closure plan requirements are specified in Rule 329 IAC 2-15.

Existing facilities are also required to establish financial responsibility for post-closure by September 1, 1989, and for closure by September 1, 1992. Procedures for establishing financial mechanisms are not part of this guidance. Mr. Kevin Hogan of the Solid Waste Management Branch may be contacted at 317/232-3412 for guidance and sample forms.

This guidance has been prepared by staff of the Office of Solid and Hazardous Waste Management, but has not been adopted or approved by the Agency. As such, it is noted as "draft". At a later date, it may be updated or finalized. If you have any comments or questions or wish to check on the availability of any new guidance, please contact the Solid Waste Management Branch at 317/232-3592.

Preparation Of Closure & Post-Closure Plans

Attached are forms that may be used to prepare your closure and/or post-closure plans. These forms are not mandated, but may be used for your convenience. If you do not use the actual forms, then the forms and these instructions should be used as a guide to what should be included in your plans.

You are reminded that if there is any change that causes the submitted information to be incorrect, the applicant must notify the commissioner within 15 days and submit corrected information within a reasonable time (329 IAC 2-8-1(c)).

Closure Plan Line-By-Line Instructions

Item I

Give the facility's name, location, county, solid waste permit number, and total fill acreage.

Existing permitted facilities should give their solid waste permit number if one has been specified in a permit or renewal issued since 329 IAC 2 became effective. Otherwise, the facility's Construction Permit Number should be given. New facilities should indicate "N/A" for not applicable.

For "Total Fill Acreage", existing facilities should provide the total acreage at the site approved for filling regardless of whether some of the area has already received final cover and vegetation. There is a further discussion of areas that are already closed under the instructions for Items II and VIII.

Item II

Give a description of partial closure activities, if any are planned, and a description of final closure activities.

Partial closure refers to the closure (including final cover, vegetation, and certification) of an area of the landfill wh...

the rest of the landfill remains in operation. The closure plan may specify that partial closure of the landfill will occur according to some type of schedule. This will decrease the area needing closure when the landfill stops operation.

The regulation indicates that the description of closure activities be acceptable for closure at any point in the facility's intended life. In most cases, allowing for early closure in the description of activities will only mean indicating that the facility will close either at the elevations specified by the approved final contour map or at lesser elevations with slopes that are consistent with permit or regulatory minimums and maximums and adequate to prevent ponding of water on filled areas.

Items that should minimally be described for final closure are:

- -notifications to the agency and customers;
- -source of cover soils;
- -compacted cover and topsoil thicknesses;
- -soil classifications and testing specifications for the compacted cover and topsoils;
- -compaction methods for the cover including lift thicknesses;
- -methods and/or testing to provide appropriate slopes and final elevations;
- -procedures to establish vegetation;
- -any planned construction, modification, or repair of drainage structures;
- -any planned new access control measures or repairs of existing access control; and
- -certification statements and notices as required by 329 IAC 2-15-5.

The preceding listing was written from the perspective of what will be needed for most sanitary landfills. Some of the requirements may not be applicable to all facilities. For instance, Type III sites and construction/demolition sites are not specifically required by regulation to provide six inches of topsoil.

For most areas that are already permitted, the approved pla and permit specify the type of soil to be used for final cover. If the source of cover soil has already been tested as part of the facility's permit application, then no further testing may be necessary as part of closure activities. Otherwise, soil classification testing should be included as necessary to characterize the soil. Compaction methods should describe lift thicknesses and should also describe either the number of passes of compacting equipment or else the testing for density which will be done.

Closure plans submitted for existing areas, as specified by 329 IAC 2-7-6(b), are not allowed, by regulation, to conflict with previously approved plans. No changes in the landfill fill area or slopes are permitted.

Many currently-permitted sanitary landfills are not required by their current permits to place six inches of topsoil on top of their cover. As specified in the regulation, these landfills will become subject to this requirement at their first permit renewal under 329 IAC 2. Landfills may indicate that their cover will include the six inches of topsoil without being considered to be in conflict with their approved plans in violation of 329 IAC 2-7-6(b). Alternatively, the closure plans may indicate that the topsoil will be included for closure of areas occurring after renewal.

Item III

Give a listing of labor, materials, and testing necessary to close the facility. All activities described in Item II should be accounted for.

Item IV

For Item IV.A, give an estimate of the expected year of closure. It is often difficult to accurately forecast the exact lifetime of a facility. The regulation reflects this uncertainty in asking for only an estimate. This date is not a commitment by the facility to close by a certain date. The time before closure may however affect the rate at which the post-closure mechanism must be funded. The date of closure should be estimated by dividing the remaining fill volume by the average rate of incoming waste. Normally for sanitary landfills, 20% of the total fill volume is subtracted to allow for cover soil volume and a 2:1 ratio of incoming to inplace volume for the waste is assumed.

For Item IV.B, the total time required to close the facility should be the anticipated length of time between when the facility ceases accepting waste and when the submittals required by 329 IAC 2-15-5 are submitted to the agency. In order to allow for periods of inclement weather during the placement of cover and establishment of vegetation, a time of one year is suggested.

The time for intermediate closure steps under Item IV.C. should be specified for placement of final cover, placement of topsoil, seeding, and activities related to drainage and access control. The regulation requires (at 329 IAC 2-14-13, 14, 15, & 16) that sites apply the final cover within certain time frames. Sanitary landfills are required to place final cover within 180 days.

It is important to note that 329 IAC 2-15-6(a) requires that final closure be initiated within 15 days after receiving the final volume of waste. It may be appropriate to include notification of closure to the agency as an early step in closure in order to meet this deadline.

Item V

Calculate the cost per acre to provide two feet of compacted clay soil; six inches of topsoil; vegetation; and certification of closure including any testing necessary for such certification. Provide this figure based on the above work regardless of whether your actual cover will be more or less extensive than what is specified. The regulation does not require a higher financial assurance for those who plan a more extensive cover system (such as a thicker cover), nor does the regulation allow a smaller amount for those required to do less.

Closure costs must be calculated based on the cost necessary for the work to be performed by a third party. A suggested reference for many of the costs is "Means Site Work Cost Data" by the R.S. Means Company, Inc. In other cases, local contractors may need to be contacted.

The cost of drainage features on the final cover, such as swales and downchutes, may be included in Item V or in Item VI. If these items are included under Item V, then they must be accomplished as part of partial closure, if planned, for an area.

Item VI

List the cost for items other than final cover and vegetation such as drainage structures (if not included above), access repair, and recording the notice on the deed.

Item VII

Multiply Item I.E. by Item V.G. and then add Item VI.C.

Item VIII

Check the yes or no box to indicate whether funding will be on an incremental basis. The regulation provides for two different options for closure cost estimates: the entire facility standard and the incremental standard.

With the entire facility standard, financial assurance must be provided for the cost of closing the entire facility although this amount may be reduced as areas are certified as partially closed. As an example, if a facility planned to fill 100 acres and needed $10,000/acre for closure, then financial assurance would need to be provided initially for $1,000,000. This amount could be decreased during the life of the facility as areas are certified as partially closed.

For the incremental standard, the facility is allowed to provide assurance for the closure cost based on a yearly projection taking into account the areas which will have received waste by the end of the year minus the area that will be closed at the beginning of the year. For example, if, at the beginning of year #3, a facility has placed waste onto five acres of which one has been certified as partially closed and the facility plans on filling two additional acres during the third year, then financial assurance must be provided at the beginning of the year for:

5 acres - 1 acre + 2 acres = 6 acres.

The question has been raised about how to handle areas that are closed either prior to the new regulation becoming effective or to closure plan approval. The regulation specifies that partial closures are to certify that the areas were closed in accordance with approved closure plan. The argument has been made that the facility's permit is, in effect, the approved closure plan prior to approval of the new plan. This argument seems to be a practical way to avoid having facilities be responsible for financial assurance of large areas that are already closed.

If the answer to Item VIII.A is no, skip to Item IX.

For Item VIII.B, attach a copy of the facility's approved final contour map. Indicate on this map the maximum areas of waste deposition on a yearly basis for the remaining life of the facility. The map should clearly identify the lines used to delineate the required boundaries. The map should also be appropriately titled, dated, and show the preparing engineer's certification.

Fill in the table for Item VIII.C. For closure plans required for existing areas under 329 IAC 2-7-6(b), year #1 should start on September 1, 1989. Photocopy additional pages as necessary.

Item IX

Closure plans are required to be certified by a professional engineer registered in the State of Indiana.

Post-Closure Plan Line-By-Line Instructions

Item I

Give the facility's name, location, county, and solid waste permit number.

Existing permitted facilities should give their solid waste permit number if one has been specified in a permit or renewal issued since 329 IAC 2 became effective. Otherwise, the facility's Construction Permit Number should be given. New facilities should indicate "N/A" for not applicable.

Item II

The name, address, and phone # of the permittee who shall be the contact person during post-closure must be provided.

Item III

Provide a description of planned ground water monitoring activities including frequencies. Certain facilities may not be required to monitor ground water. Construction/demolition sites and Restricted Waste Type III sites do not have to monitor ground water if not specified by their permits. These facilities may indicate "N/A" for this item.

You should be aware that 329 IAC 2 requires semi-annual monitoring of ground water as opposed to the quarterly monitoring required in the past. Specific parameters, different from those commonly required in the past, are also specified in the regulation.

Item IV

329 IAC 2-15-7 specifies required post-closure duties. These duties should be reiterated here within the post-closure plan with any necessary detail provided. In particular, 329 IAC 2-15-7(a)(8) & (9) require monitoring of leachate collection and treatment and methane control systems plus control of any gas or leachate generated. These monitoring and control activities need to be

delineated.

You should be aware that Rule 14 of the regulation requires that sanitary landfills implement an approved methane monitoring program. Existing facilities should describe their anticipated monitoring program within the post-closure plan if one has not yet been approved.

Item V

Provide post-closure cost estimates as specified. These estimates should be for the entire 10-year post-closure period rather than on a yearly basis. Costs must be calculated based on the cost necessary for the work to be performed by a third party.

For maintenance of the final cover and vegetation (Item V.B), the cost shall be 10% of the cost per acre calculated for final cover and vegetation calculated in the closure plan multiplied by the total acreage permitted for filling.

Item V.C requires the cost for vegetation control. The regulation at 329 IAC 2-15-7(a)(4) requires control of vegetation on vehicular accessways to monitoring wells. At 329 IAC 2-15-7(a)(5), the regulation requires control of vegetation at the site as necessary to enable the need for slope and cover maintenance and leachate outbreak abatement. In general this will require the landfill to mow portions of the site on at least a yearly basis.

Item V.H requires the cost for ground water monitoring. A January of 1988 survey of ground water monitoring costs by staff indicated an approximate cost per well of $140 for sampling and $310 for analysis of the parameters required for sanitary landfills. This cost of $450 would need to be multiplied by 20 to provide for 10 years of biannual sampling and then multiplied by the number of wells needing to be monitored. This projected cost may change if rates by monitoring laboratories change.

The costs for leachate hauling and disposal (Item V.I & [illegible]) [illegible] be quite extensive for some facilities and not applicable to others. For facilities not required to collect leachate, these items may be marked "N/A".

Item VI

The permittee or an authorized representative of the permittee must sign the post-closure plan and provide his name, address, and phone number.

II. **CLOSURE ACTIVITIES** (Continued. Photocopy additional pages as necessary.)

SOLID WASTE CLOSURE PLAN

I. GENERAL INFORMATION

A. Facility Name: ____

B. Facility Location: ____

____

C. Facility County: ____

D. Facility Solid Waste Permit No.: ______________________

E. Total Fill Acreage (See instructions.): __________________

II. CLOSURE ACTIVITIES (Provide a description of the steps that will be used to partially close, if applicable, and finally close the facility. See instructions for items that should be included.)

III. **LABOR, MATERIALS, & TESTING** (Provide a listing of items necessary to close the facility. For items that will vary depending upon the number of acres to be closed, the quantities should be indicated on a per acre basis.)

A. Item	B. Quantity	C. Units

IV. EXPECTED YEAR OF CLOSURE

A. Expected Year Of Closure: ______________________

B. Total Time Required To Close Facility
(See instructions.) ______________________

C. Time Required For Intermediate Steps In Closure (Provide a description of intermediate closure activities and the time required. See instructions.)

V. COST PER ACRE FOR FINAL COVER & VEGETATION

A. What % Of Final Cover And Topsoil Is Available From Areas That Are Controlled, And Will Be Controlled Through Post-Closure, By The Permittee?

1. % of final cover ________
2. Describe location of sources ________
3. % of topsoil ________
4. Describe location of sources ________

B. Cost Per Acre for Acquisition, Placement, & Compaction of Two Feet of Final Cover

1. Acquisition

   a. Quantity of clay needed per acre (cy/acre) 3,230

   b. Excavation unit cost ($/cy) (if obtained on-site) ________

   c. Purchase unit cost ($/cy) (if obtained off-site) ________

   d. Delivery unit cost ($/cy) (if obtained off-site) ________

   e. Acquisition cost ($/acre) Line 1a * Line 1b (or) Line 1a * (Line 1c + Line 1d) ________

2. Placement and Compaction

   a. Placement/spreading unit cost ($/cy) ________

   b. Compaction unit cost ($/cy) ________

   c. Placement and compaction cost ($/acre) Line 1a * (Line 2a + Line 2b) ________

3. Testing

   a. Soil classification (if soil source is of variable quality)($/acre) ______

   b. Survey control for cover thickness and proper slopes ($/acre) ______

   c. Density testing (if planned)($/acre) ______

   d. Testing cost ($/acre)
      Line 3a + Line 3b + Line 3c ______

4. Clay Cover Cost ($/acre)
   Line 1e + Line 2c + Line 3d ______

C. Cost Per Acre For Acquisition & Placement of Topsoil

1. Acquisition

   a. Quantity of topsoil needed per acre (cy/acre) 807

   b. Excavation unit cost ($/cy) (if obtained on-site) ______

   c. Purchase unit cost ($/cy) (if obtained off-site) ______

   d. Delivery unit cost ($/cy) (if obtained off-site) ______

   e. Acquisition cost ($/acre)
      Line 1a * Line 1b (or)
      Line 1a * (Line 1c + Line 1d) ______

2. Placement

   a. Spreading unit cost ($/cy) ______

   b. Placement cost ($/acre)
      Line 1a * Line 2a ______

3. Topsoil Cost ($/acre)
   Line 1e + Line 2b ______

D. Cost Per Acre to Establish Vegetation

1. Vegetation

   a. Seeding unit cost ($/acre) ________

   b. Fertilization unit cost ($/acre) ________

   c. Mulching unit cost ($/acre) ________

   d. Vegetation Establishment Cost ($/acre)
      Line 1a + Line 1b + Line 1c ________

E. Cost Per Acre to Certify Closure

1. Registered Professional Engineer

   a. Initial review of closure plan (hrs) ________

   b. Total number of inspections ________

   c. Inspection time required (hrs/visit) ________

   d. Total inspection time (hrs)
      Line 1b * Line 1c ________

   e. Prepare final documentation (hrs) ________

   f. Total engineer time (hrs)
      Line 1a + Line 1d + Line 1e ________

   g. Engineer unit labor cost ($/hr) ________

   h. Professional engineer cost ($)
      Line 1f * Line 1g ________

   i. Area of site permitted for
      filling (acres) ________

   j. Closure Certification Cost ($/acre)
      Line 1h ÷ Line 1i ________

F. Other Costs Per Acre for Final Cover and Vegetation

1. Other Costs ($/acre) (Specify.) ________

____
____
____
____

G. Total of Items B Through F
(Must not be less than $5,000) ________

VI. **OTHER CLOSURE COSTS** (Give these on a total facility basis rather than per acre.)

A. Notation on Property Deed ________

B. Other Costs

Costs for items such as drainage features, installation of gas vents, etc. should be delineated in this section.

1. Activity | Cost

C. Total (Add costs from sections A. and B.) ________

VII. **CLOSURE COST ESTIMATE** (Multiply Item I.E by Item V.G. and then add Item VI.C.): ______________________

VIII. **ADDITIONAL INFORMATION REQUIRED FOR FACILITIES PROVIDING FINANCIAL ASSURANCE ON AN INCREMENTAL BASIS**

A. Will Closure Financial Assurance Be Provided On An Incremental Basis? (If the answer to this question is no, skip to Item IX.): ______________________

B. Map Of Areas Of Waste Deposition (Attach a copy of the facility's final contour map which shows the maximum areas of waste deposition on a yearly basis for the remaining life of the facility.)

C. Maximum Areas Of Waste Deposition & Closure Costs (Fill in the following table for each remaining year of the facility's life.)

Year	Max. Area of Waste Deposition (cumulative acres) (end of year)	Closure Cost w/o Partial Closure ($)	Area Partially Closed (cumulative acres) (start of year)	Incremental Closure Cost $

IX. ENGINEER CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information.

Signature: ______________________________ Date: ______________

Name: ______________________________

Address: ______________________________

____

Telephone #: ______________________________

Professional Engineer Registration No.: ______________________________

SOLID WASTE POST-CLOSURE PLAN

I. GENERAL INFORMATION

A. Facility Name: ____

B. Facility Location: ____

____

C. Facility County: ____

D. Facility Solid Waste Permit No.: ________________________

II. POST-CLOSURE CONTACT PERSON

A. Name: ____

B. Address: ____

____

C. Telephone No.: ____

III. **GROUND WATER MONITORING ACTIVITIES** (Provide a description of planned ground water monitoring activities including the frequency of the activities. See instructions.)

IV. **MAINTENANCE ACTIVITIES** (Provide a description of planned maintenance activities and the frequency at which they will be performed. See instructions.)

V. POST-CLOSURE COST ESTIMATE (See instructions. Note that these estimates are to be presented for the entire 10-year post-closure care period rather than on a yearly basis.)

A. Cost for Semi-Annual Inspections and Reports

1. Inspection

   a. Number of inspections during post-closure period (semiannual inspections for 10 years) 20

   b. Inspector time required (hrs/insp) ______

   c. Inspector unit labor cost ($/hr) ______

   d. Inspection Cost ($) Line 1a * Line 1b * Line 1c ______

2. Report Preparation

   a. Number of reports during post-closure period 20

   b. Cost per report ($) ______

   c. Report cost ($) Line 2a * Line 2b ______

3. Inspection and Report Cost ($) ______

B. Cost for Maintenance of Final Cover and Vegetation

The cost for cover maintenance and vegetation shall be 10 percent of the cost per acre calculated for final cover and vegetation in the closure plan. (329 IAC 2-15-8(b)(4))

1. Final Cover Maintenance

   a. 10% of cost for placement of final cover and vegetation (as determined in Item V.G of the Closure Plan) ($/acre) ______

   b. Total area of site permitted for filling (acres) ______

   c. Cover Maintenance Cost ($) Line 1a * Line 1b ______

C. Cost for Vegetation Control

Certain areas are required to be mowed per regulation. See instructions.

1. Mowing

   a. Mowing frequency (visits/10 years) ________
   b. Area to be mowed (acres/visit) ________
   c. Mowing unit cost ($/acre) ________
   d. Vegetation Control Cost ($)
      Line 1a * Line 1b * Line 1c

____

D. Cost for Maintenance of Access Control & Benchmarks

1. Access Control Maintenance

   a. Access control maintenance
      frequency (visits/10 years) ________
   b. Amount of fence needing replacement
      (linear feet/visit) ________
   c. Fencing unit cost ($/linear foot) ________
   d. Fence cost ($)
      Line 1a * Line 1b * Line 1c ________
   e. Other ($)
      (specify)________________________ ________
      ____
   f. **Access Control Maintenance Cost ($)**
      Line 1d + 1e ________

2. **Benchmark Maintenance** Cost (if any)($) ________

3. **Access Control & Benchmark** Repair Cost ($)
   Line 1f + Line 2

____

E. Cost for Leachate Collection System Monitoring and Maintenance

1. Leachate Collection System Inspection

a. Inspection frequency (insp/10 years) ________

b. Inspection time required (hrs/insp) ________

c. Inspector unit labor cost ($/hr) ________

d. Inspection cost ($)
Line 1a * Line 1b * Line 1c ________

2. Leachate Collection System Maintenance

a. Number of pumps replaced during post-closure (pumps/10 years) ________

b. Pump unit cost ($/pump) ________

c. Other ($)
(specify)______________________________ ________
____
____

d. Leachate system maintenance
(Line 2a * Line 2b) + Line 2c ________

3. Leachate Collection Monitoring and Maintenance Cost ($)
Line 1d + Line 2d ________

F. Cost for Methane Control System Monitoring and Maintenance

1. Methane Control System Monitoring

a. Gas monitoring frequency (visits/10 years) ________

b. Time required to monitor (hrs/visit) ________

c. Contract lab technician unit labor cost ($/hr) ________

d. Gas monitoring cost ($)
Line 1a * Line 1b * Line 1c ________

2. Gas Monitoring Well Maintenance

   a. Maintenance frequency (visits/10 years) ________

   b. Monitoring wells needing maintenance per visit ________

   c. Maintenance time required (hrs/well) ________

   d. Unit labor cost ($/hr) ________

   e. Monitoring well maintenance cost ($) Line 2a * Line 2b * Line 2c * Line 2d ________

3. Gas Monitoring and Maintenance Cost ($) Line 1d + Line 2e ________

G. <u>Cost for Ground Water Monitoring System Maintenance</u>

1. Monitoring Well Maintenance

   a. Maintenance frequency (visits/10 yrs) ________

   b. Number of monitoring wells needing maintenance per visit ________

   c. Maintenance time required (hrs/well) ________

   d. Unit labor cost ($/hr) ________

   e. Monitoring well maintenance cost ($) Line 1a * Line 1b * Line 1c * Line 1d ________

2. Monitoring Well and Parts Replacement

   a. Number of wells needing replacement during post-closure period ________

   b. Existing monitoring well sealing unit cost ($/well) ________

   c. New monitoring well construction unit cost ($/well) ________

d. Monitoring well replacement cost ($)
Line 2a * (Line 2b + Line 2c) ________

e. Number of pumps needing replacement during post-closure period ________

f. Pump unit cost ($/pump) ________

g. Pump cost ($)
Line 2e * Line 2f ________

3. Ground Water Monitoring System Maintenance Cost ($)
Line 1e + Line 2d + Line 2g ________

H. Cost for Ground Water Monitoring

1. Ground Water Monitoring

a. Number of required monitoring wells ________

b. Monitoring frequency (semiannual sampling for 10 years) 20

c. Sampling and analysis cost ($/well) ________

d. Ground Water Monitoring Cost ($)
Line 1a * Line 1b * Line 1c ________

I. Cost for Leachate Hauling

1. Leachate Pumping & Hauling

a. Leachate removal frequency (visits/10 years) ________

b. Quantity to be managed off site (gallons/visit) ________

c. Truck capacity (gallons) ________

d. Number of loads/visit
Line 1b ÷ Line 1c
(round up to nearest integer) ________

e. Pumping and transportation unit cost ($/load) ______

f. Leachate Hauling Cost ($) Line 1a * Line 1d * Line 1e ______

J. Cost for Leachate Disposal

1. Leachate Treatment

a. Volume of leachate requiring disposal (gallons) ______

b. Disposal unit cost ($/gal) ______

c. Leachate Disposal Cost ($) Line 1a * Line 1b ______

K. Other Costs

Any costs not included in the above items should be included here. These might include drainage ditch, access road, and sedimentation pond maintenance, lift station power costs, etc.

1. Activity	Cost

2. Total of Other Costs ($) ______

L. Total Post Closure Cost Estimate ($)
(Total of preceding categories)

____

VI. SIGNATORY CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information.

Signature: ______________________ Date: ______________

Name: ______________________

Address: ______________________

____

Telephone #: ______________________

APPENDIX

AA

This document is provided for informational purposes. It is not an enforceable guidance document.

INDIANA DEPARTMENT OF ENVIR(

We make Indiana a cleaner, healthier place to live

Evan Bayh
Governor
Kathy Prosser
Commissioner

105 South Meridian Street
P.O. Box 6015
Indianapolis, Indiana 46206-6015
Telephone 317-232-8603
Environmental Helpline 1-800-451-6027

TO: Landfill Owners and Operators

DATE: September 10, 1992

FROM: Timothy J. Method
Assistant Commissioner
Office of Solid and Hazardous Waste Management

SUBJECT: **INDIANA IMPLEMENTATION OF SUBTITLE D**

As you may be aware, on October 9, 1991, and June 26, 1992, the U.S. EPA published final regulations, for municipal solid waste landfills. The Municipal Solid Waste Landfill Criteria Part 258, otherwise known as Subtitle D, are very comprehensive, addressing location restrictions, facility design and operations, ground water monitoring, corrective action measures, conditions for closing and providing post-closure care, and financial responsibility requirements.

IN GENERAL, ALL MUNICIPAL SOLID WASTE LANDFILLS THAT ARE RECEIVING WASTE ON OCTOBER 9, 1993, MUST COMPLY WITH ALL OF THE SUBTITLE D REQUIREMENTS. ANY LANDFILL THAT STOPS RECEIVING WASTE BETWEEN OCTOBER 9, 1991, AND OCTOBER 9, 1993, MUST COMPLY WITH THE SUBTITLE D REQUIREMENTS FOR FINAL COVER.

The Indiana Department of Environmental Management is in the process of preparing to administer this new federal program. To do so, we want to work with landfill owners and operators to assure compliance and a smooth transition in meeting these requirements. In many cases, the new federal regulations will require very extensive, expensive modifications to your site. Indiana must also promulgate acceptable rules by October 9, 1993. (Even if Indiana does not obtain approval by this date, municipal solid waste landfills must comply with the Subtitle D requirements.) In order to administer this program, we are requesting some information on the potential impacts of the Subtitle D regulations. We are also enclosing a brief summary of some of the provisions contained in Subtitle D. If you want to receive the complete text of Subtitle D, the IDEM has a limited number of copies that you can obtain by contacting Mr. Jerry Rud at 317-232-7200.

We appreciate your assistance in this matter. Compliance with the Subtitle D standards is an important matter for all landfill owners and operators.

If you have any questions or suggestions on this survey, or on a particular aspect of Subtitle D, please contact Mr. Pat Carroll at 317-232-8866.

SUMMARY

MUNICIPAL SOLID WASTE LANDFILL CRITERIA PART 258 (SUBTITLE D)

Subpart A. General

Applicability

Subtitle D is not applicable to landfills that were closed, or portions of landfills that were closed, prior to October 9, 1991.

Landfills that closed after October 9, 1991, or will close prior to October 9, 1993, must comply with the Subtitle D closure requirements.

Landfills which close after October 9, 1993, must comply with all Subtitle D requirements unless otherwise noted by Subtitle D.

Subpart B. Location Restrictions

1. The following requirements apply to all existing municipal waste landfills that have not closed prior to October 9, 1993. The EPA has promulgated location restrictions for landfills located near or in the following areas:

   a. Airports

      Within 10,000 feet of any airports used by turbojets or within 5,000 feet of airports used only by piston aircraft.

   b. Floodplains

      Within the 100-year floodplain

   c. Unstable Areas

      Within an unstable area such as areas where underground mining has occurred under the site, or areas of Karst terranes.

   Landfills that are affected by these location restrictions must either close by October 9, 1996, or provide demonstration that there will be no adverse affects caused by operating the landfill in these areas.

2. The following location restrictions apply to all areas of existing landfills which have not received waste as of October 9, 1993.

   a. Wetlands

      Within a wetlands.

   b. Fault Areas

      Within 200 feet of a fault.

   c. Seismic Impact Zones

      Within a seismic impact zone. "Seismic impact zone" means an area with a 10% or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull, will exceed 0.10g in 250 years.

   Waste shall not be placed in areas affected by these location restrictions unless the appropriate demonstrations are made.

wells or springs. The definition is dependent on site specific conditions. In other words, this section applies to most MSWLF in Indiana.

258.51 Ground Water Monitoring Systems

The federal requirements are very similar to Indiana's current requirements. Differences between federal and state requirements occur in the information needed for determining the number, spacing, and depths of monitoring wells. The federal requirements are more specific in that the information must be site specific while Indiana's requirements have allowed the use of regional aquifer information for some of the information.

258.53 Ground Water Sampling and Analysis

The federal requirements and Indiana's requirements are very similar on what is expected in the sampling and analysis plan. This part also discusses statistical requirements that are very similar to Indiana's. Differences of special interest will be discussed below.

Compliance Schedule

EPA has outlined the ground water monitoring compliance schedule that is dependent on the state program having EPA approval. The schedule covers all existing units receiving waste after October 9, 1993, and lateral expansions.

Existing Units and Lateral Expansions

Unapproved States		Approved States (option)
If <1 mile from drinking water intake	10/9/94	50% existing units by 10/9/94
If 1-2 miles from drinking water intake	10/9/95	100% existing units by 10/9/96
If > 2 miles from drinking water intake	10/9/96	

All new units prior to accepting waste

258.54 Detection Monitoring Program

The detection monitoring program is similar to the Phase I monitoring program required under Indiana's current regulations. Under federal regulations the wells will be sampled twice a year (semi-annually). The federal regulations require a minimum of four independent samples for both the background well(s) and the downgradient wells during the first semi-annual sampling event. It is noted here that independent samples are not the same as replicate samples. Because EPA did not define the term "independent sample", the state will be asking for written clarification.

258.55 Assessment Monitoring Program

The assessment monitoring program is similar to Indiana's Phase II monitoring program. Assessment monitoring is required whenever a statistically significant increase over background has been detected for one or more of the constituents listed in the appendix. Background is established for all detected constituents.

SURVEY

Please complete this survey to the best of your ability, and return it as soon as possible to:

Patrick Carroll, Chief
Technical Support Branch
Office of Solid and Hazardous Waste Management
Indiana Department of Environmental Management
105 South Meridian Street
Indianapolis, Indiana 46225

Name of Facility	County
Contact Person	Telephone No.

Acreage permitted to receive waste	

	As of October 9, 1992	As of October 9, 1993
Area that will have received some waste (acres)		
Existing airspace over this area (yd^3)		
Amount of time to fill this airspace (months)		

	Average Area	Largest Area	Smallest Area
Typical size of construction area (acres)			
Typical airspace of this construction area (yd^3)			
Amount of time to fill this airspace (months)			

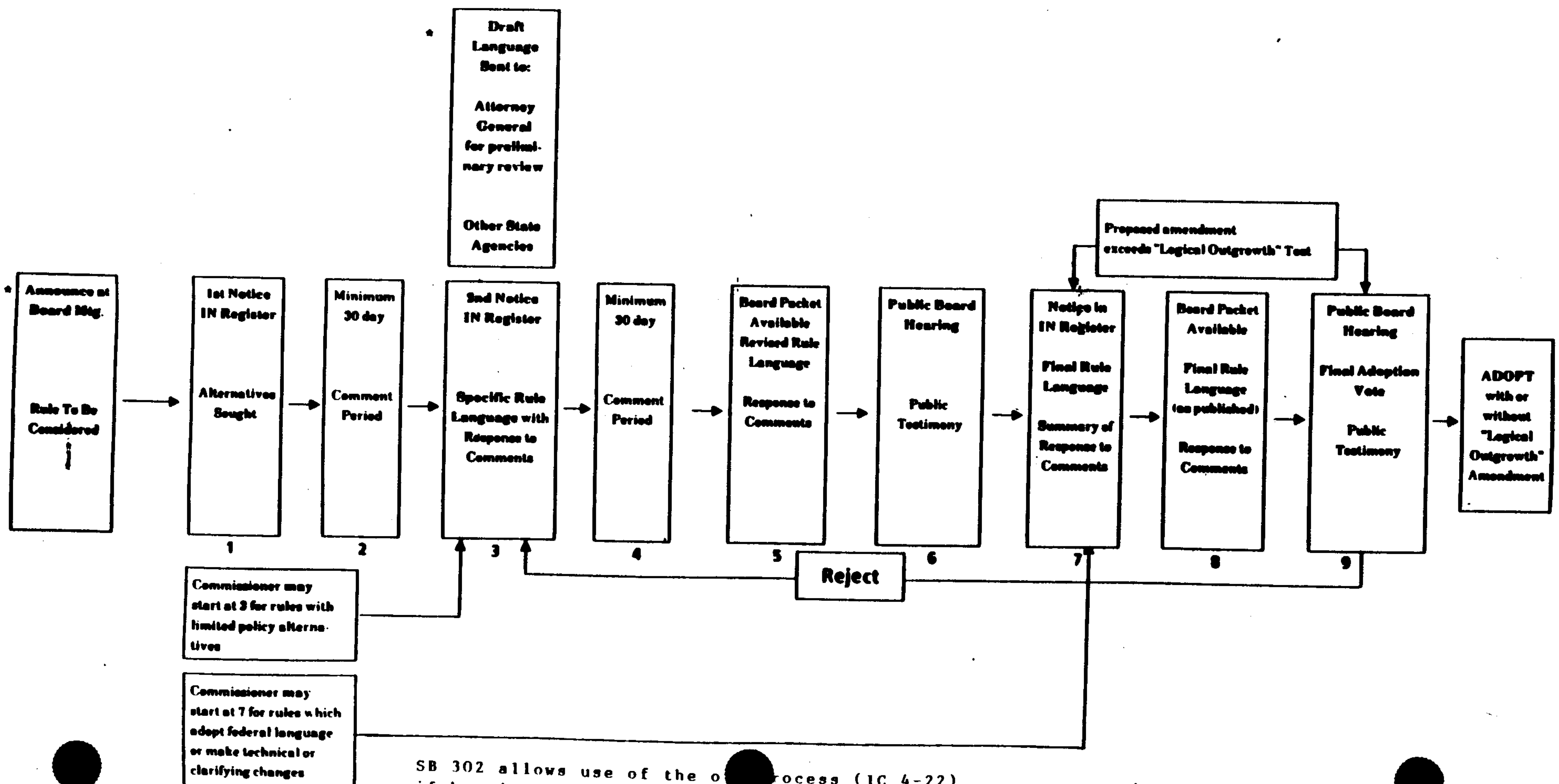
Does the current IDEM approved permit contain a leachate collection system designed in accordance with existing IDEM rules for areas to be filled after October 9, 1993.	YES NO (circle one)
Does the current IDEM approved permit contain a composite liner system designed in accordance with Subtitle D requirements for areas to be filled after October 9, 1993.	YES NO (circle one)
Is your landfill located in an area governed under the Subtitle D location restrictions that will require a demonstration to continue operation of the facility.	YES NO (circle one)
Do you anticipate any difficulty in complying with any provisions of the Subtitle D regulations?	YES NO (circle one)
If so, which ones?	

APPENDIX

BB

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

NEW RULEMAKING PROCEDURES



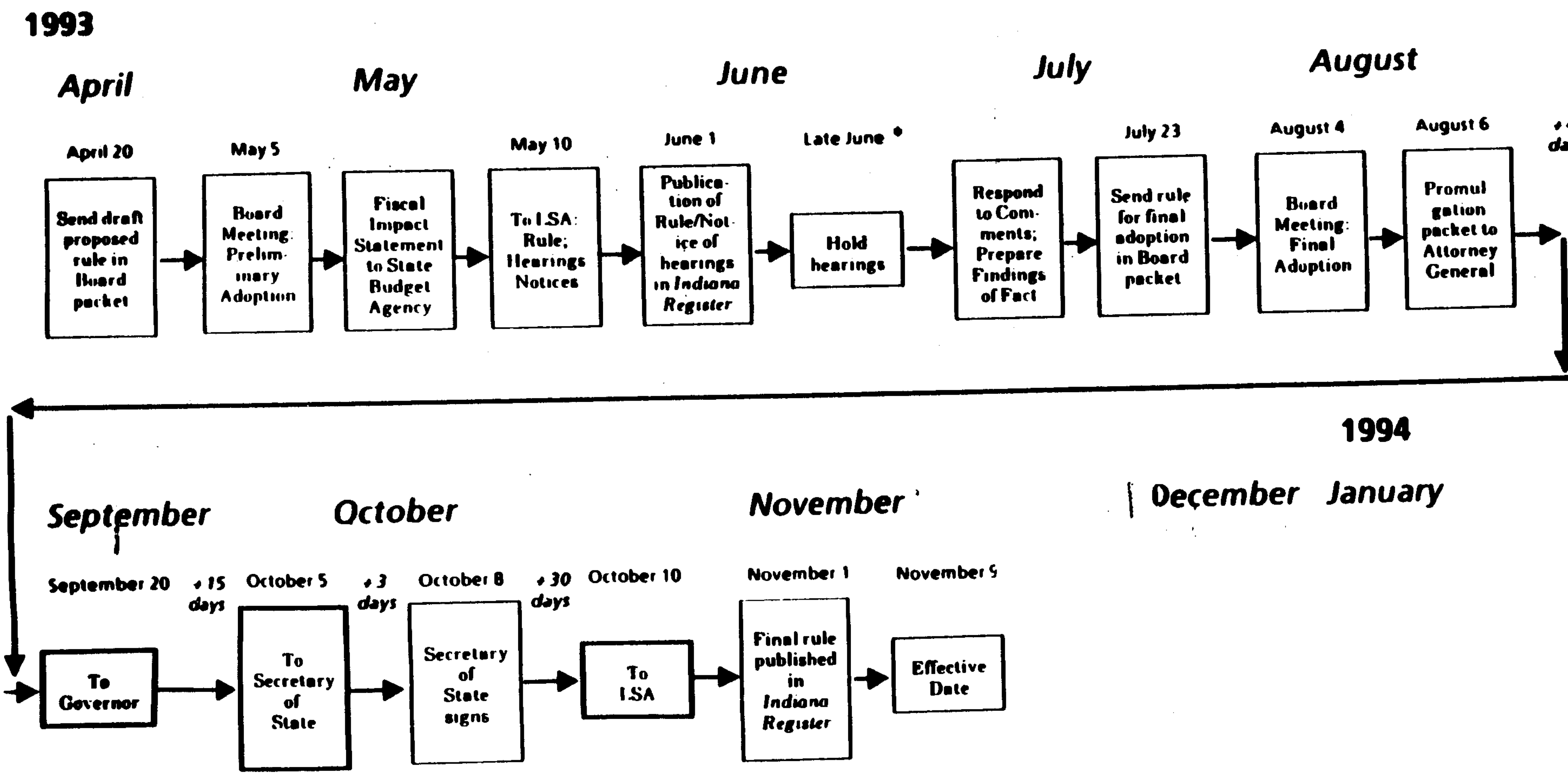
SB 302 allows use of the o[illegible]rocess (IC 4-22) if hearings are noticed on or before July 1, 1993.

* Optional, non-statut[illegible]

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

TIMELINES

IC 4-22 (Old Process)



* As SB 302 currently reads, if notice of hearings is published before July 1, 1993, rule proceeds under the old process

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

TIMELINES

IC 13-7-7.1 *(New Process - Amended to Start April 1993)*

1993

April
- April 10 — To LSA: Issue Brief →

May
- May 1 — Issue Brief published in *Indiana Register*; Start 30 day comment period →

June
- June 1-10 — Respond to comments →
- June 10 — To LSA: draft text of rule; comment response →

July
- July 1 — Publish draft text, comments in *Indiana Register*; Start 30 day comment period →

August
- August 1-10 — Develop Final Rule language; Respond to comments; Send out Board packets →
- August 18 — Public Board Hearing; Testimony →
- Fiscal Impact Statement to State Budget Agency →

September
- Sept 10 — To LSA: Text of rule; Summary of testimony →

1994

October
- Oct. 1 — Proposed rule published in *Indiana Register* →
- Oct 13 — Public Board Hearing: Final Adoption →
- Oct 15 — To Attorney General →

Nov.
- +45 days
- November 30 — To Governor →
- +15 days

December
- Dec 15 — To Secretary of State →
- +3 days
- Dec 18 — Secretary of State Signs →

Jan.
- January 10 — To LSA: Final Rule →
- January 17 — Effective Date →

February
- February 1 — Final rule published in *Indiana Register*

APPENDIX

CC

FIRST NOTICE
DEVELOPMENT OF NEW SOLID WASTE MANAGEMENT BOARD RULES
INDIANA MUNICIPAL SOLID WASTE LANDFILL CONSTRUCTION, OPERATING, AND CLOSURE PERMITS
TITLE 329 Solid Waste Management Board #93-1
REQUEST FOR PUBLIC COMMENT

PURPOSE OF NOTICE

The Indiana Department of Environmental Management (IDEM) is soliciting public comment on the development of construction, operating, and closure permit standards for municipal solid waste landfill (MSWLF) units in Indiana. The purpose of this notice is to identify the authority, subject matter, and regulatory requirements relating to the development of such standards and to request public comments.

AUTHORITY

The authority under which the proposed rules are to be adopted:
IC 4-22-2
IC 13-1-12-8
IC 13-7-2-15
IC 13-7-7-1
IC 13-7-7.1

SUBJECT MATTER AND BASIC PURPOSE

The department is reviewing current solid waste landfill regulations as part of its stated mission to protect the environment. This review is also being done in an effort to meet the requirements of federal regulations, 40 CFR Part 258 (Federal Register published October 9, 1991), which specify the required minimum standards for municipal solid waste landfills. The United States Environmental Protection Agency (EPA) promulgated 40 CFR 258 in response to the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA).

On April 28, 1993, the department announced at the Solid Waste Management Board meeting its intention to initiate the rule making process for issuing construction, operating, and closure permits for MSWLF units.

The department is soliciting comments, suggestions, alternatives and proposed rule language concerning:

* definitions, e.g., upper-most aquifer, unstable areas, wetlands, sanitary landfill;

* landfill siting limitations, e.g., geologic, meteorologic;

* landfill setbacks and distances, e.g., schools, residences, water bodies;

* landfill design and construction, e.g., material types, liner designs, slopes, quality control/quality assurance;

* vertical expansions, e.g., limitations, design standards;

* ground water characterization and monitoring, e.g., number, location and types of wells, zones to be monitored, monitoring parameters and frequency, minimum qualifications for ground water sample collectors, appropriate statistical methods;

* laboratory methods for data analysis of ground water samples, e.g., EPA SW 846 approved methods;

* sampling and analysis plan, e.g., content, format and timing of approval;

* operational standards, e.g., placement of waste, waste compaction equipment, daily and intermediate cover, vegetation, traffic volumes, odor, litter and vector control, security, spotters and random waste inspection by the facility;

* waste volume intake measurement and control, e.g., disposal rates, monitoring and measuring;

* special waste disposal standards, e.g., special waste receipt and handling restrictions, application content and form;

* leachate collection, storage, treatment and disposal;

* gas management;

* closure requirements, e.g., design, material, monitoring systems and periods, allowable uses of closed areas;

* transition scheme to new rules, e.g., applicability to existing permitted facilities, phase-in period for different rules or standards, closure date for existing MSWLF units not complying with new state and federal regulations, applicability to pending permit applications, repermitting of existing facilities;

* requirements for permit application package, e.g., type, format and content of submittal;

* possibilities for standardized landfill designs;

* separation and/or collection of recyclables at the facility;

* financial assurance requirements for closure, post-closure and corrective action, e.g., calculations, amounts, mechanisms;

* landfill waste volume, type and source data collection, maintenance and submission;

* appropriate areas or mechanisms for landfill self-monitoring and compliance;

* public notice requirements for siting a solid waste landfill; and

* other issues, alternatives or factors which should be included in the regulations.

REGULATORY REQUIREMENTS

Alternative and proposed rulemaking provisions must be at least as stringent as the restrictions set forth in the 1984 Hazardous and Solid Waste Amendments to the Resource Conservation and Recovery Act, the provisions of 40 CFR Part 258 and the proposed regulations in 40 CFR Part 239.

IC 13-7-7-2(b) requires the Solid Waste Management Board to consider the following factors:

(1) all existing physical conditions and the character of the area affected;

(2) past, present, and probable future uses of the area, including the character of the uses of surrounding areas;

(3) zoning classification;

(4) the nature of the existing air quality or existing waste quality, as the case may be;

(5) technical feasibility, including the quality conditions that could reasonably be achieved through coordinated control of all factors affecting the quality; and

(6) economic reasonableness of measuring or reducing any particular type of pollution.

PUBLIC COMMENTS

At this time, the department solicits:

(1) the submission of alternative ways to achieve the purpose of the proposed rule; and

(2) the submission of comments on the proposed rule, including suggestions of specific language for the proposed rule.

Mailed comments should be sent to the attention of: Lynn West, Office of Solid and Hazardous Waste Management, 105 South Meridian Street, P. O. Box 6015, Indianapolis, IN 46206-6015. Hand delivered comments will be accepted by the IDEM employee on duty at the eighth floor reception desk, Office of Solid and Hazardous Waste Management, 105 South Meridian Street, Indianapolis, IN 46225.

Comment period deadline is July 15, 1993.

Additional information regarding the requirements of this proposed rule; 40 CFR Part 258; and/or proposed regulation 40 CFR Part 239 can be obtained from: Bruce Palin, Solid Waste Management Branch Chief, Office of Solid and Hazardous Waste Management, (317) 232-8892.