

**INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
VOLUNTARY REMEDIATION PROGRAM**

TABLE OF CONTENT

INTRODUCTION PAGE 1

 1.0 ELIGIBILITY PAGE 1

 2.0 APPLICATION PROCESS PAGE 1

 3.0 VOLUNTARY REMEDIATION AGREEMENT PAGE 2

 4.0 PUBLIC PARTICIPATION PAGE 2

 5.0 IMPLEMENTATION PAGE 2

 6.0 CLEANUP CRITERIA PAGE 3

 7.0 PROJECT COMPLETION PAGE 3

 8.0 ADVANTAGES OF PARTICIPATING IN THE PROGRAM PAGE 3

 INFORMATIONAL FLOWCHART PAGE 4

PHASE II INVESTIGATION REPORT PAGE 5

 1.0 INTRODUCTION PAGE 5

 2.0 STATEMENT OF WORK PAGE 5

 3.0 SITE CHARACTERIZATION PAGE 6

 4.0 PHASE II INVESTIGATION REPORT PAGE 9

 5.0 PHASE II INVESTIGATION REPORT SCHEDULE PAGE 9

 6.0 CONCLUSION PAGE 10

VOLUNTARY REMEDIATION AGREEMENT PAGE 11

 INTRODUCTION PAGE 11

 VOLUNTARY REMEDIATION AGREEMENT PAGE 13

REMEDIAL ACTION PLAN PAGE 29

 1.0 EXECUTIVE SUMMARY PAGE 29

 2.0 INTRODUCTION PAGE 29

 3.0 CLEANUP CRITERIA SELECTION PAGE 30

 4.0 STATEMENT OF WORK PAGE 31

 5.0 RISK ASSESSMENT (IF APPLICABLE) PAGE 32

 6.0 REMEDIATION PLAN PAGE 32

 7.0 OPERATION AND MAINTENANCE PLAN (IF APPLICABLE) PAGE 35

 8.0 COMMUNITY RELATIONS PAGE 35

 9.0 COMPLETION OF REMEDIAL ACTION PAGE 36

 10.0 SCHEDULE PAGE 36

 11.0 COST ESTIMATE PAGE 37

**REMEDIAL ACTION PLAN FOR SITES WHERE PHASE II INVESTIGATION RESULTS
ARE BELOW TIER I OR TIER II LEVELS** PAGE 39

 1.0 EXECUTIVE SUMMARY PAGE 39

 2.0 INTRODUCTION PAGE 39

 3.0 CLEANUP CRITERIA SELECTION PAGE 40

 4.0 STATEMENT OF WORK PAGE 41

 5.0 COMMUNITY RELATIONS PAGE 41

 6.0 FUTURE USE OF SITE PAGE 42

 7.0 COST ESTIMATE PAGE 42

REMEDIATION COMPLETION REPORT PAGE 43
 1.0 INTRODUCTION PAGE 43
 2.0 REMEDIAL ACTION PAGE 43

APPENDICES

APPENDIX A: HEALTH AND SAFETY PLAN OUTLINE PAGE 47
APPENDIX B: QUALITY ASSURANCE PROJECT PLAN (QAPP) PAGE 51
 TERMS AND ACRONYMS PAGE 52
 MODEL QAPP PAGE 58
APPENDIX C: BASELINE ECOLOGICAL ASSESSMENT PAGE 85
APPENDIX D: PROJECT COMPLETION SAMPLING PAGE 87
APPENDIX E: TECHNICAL STANDARDS PAGE 91
APPENDIX F: TIER II CLEANUP GOALS - HUMAN HEALTH EVALUATION PAGE 99
 TABLE 6 - REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS PAGE 123
 TABLE 7 - CHEMICAL PROPERTIES AND DOSE-RESPONSE PAGE 125
 TABLE 8 - HEALTH-BASED CRITERIA FOR GROUNDWATER PAGE 127
 TABLE 9 - HEALTH-BASED CRITERIA FOR SURFACE SOILS (NON-RESIDENTIAL
 LAND-USE SCENARIO) PAGE 129
 TABLE 10 - SUMMARY OF HEALTH-BASED CRITERIA FOR SUBSURFACE SOILS
 (NON-RESIDENTIAL LAND-USE SCENARIO) PAGE 131
 TABLE 11 - SUMMARY OF HEALTH-BASED CRITERIA FOR GROUNDWATER
 (RESIDENTIAL LAND-USE SCENARIO) PAGE 133
 TABLE 12 - SUMMARY OF HEALTH-BASED CRITERIA FOR SURFACE SOILS
 (RESIDENTIAL LAND-USE SCENARIO) PAGE 135
 TABLE 13 - SUMMARY OF HEALTH-BASED CRITERIA FOR SUBSURFACE SOILS
 (RESIDENTIAL LAND-USE SCENARIO) PAGE 137
 TABLE 14 - SUMMARY OF TIER II CLEANUP GOALS FOR THE NON-RESIDENTIAL
 LAND-USE SCENARIO PAGE 139
 TABLE 15 - SUMMARY OF TIER II CLEANUP GOALS FOR THE RESIDENTIAL
 LAND-USE SCENARIO PAGE 141
APPENDIX G: INDIANA CODE CHAPTER 13 - ARTICLE 11. CHAPTER 2 - DEFINITIONS PAGE 143
 **INDIANA CODE CHAPTER 13 - ARTICLE 25. CHAPTER 5 - VOLUNTARY
 REMEDIATION OF HAZARDOUS SUBSTANCES AND PETROLEUM** PAGE 145
**APPENDIX H: ADDENDUM SUPERFUND MEMORANDUM OF AGREEMENT - BROWNFIELDS
 AND VOLUNTARY REMEDIATION PROGRAM** PAGE 153

**INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
VOLUNTARY REMEDIATION PROGRAM**

INTRODUCTION

Indiana was one of the first states to address, through statutes, the liability issues associated with buying, selling or developing property contaminated by hazardous substances. In response to the growing need for the Indiana Department of Environmental Management's (IDEM) review and oversight of voluntary investigations and response actions, primarily involving property transactions, the Voluntary Remediation Program (VRP) was established in 1993, pursuant to Indiana Code 13-25-5 (prior to July 1, 1996, IC 13-7-8.9).

The VRP provides a mechanism for site owners, operators or potential purchasers voluntarily to enter an agreement with IDEM to cleanup contaminated property. When the cleanup is successfully completed, IDEM will issue a Certificate of Completion and the Governor's office will issue a Covenant Not to Sue to the cleaned up property. These documents provide assurance that the remediated areas will not become the subject of future IDEM enforcement action.

Implicit in the voluntary nature of the VRP is the recognition that voluntary Parties have a choice to participate or not participate in the VRP. Thus, a voluntary Party can terminate their participation at any point by written notification to the appropriate VRP staff. The voluntary nature of the VRP benefits owners, real estate purchasers, lending institutions and developers. At the same time, the VRP benefits the environment and the public interest by the resulting identification and cleanup of contaminated property.

1.0 ELIGIBILITY

Any site owner or operator, or a prospective owner or operator, who wishes to clean up property that has been contaminated with petroleum or hazardous substances is potentially eligible to participate in the Voluntary Remediation Program.

An application may be rejected if:

1. A state or federal enforcement action concerning the proposed cleanup is pending; or
2. A federal grant compels IDEM to take enforcement action; or
3. Conditions at the site are considered to be an imminent and substantial threat to human health or the environment.
4. The application is not complete.

Cleanups that have already been completed are potentially eligible for the program. The applicant must submit documentation of the clean up that satisfies the VRP's requirements and assure that current cleanup criteria have been met.

2.0 APPLICATION PROCESS

The first step in the Voluntary Remediation process is to complete and submit an application with a \$1000.00 application fee. If an applicant withdraws from the VRP, the unexpended portion of the application fee will be refunded. The application assumes that a site characterization has already been

completed on the site. Pursuant to Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7), the application will receive confidential treatment. The application itself will not be part of IDEM's public records. Material submitted after the application has been accepted will not be confidential and will be a part of IDEM's public records. Do not submit additional documents with your application. These will be returned.

IDEM has 30 days to make an eligibility decision. An incomplete application is grounds for rejection. Incomplete applications will be returned to the applicant within 45 days of receipt with the missing information identified. Incomplete applications may be resubmitted upon revision.

3.0 VOLUNTARY REMEDIATION AGREEMENT

The Voluntary Remediation Agreement is a standard document that identifies the obligations of both the applicant and IDEM. Parties seeking assistance under the VRP are expected to cooperate and adhere to certain standards in the investigation of the extent and nature of contamination, the evaluation and recommendation of remedial actions and the level of cleanup attained. In addition, the applicant agrees to reimburse IDEM for the costs that it incurs in reviewing work plans and reports, and for oversight of the cleanup itself. IDEM will provide the applicant with an estimate of review and oversight costs within the Agreement. The Agreement also establishes deadlines for the completion of milestone tasks, and the schedule for payments by the applicant to IDEM. Once the Agreement is signed, the applicant prepares and submits a series of work plans and reports for IDEM's review. These include:

1. A Phase II Investigation Report.
2. A Remediation Work Plan
3. A Remediation Completion Report

The Voluntary Remediation Program: Resource Guide contains the requirements and guidance for all of these documents.

4.0 PUBLIC PARTICIPATION

Public involvement is an essential component of the VRP. The Remediation Work Plan is subject to a 30-day public notice and comment period. During the public notice period, IDEM will place a copy of the Remediation Work Plan in a local repository and invite interested Parties to comment. IDEM may hold a public hearing if at least one request is received during the public comment period. Applicants are encouraged to contact any affected Parties, community groups and local officials regarding their voluntary cleanup as soon as possible.

5.0 IMPLEMENTATION

Upon approval of the Remediation Work Plan, remediation work may begin. The site owner or operator must notify IDEM within 60 days of approval that he or she intends to proceed with implementation of the plan.

Implementation oversight of the Remediation Work Plan is accomplished through a combination of written progress reports and IDEM field oversight. A schedule for progress reporting and operational inspections is required in the Remediation Work Plan.

6.0 CLEANUP CRITERIA

Cleanup criteria for sites within the Voluntary Remediation Program consists of a combination of performance and quantitative standards. The performance standards apply to all cleanups. Quantitative standards are based on a three tiered approach which includes background levels, generic risk based standards and site specific risk based standards.

7.0 PROJECT COMPLETION

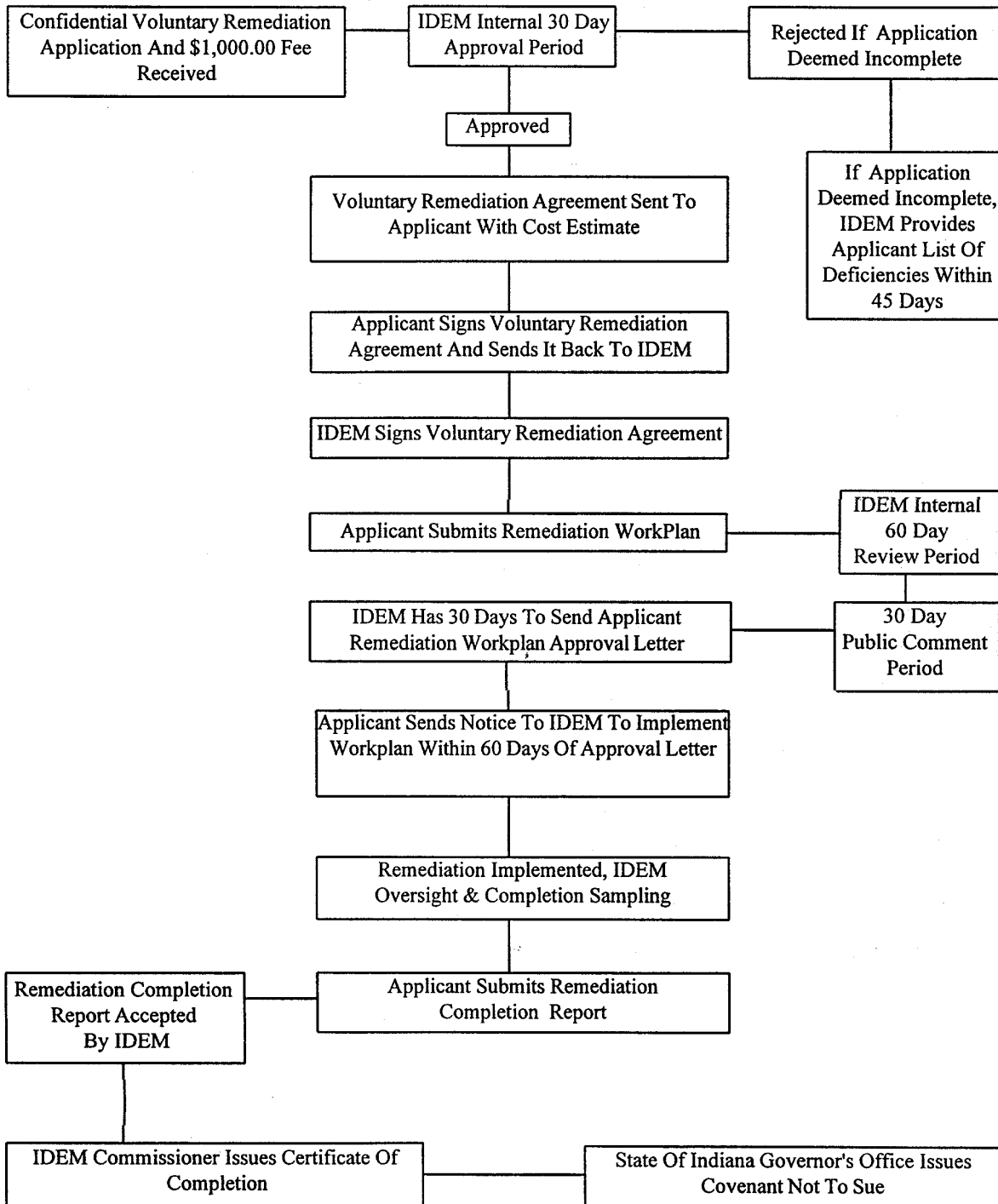
When the remediation is completed, the applicant will submit a Remediation Completion Report. The Completion Report contains results of sampling to confirm that cleanup criteria have been met as well as other information necessary to demonstrate that the Remediation Work Plan has been successfully completed. IDEM will split all confirmatory sampling with the Applicant. Once the voluntary cleanup has been successfully completed and payments to IDEM have been made for oversight costs, IDEM's Commissioner will issue a Certificate of Completion and the Governor's office will issue a Covenant Not to Sue. The Voluntary Remediation process is then complete.

8.0 ADVANTAGES OF PARTICIPATING IN THE PROGRAM

The Certificate of Completion and Covenant Not to Sue provide both the applicant and future land owners with an assurance that the voluntary cleanup has been performed properly and their future liability is strictly limited. This assurance is important to prospective purchasers of the property, and prospective lenders where property is being offered as collateral. Participation in the Voluntary Remediation Program will facilitate the sale and reuse of industrial and commercial properties in the State, an important benefit to all Indiana residents.

Although the Voluntary Remediation process has controls to ensure that cleanups result in a level of protection no less stringent than regulated or enforced cleanups, the process provides both IDEM and participants with greater flexibility in developing remedial solutions. Participants who are accepted in the Voluntary Remediation Program work cooperatively with IDEM which minimizes their transactional costs.

In order to facilitate cleanups, the Voluntary Remediation statute waives state and local permit requirements associated with the construction of remediation technologies or other aspects of a cleanup if it is pursued under the Voluntary Remediation Program. Federal permits, such as RCRA, NPDES, and Air permits cannot be waived.



INFORMATIONAL FLOWCHART

Indiana Department of Environmental Management
Voluntary Remediation Program
Application and Instructions

How Will the Information I submit be Used?

The information provided on the Application will be used to determine an Applicant's eligibility for participation in the Voluntary Remediation Program. It also serves as an initial summary of conditions at the site. The Application assumes that a Phase I Environmental Site Assessment or similar investigation has already been performed.

Application Fee

Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7) establishes a \$1,000.00 application fee which must be submitted along with the completed Application Form. IDEM cannot process the Application until the fee is submitted.

Where Should I Send My Application?

Remove the Application Form by tearing along the perforation. Send the completed form along with the application fee to:

Indiana Department of Environmental Management
Attn.: Cashiers Office
Voluntary Remediation Program
100 N. Senate Ave.-IGCN
P.O. Box 7060
Indianapolis, Indiana 46206-7060

Send an additional copy of the Application Form to:

Indiana Department of Environmental Management
Office of Environmental Response
Voluntary Remediation Program
100 N. Senate Ave
P.O. Box 6015
Indianapolis, Indiana 46206-6015

How Long Will it Take to Process My Application?

IDEM has 30 days to make an eligibility determination on an application. An incomplete application is grounds for rejection. Incomplete applications will be returned to the Applicant within 45 days of receipt, with the missing information identified. Incomplete applications may be resubmitted upon revision.

INSTRUCTIONS

FOR THE

CONFIDENTIAL VOLUNTARY REMEDIATION PROGRAM APPLICATION (PAGE ONE)

Headers - At the top of each following page, indicate the Facility Name to ensure that separated pages will be properly filed with their respective facility.

Facility ID Number - Leave blank, assigned by the Department of Environmental Management

EPA ID Number - Enter the ten character alphanumeric code for facilities which have an EPA Identification number. If the facility does not have such a number, enter N/A.

A. General Information - Indicate the level of oversight requested, site activities and site status by filling in the oval next to the appropriate answer. Be sure to include operational dates and location information as requested on the form.

Site Investigation - Indicate status of any site investigation as related to contaminant and/or area to be voluntarily remediated at time of application. Check Formal Workplan Review Requested if you want IDEM to comment on a site investigation plan prior to implementation. Please note: IDEM, by statute, cannot formally approve a site investigation workplan.

Site Remediation - Indicate status of any site remediation as related to contaminant and/or area to be voluntarily remediated at time of application.

Current Site Status - Indicate current site operational status. Self explanatory.

Years of Operation - If known, enter the beginning and ending years (or beginning only if current operations are on-going), e.g. 1932 / 1995, of site operation. Check Unknown if years of operation are unknown.

UTM Coordinates and Township, Range, and Section - Indicate proper UTM Coordinates and Township, Range, and Section numbers.

GENERAL

B. Property Ownership - Indicate both facility owner and operator information

Applicant - Indicate the name, mailing address, city, state, zip code, and telephone number of the applicant. Indicate the two character Alpha FIPS code for the state of the applicant e.g., IN - Indiana, NY - New York, etc. The applicant is the person or group who is guiding the remedial activities at the site and will be issued the Covenant Not to Sue upon completion of remediation activities.

Operator of Facility - Complete this section if the operator of the facility is different from the applicant. Indicate the two character Alpha FIPS code for the state of the facility operator, e.g., IN - Indiana, NY - New York, etc.. Use this section only if the facility is still operated by the person or group who will be conducting the voluntary remediation.

PROPERTY OWNERSHIP

C. Facility Location & Description - Indicate facility and contact person information along with any unusual site hazards and Standard Industrial Classification associated with the facility's current operations.

Facility Location - If the facility name or location is different than the applicant or operator mailing address, indicate this in the space provided. Enter the street address where the facility is located. If the precise street address is unavailable, enter a brief direction identifier, e.g., NW jct I-295 & US99. If the facility is currently owned by someone other than those conducting the voluntary remediation, please identify the facility name as it occurred under ownership or direction of the applicant, e.g., the former XYZ facility. Please be sure to include the county where the facility is located.

Contact Person - Identify the contact person for remedial activities at the site. Indicate the two character Alpha FIPS code for the state of the contact person, e.g., IN - Indiana, NY - New York, etc.. **All correspondence and information from IDEM will be sent to the person identified.**

Brief Description - Mark the oval(s) to indicate the hazards posed by the facility or contaminant(s) at the site. If the facility or contaminant(s) poses no unusual hazard, mark None.

Standard Industrial Classification - Please mark the oval(s) that apply to the operation(s) that currently occur at the facility. If the facility is currently inactive, indicate the most current operation identification. Refer to the general Standard Industrial Code (SIC) classifications when describing the type of operation.

FACILITY LOCATION & DESCRIPTION

INSTRUCTIONS

FOR THE

CONFIDENTIAL VOLUNTARY REMEDIATION PROGRAM APPLICATION (PAGE TWO)

CONTAMINANT INFORMATION

D. Contaminant Information- Page 2 and 3 (if needed) - Each column of the Contaminant Information is dedicated to **One Contaminant Category**. Only include information on contaminants that are to be included in the Voluntary Remediation Program.

Storage - Mark the oval(s) to indicate how the contaminant to be remediated is stored at the facility .

Physical State - Mark the oval(s) that describes the physical state of the contaminant to be remediated.

Gross Amounts - Indicate the type and units of measure of storage for the contaminant to be remediated. Please indicate a numeric value associated with the appropriate unit(s) of measure in the space provided under the appropriate general contaminant category.

Maximum Levels & Units - Fill in the appropriate spaces to show the maximum levels detected during contaminant(s) sampling. Refer only to contaminant(s) targeted for voluntary remediation.

Media Targeted for Clean Up - Mark the oval(s) to show what media has been impacted by the contaminant(s) targeted for voluntary remediation.

Constituents - Use this space to identify the specific individual chemical, as described in the contaminant category information, that is to be voluntarily remediated. Please identify all constituents to be remediated. The Covenant Not To Sue will be specific to the identified chemical constituents. To ensure that all potential contaminants are included in the Covenant Not To Sue when it is issued, include any potential breakdown constituents in this space.

PERMITS/ENFORCEMENT

E. Permits/ Enforcement Information- Answer the questions by marking the appropriate boxes, and if applicable, further explain any environmental permits and/or enforcement action taken at the facility.

Permits- Please identify any environmental permits issued to the facility. If federal, state, local or other types of environmental permits have been issued, specify the type, permit number, date issued and expiration date.

Enforcement- Mark the appropriate box to indicate any past or current enforcement actions at the facility. Provide a narrative description of any enforcement action against the facility if applicable. One of the conditions which *may* (but not necessarily) cause a Voluntary Remediation Program Application to be rejected is a pending enforcement action which addresses the subject of the proposed cleanup.

WATER INFORMATION

F. Water Information-

Local Drinking Water Supply- Indicate the *closest* source(s) of local drinking water within the vicinity of the facility. This must include, at a minimum, all adjoining properties and local communities. Indicate either municipal or private/residential water supplies. Identified drinking water supply(s) must be listed under the Water Quality Usage Descriptions. Also identify the distance of the *closest* drinking water source from the facility.

Local Surface Water Bodies- Indicate the type of surface water bodies that may be in the vicinity of the facility. Identified surface water supply(s) must be listed under the Water Quality Usage Descriptions. Also identify the distance of these bodies from the facility.

Local Surface Water Use- Indicate if any surface water body(s) is used, affected and/or potentially affected by the contaminants targeted for voluntary cleanup at the facility. Mark the appropriate oval(s).

Local Groundwater Use - Indicate if groundwater is used, affected, and/or potentially affected by the contaminants targeted for voluntary cleanup at the facility. Mark the appropriate oval(s).

Site Specific Depth To Groundwater - Use information already gathered from previous site investigation(s). If unknown mark appropriate oval.

Site Specific Groundwater Flow Direction - Use information already gathered from previous site investigation(s). If you marked Unknown for Site Specific Depth To Groundwater, then do not mark an oval.

Water Quality - Usage Descriptions- Use this space to detail all identified water bodies and water supplies along with additional information you wish to provide.

INSTRUCTIONS
FOR THE
CONFIDENTIAL VOLUNTARY REMEDIATION PROGRAM APPLICATION (PAGE THREE)

CHRONOLOGY

G. Chronological Summary and Conclusions - Provide the following information in as much detail as space allows. Use all headings. A lack of a response will jeopardize the application's completeness.

Facility Operational History - Indicate past operational activities associated with the facility. If known, please identify all past companies, years of operation and type of operations for the past 25 years.

Past Spill History - Identify all past spill incidents associated with the facility that relate to the contaminant(s) targeted for voluntary cleanup. Please include dates and IDEM incident numbers assigned to the spill and cleanup status. If the facility has no spill history, mark the oval and *do not* write in the spaces provided.

Soil Information - Indicate from previous site specific investigation(s) basic soil information. To include, but not limited to, the following items: site soil stratigraphy, lithologic descriptions or USDA soil textures, Munsell soil color, sedimentary contacts, etc.

Hydrogeological Information - Indicate from previous site specific investigation(s) basic hydrogeological information, including, but not limited to, the following items: depth to groundwater, flow direction, hydraulic conductivity, transmissivity, storativity, confined or un-confined conditions, porosity, average linear velocity, etc.

Off-Site Migration & Pathways - Identify all known and potential off-site contaminant migration and preferential migration pathways (utility lines, sand seams, etc.). If no off-site impacts are known, mark the oval and *do not* write in the spaces provided.

Projected Cleanup Objectives - Mark the oval that describes the potential cleanup objectives for the facility. Answers are non-binding and can be altered at a later date. If the cleanup objectives are unknown at this time, please mark the appropriate oval.

MISCELLANEOUS

H. Miscellaneous Environmental Information - Please mark the boxes that identify informational resources that were used to assist in completing this application. Include report titles and dates. Indicate if an imminent or substantial threat resulting from the contaminants described in the application is present. Give explanation if needed, and proceed with steps to mitigate the threat.

CERTIFICATION

I. Statement Of Certification - Before signing the application, please read the highlighted box. All applications must be signed and dated in ink. No signature photocopies will be accepted.

APPENDICES

J. Appendices Information - The application will not be considered complete unless the information asked for in the appendices is provided.

Appendix A: Site Map - Map(s) must include, but are not limited to, the following: illustrated legends and compass directions and at an appropriate scale; identified above ground features (buildings, roadways, property lines, etc.); horizontal and vertical plume identification; geologic cross sections showing the watertable and vertical plume identification; groundwater flow direction; sample locations along with concentrations, etc.. If previous site investigations have not been completed, then please indicate that in the space provided.

Appendix B: Legal Description - Please include the legal description of the facility. Include the facility street address, township, range, section, direction lines, distances, etc..

Appendix C: Miscellaneous - Include other information about the facility, if needed.

Voluntary Remediation Program Application



RETURN
COMPLETED
APPLICATION
TO

Indiana Department of Environmental Management
Voluntary Remediation Program
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015
(317) 308 - 3106

Facility ID Number <small>(IDEM use only)</small>							
Account Number	2680	110000					
EPA ID Number							

Pursuant to Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7), your application to the Voluntary Remediation Program (VRP) will receive confidential treatment. Neither the application nor any information which comes from the application will be made available to the public. However, any material submitted to or generated by the VRP after your notification of eligibility, will be considered IDEM public record.

A GENERAL	SITE INVESTIGATION (CHECK ALL THAT APPLY): <input type="radio"/> None <input type="radio"/> Ongoing <input type="radio"/> Complete <input type="radio"/> Formal Workplan Review Requested	SITE REMEDIATION (CHECK ALL THAT APPLY): <input type="radio"/> None <input type="radio"/> Ongoing <input type="radio"/> Complete	
	CURRENT SITE STATUS: <input type="radio"/> Active <input type="radio"/> Inactive	YEARS OF OPERATION: _____ <input type="radio"/> Unknown <div style="display: flex; justify-content: space-between; width: 100%;"> Beginning Year Ending Year </div>	
	UTM COORDINATES AND TOWNSHIP, RANGE, AND SECTION: _____		

B PROPERTY OWNERSHIP	VOLUNTARY CLEANUP APPLICANT	OPERATOR OF FACILITY
	APPLICANT NAME _____ MAILING ADDRESS _____ _____ CITY _____ STATE _____ ZIP CODE _____ TELEPHONE () _____	OPERATOR NAME (If Same As Applicant, Mark Oval Here <input type="radio"/>) _____ MAILING ADDRESS _____ _____ CITY _____ STATE _____ ZIP CODE _____ TELEPHONE () _____
	C FACILITY LOCATION & DESCRIPTION	
	FACILITY LOCATION	CONTACT PERSON
FACILITY NAME (If Same As Applicant, Mark Oval Here <input type="radio"/>) _____ MAILING ADDRESS (If Same As Applicant, Mark Oval Here <input type="radio"/>) _____ _____ CITY _____ ZIP CODE _____ COUNTY _____		ORGANIZATION (If Same As Applicant, Mark Oval Here <input type="radio"/>) _____ CONTACT PERSON (All Correspondence Will Be Sent To Person Identified) _____ MAILING ADDRESS _____ CITY _____ STATE _____ ZIP CODE _____ TELEPHONE () _____

C FACILITY LOCATION & DESCRIPTION	BRIEF DESCRIPTION												
	UNUSUAL SITE HAZARDS / CONDITION (Check all that apply) <table style="width: 100%; margin-top: 10px;"> <tr> <td><input type="radio"/> Radioactivity</td> <td><input type="radio"/> Explosive Conditions</td> <td><input type="radio"/> None</td> </tr> <tr> <td><input type="radio"/> Confined Spaces</td> <td><input type="radio"/> Reactive Materials</td> <td><input type="radio"/> Other: _____</td> </tr> <tr> <td></td> <td></td> <td><input type="radio"/> Infectious Material Present</td> </tr> <tr> <td></td> <td></td> <td><input type="radio"/> Off-Site Contamination</td> </tr> </table>		<input type="radio"/> Radioactivity	<input type="radio"/> Explosive Conditions	<input type="radio"/> None	<input type="radio"/> Confined Spaces	<input type="radio"/> Reactive Materials	<input type="radio"/> Other: _____			<input type="radio"/> Infectious Material Present		
<input type="radio"/> Radioactivity	<input type="radio"/> Explosive Conditions	<input type="radio"/> None											
<input type="radio"/> Confined Spaces	<input type="radio"/> Reactive Materials	<input type="radio"/> Other: _____											
		<input type="radio"/> Infectious Material Present											
		<input type="radio"/> Off-Site Contamination											

STANDARD INDUSTRIAL CLASSIFICATION (Select only one) <table style="width: 100%; margin-top: 5px;"> <tr> <td><input type="radio"/> Metal Mining</td> <td><input type="radio"/> Coal Mining</td> </tr> <tr> <td><input type="radio"/> Paper & Allied Products</td> <td><input type="radio"/> Petroleum & Coal Products</td> </tr> <tr> <td><input type="radio"/> Primary Metal Industries</td> <td><input type="radio"/> Electronic Equipment</td> </tr> <tr> <td><input type="radio"/> Pipelines (Excluding Natural Gas)</td> <td><input type="radio"/> Oil & Gas Production</td> </tr> <tr> <td><input type="radio"/> Auto Dealers & Service Stations</td> <td><input type="radio"/> Auto Repair, Services & Parking</td> </tr> <tr> <td><input type="radio"/> Wholesale Trade Nondurable Goods</td> <td><input type="radio"/> Rubber & Plastic Products</td> </tr> <tr> <td><input type="radio"/> Wholesale Trade Durable Goods</td> <td><input type="radio"/> Transportation Equipment</td> </tr> <tr> <td><input type="radio"/> Other: _____</td> <td></td> </tr> </table>	<input type="radio"/> Metal Mining	<input type="radio"/> Coal Mining	<input type="radio"/> Paper & Allied Products	<input type="radio"/> Petroleum & Coal Products	<input type="radio"/> Primary Metal Industries	<input type="radio"/> Electronic Equipment	<input type="radio"/> Pipelines (Excluding Natural Gas)	<input type="radio"/> Oil & Gas Production	<input type="radio"/> Auto Dealers & Service Stations	<input type="radio"/> Auto Repair, Services & Parking	<input type="radio"/> Wholesale Trade Nondurable Goods	<input type="radio"/> Rubber & Plastic Products	<input type="radio"/> Wholesale Trade Durable Goods	<input type="radio"/> Transportation Equipment	<input type="radio"/> Other: _____		Official State Use Only _____ _____ _____
<input type="radio"/> Metal Mining	<input type="radio"/> Coal Mining																
<input type="radio"/> Paper & Allied Products	<input type="radio"/> Petroleum & Coal Products																
<input type="radio"/> Primary Metal Industries	<input type="radio"/> Electronic Equipment																
<input type="radio"/> Pipelines (Excluding Natural Gas)	<input type="radio"/> Oil & Gas Production																
<input type="radio"/> Auto Dealers & Service Stations	<input type="radio"/> Auto Repair, Services & Parking																
<input type="radio"/> Wholesale Trade Nondurable Goods	<input type="radio"/> Rubber & Plastic Products																
<input type="radio"/> Wholesale Trade Durable Goods	<input type="radio"/> Transportation Equipment																
<input type="radio"/> Other: _____																	


FACILITY NAME _____

D

CONTAMINANT INFORMATION

COMPLETE A COLUMN FOR EACH CONSTITUENT TARGETED FOR VOLUNTARY REMEDIATION ATTACH ADDITIONAL SHEETS AS NEEDED

CONTAMINANT INFORMATION

CONSTITUENT CODE 					
STORAGE (Check only one response)					
Surface Impoundments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Above Ground Drums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buried Drums	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AST	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
UST	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Piles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landfill	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Landfarm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Dump	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PHYSICAL STATE (Check only one)					
Solid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Liquid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sludge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Powder/Fines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gaseous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Slurry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GROSS AMOUNTS (Check only one)					
Number Of Drums	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Cubic Yards	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Tons	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Gallons	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Other:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
MAXIMUM LEVELS & UNITS (Check only one)					
ppm	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ppb	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
MEDIA TARGETED FOR CLEANUP (Check only one)					
Surface Soil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Subsurface Soil	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Surface Water	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Groundwater	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CONTAMINANT CATAGORY (Check only one)					
Solvents	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Petroleum	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Metals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Organics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inorganics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acids/Bases	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pesticides	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sludge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

FACILITY NAME _____

E PERMITS / ENFORCEMENT INFORMATION

PERMITS/ENFORCEMENT

Does Your Facility Have Now Or Ever Had A RCRA Permit Or RCRA Interim Status?
 No Yes

TYPE OF PERMIT	PERMIT NUMBER	DATE ISSUED	EXPIRATION DATE

Are You Required To Investigate Or Remediate This Facility By Any Other Permit Condition, Commissioner's Order Or Condition Of Any Other Rule?
 No Yes

Has Your Facility Had Any Past Regulatory Or Enforcement Action At The Following Levels?
 (If So, Please Provide A Brief Narrative Description Below)
 Federal State Local

F WATER INFORMATION

WATER INFORMATION

LOCAL DRINKING WATER SUPPLY			WATER SUPPLY DISTANCE FROM SITE	
	SURFACE	WELL	() Feet	_____
Municipal	()	()	() Mile(s)	_____
Private/Residential	()	()		

LOCAL SURFACE WATER BODIES					SURFACE WATER DISTANCE FROM SITE	
Wetland(s)	Stream	River	Lake	Pond	() Feet	_____
()	()	()	()	()	() Mile(s)	_____

LOCAL SURFACE WATER USE (Check all that apply)			LOCAL GROUNDWATER USE (Check all that apply)		
USED	AFFECTED	POTENTIALLY AFFECTED	USED	AFFECTED	POTENTIALLY AFFECTED
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

SITE SPECIFIC DEPTH TO GROUNDWATER () Unknown _____ Feet		SITE SPECIFIC GROUNDWATER FLOW DIRECTION () () () () () () () NorthWest North NorthEast East SouthEast South SouthWest West						
---	--	--	--	--	--	--	--	--

WATER QUALITY USAGE DESCRIPTIONS

FACILITY NAME _____

G CHRONOLOGICAL SUMMARY AND CONCLUSIONS

Please Provide The Following Information In As Much Detail as Space Allows. Limit The Information To The "Highlights" And Maintain A Chronological Format.

FACILITY OPERATIONAL HISTORY:

PAST SPILL HISTORY: (If No Incidents Have Occurred, Then Mark Oval Here)

SOIL INFORMATION:

HYDROGEOLOGICAL INFORMATION:

OFF-SITE MIGRATION & PATHWAYS: (If Not Impacted, Then Mark Oval Here)

PROJECTED CLEANUP OBJECTIVES: TIER I TIER II TIER III CURRENTLY UNDETERMINED
 RESIDENTIAL NONRESIDENTIAL

FACILITY NAME _____

H MISCELLANEOUS ENVIRONMENTAL INFORMATION

INFORMATION RESOURCE(S) (Check All That Apply)

PREVIOUS SITE STUDY: (Include Title & Date)

OTHER: (Include Title & Date)

- U.S GEOLOGICAL SURVEY
- SOIL CONSERVATION SERVICE
- REGULATORY REPORTING

- STATE REPORTS
- SITE SPECIFIC DATA
- OTHER GOVERNMENT AGENCIES

Do The Conditions Regarding Hazardous Substances Or Petroleum, As Described In This Confidential Application, Constitute An Imminent Or Substantial Threat To Human Health Or The Environment?

No

Yes (If Yes, Please Explain Below)

I STATEMENT OF CERTIFICATION

Pursuant to Indiana Code 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7), your application to the Voluntary Remediation Program (VRP) will receive confidential treatment. Neither the application nor any information which comes from the application will be made available to the public. However, any material submitted to or generated by the VRP after your notification of eligibility, will be considered IDEM public record.

I, _____, Do Hereby Attest And Certify That The
(Print Or TypeName)

Information Included Herein Is, To The Best Of My Knowledge And Belief, Accurate And Complete.

Signature Date

J APPENDICES INFORMATION

This Voluntary Application will not be considered complete unless the following Appendices are included:

- APPENDIX A. SITE MAP
- APPENDIX B. LEGAL DESCRIPTION
- APPENDIX C. MISCELLANEOUS (IF NEEDED)

PHASE II INVESTIGATION REPORT

At the request of the VRP participant, IDEM may informally review a Phase II Investigation Work Plan. Please submit one (1) copy to IDEM to facilitate work plan review. If a Phase II Investigation Work Plan was prepared before site investigation work began, then the purpose of the Phase II Investigation Report is to present site investigation findings. Voluntary Remediation Program participants who elect not to submit a Phase II Investigation Work Plan must document the objectives, rationale and procedures which were followed during the site investigation in the Phase II Investigation Report, as well as presenting site investigation findings. Please submit two (2) copies to IDEM for complete review.

1.0 INTRODUCTION

The Introduction section of the Phase II Investigation Report must identify the site's name and address, include a brief description of site operations, and a brief description of the site's history, including a discussion of the events which led up to the site investigation. A site location map and site layout drawing must also be provided. A U.S. Geological Survey map excerpt may be used as a site location map. The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; and any surface water bodies or water wells on or bordering the property.

1.1 SITE BACKGROUND

1.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.
- C. Site map depicting property lines, building outlines, underground utility lines, raw materials and bulk storage, tanks, roads, loading/unloading areas, on-site waste storage, treatment, disposal areas, surface water bodies, and water supply wells.
- D. Brief summary of site history.
- E. Overview of the initial discovery of contamination and/or previous investigations.
- F. Summary of results of Phase II Investigations.
- G. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.)

1.1.2 SITE DOCUMENTATION

- A. Identification of previous reports prepared for the site.
- B. Description of available data and/or other documentation regarding the site.

2.0 STATEMENT OF WORK

2.1 OBJECTIVES OF PHASE II INVESTIGATION (Complete this section only if Phase II Investigation has not been initiated)

- A. Description of Phase II Investigation area(s)
- B. Statement of objectives for each Phase II Investigation area.

2.2 SITE SAFETY PLAN (Please refer to [Appendix A](#), page 47)

- A. Attached standard IDEM Site Safety Plan.

2.3 QUALITY ASSURANCE PROJECT PLAN (QAPP) (Please refer to [Appendix B](#), page 51)

- A. Attached site-specific QAPP

3.0 SITE CHARACTERIZATION**3.1 BASELINE ASSESSMENT** (Please refer to [Appendix C](#), page 85)**3.1.1 ECOLOGICAL ASSESSMENT**

Participants must present the results of their assessment of potentially affected environmentally sensitive areas (e.g. wetlands, riparian areas, parks, etc.), and potentially affected aquatic and wildlife populations. Potentially affected environmentally sensitive areas must be identified on a map. Key aquatic and wildlife species must be listed. If any endangered species are present in potentially affected areas, their endangered status must be clearly indicated. Potential exposure routes to sensitive areas and/or populations must be identified, and any observed or potential consequences of exposure discussed. If the Baseline Ecological Assessment doesn't potentially find any affected sensitive areas, that fact must be stated.

- A. Identification of potentially affected endangered species.
- B. Identification of aquatic life present.
- C. Contamination pathways to surface water.
- D. Potential exposures to aquatic life.
- E. Identification of wildlife and vegetation found in the vicinity.
- F. Potential wildlife/vegetation exposure pathways.
- G. Discussion of potential or observed effects of contamination on vegetative or wildlife populations.
- H. Identification of environmentally sensitive areas (e.g., riparian areas, floodplain).
- I. Flow and drainage patterns.
- J. Identification of potential stresses to wetlands and floodplain.
- K. Potential exposure routes to environmentally sensitive areas.
- L. Map depicting the locations of floodplain and wetlands.

3.1.2 BACKGROUND HYDROGEOLOGIC ASSESSMENT

In this section, participants must present the results of their "desktop" evaluation of hydrogeologic conditions at the site. Significant findings resulting from a literature search and/or review of publicly available documents must be presented. If existing site-specific subsurface information is available, for example, from foundation borings or existing on-site monitoring wells, this must be summarized. Depth to bedrock; local lithology; regional aquifers; and the occurrence of significant structural features such as jointing, faulting, or folding are examples of topics which must be addressed by the Baseline Hydrogeological Assessment. If participants elect not to undertake a site-specific hydrogeological investigation based upon existing site-specific data discovered during the Baseline Hydrogeological Assessment, the rationale for this decision must be discussed.

- A. Presentation of geologic information obtained during literature search.
- B. Presentation of geologic information obtained from review of available public documents.

- C. Depth to bedrock and description of lithology.
- D. Identification of regional aquifer(s).
- E. Locations of surface water bodies, floodways and drainage.
- F. Description of structural features such as jointing, faulting, and folding.
- G. Summary of existing site-specific data.
- H. Rationale for not undertaking a site-specific hydrogeologic investigation (if applicable).

3.2 BACKGROUND CONCENTRATIONS (Please refer to Appendix E, Tier I, page 95)

Complete this section only if using Background concentrations as potential cleanup objectives.

Background concentrations are useful as a basis for determining whether or not soil, groundwater or other media has been contaminated. They are also one of the cleanup level options available to Voluntary Remediation Program participants. In the Background Concentration section of the Phase II Investigation Report, participants must identify how site background was established and for which media (soil, groundwater, and/or surface water). The investigative methods used must be identified (e.g. monitoring wells, soil borings, water samples). Sample locations must be shown on a map. Sample results must be presented, and the statistical evaluation method(s) used to arrive at background values described. Tabular presentation of sample results will facilitate review.

- A. List of background investigation analytical methods.
- B. Description of methods used in collecting background data (e.g., soil borings, monitoring wells, existing data or literature).
- C. Background sample location map.
- D. Sampling procedures in accordance with QAPP? (If not, explanation of variations).
- E. Presentation of background data in tabular form (media, parameters, concentrations, depth of sample, date, etc.).
- F. Statistical evaluation of background results, if applicable.

3.3 SAMPLING METHODOLOGY

The Sampling Methodology section of the Phase II Investigation Report must identify the areas of the site which were investigated for potential contamination, and indicate which media (e.g. soil, groundwater, debris, sludge) were sampled and why. Sample locations must be shown on a map, and the rationale for their selection discussed. The investigative methods used (e.g. soil borings, monitoring wells, composite debris samples) must be described. Standard monitoring well construction details must be included if monitoring wells were installed. Sampling equipment used must be described, including how field screening equipment and results were used, if applicable. If sample collection, preservation, equipment decontamination and documentation procedures varied from the standard Quality Assurance Project Plan (QAPP) provided as part of the Program application package, these variations must be identified and explained. Copies of waste disposal manifests (if applicable) and chain-of custody forms must be attached.

3.3.1 SAMPLE MATRICES

- A. Description of media sampled (e.g., soil, water, sludge).

3.3.2 SAMPLE LOCATIONS

- A. Map showing sample locations.
- B. Rationale for sample locations.

3.3.3 INVESTIGATION METHODS

- A. Methods of investigation used (e.g., soil borings, monitoring wells)
- B. Description of monitoring well installation (drilling method, well depths, well construction details, development procedures).
- C. Description of soil boring installation (drilling method, depths).

3.3.4 SAMPLE COLLECTION

- A. Description of sampling equipment used.
- B. Sample collection procedures in accordance with QAPP? (If not, explanation of variations.)
- C. Sample depths and identification numbers.
- D. Description of the collection of quality control samples (trip blanks, equipment blanks).
- E. Decontamination procedures in accordance with QAPP? (If not, explanation of variations.)
- F. Sample containers in accordance with QAPP? (If not, explanation of variations.)
- G. Sample preservation procedures in accordance with QAPP? (If not, explanation of variations.)
- H. Description of field screening procedures.
- I. Tabulated results of field screening.
- J. Documentation procedures in accordance with QAPP? (If not, explanation of variations.)
- K. Waste disposal data and manifests, chain-of-custody forms.

3.4 SAMPLE ANALYSIS

The analytical methods, sample containers, and preservation techniques used to collect and characterize each sample must be identified. A table showing this information by media and sample location will facilitate review.

3.4.1 ANALYTICAL METHODS

- A. Table summarizing the analytical methods, sample containers, and preservation procedures used for each sample matrix and locations.

3.5 SITE INVESTIGATION RESULTS

Sample analysis results must be presented in tabular form for all analysis parameters, media and sample locations. Parameters found at concentrations above method detection limits must be identified. Parameters found at levels above background concentrations must also be identified. Laboratory analytical reports must be attached. Conclusions regarding the vertical and horizontal extent of contamination in soil, groundwater and other affected media (e.g. sediments, surface water) must be discussed. Contaminated areas must be indicated on a map. The results of the site-specific hydrogeologic investigation must also be presented, including the properties of site soils; hydrogeologic

cross sections; water level measurements; water table elevations and potentiometric maps; groundwater flow direction(s) and velocity. If any temporal fluctuations in water levels were observed, these must be identified, and their effect on groundwater flow discussed.

3.5.1 SAMPLE ANALYSIS RESULTS

- A. Table(s) presenting analysis results for all media and parameters above method detection levels.
- B. Identification of parameters found above background levels.
- C. Laboratory analytical reports (attached in an appendix).
- D. Description of the horizontal and vertical extent of contamination in soil (include soil boring logs attached in an appendix).
- E. Description and quantification of groundwater quality in the uppermost aquifer and all significant zones of saturation or permeable zones.
- F. Description of the horizontal and vertical extent in the groundwater of any immiscible or dissolved contaminant plume(s) originating from the site or facility.
- G. Velocity of contaminant movement in the groundwater.
- H. Mapped concentrations of contaminants to show vertical and horizontal extent in the soil and groundwater (e.g., mapped sample locations along with depth and contaminant concentrations).
- I. Description/mapping of contamination in other affected media (e.g., sediments, surface water).

3.5.2 HYDROGEOLOGIC INVESTIGATION RESULTS

- A. Geologic and hydrogeologic properties of contaminated area (e.g., hydraulic conductivity, porosity, grain-size distribution).
- B. Geologic/hydrogeologic cross-sections.
- C. Water level measurements.
- D. Water table elevations and potentiometric maps.
- E. Groundwater flow direction.
- F. Groundwater flow rate.
- G. Groundwater flow gradient, including how it was calculated.
- H. Temporal fluctuations in water levels and their effect on flow direction.

4.0 PHASE II INVESTIGATION REPORT (Complete this section only if Phase II Investigation has not been completed)

- 4.1 Statement that a Phase II Investigation Report will be submitted and what will be included.

5.0 PHASE II INVESTIGATION REPORT SCHEDULE (Complete this section only if Phase II Investigation has not been completed)

- 5.1 Proposed schedule indicating expected milestones for completion of the Phase II Investigation Work Plan

6.0 CONCLUSION

Participants must conclude the Phase II Investigation Report with an overall assessment of the extent of contamination on and off-site to include geologic/hydrogeologic illustrations that adequately describe subsurface and contaminant plume identification (e.g., cross-sections, fence diagrams, geophysical profiles, etc.). An initial assessment of the potential risks associated with the contamination must also be presented. If remediation is planned, preliminary remediation alternatives must be identified to the extent possible. A tentative schedule for the submission of a Remediation Work Plan must be given.

- 6.1 Summary of the extent of contamination.
- 6.2 Summary of potential risks associated with the site.
- 6.3 Description of preliminary remediation alternatives and plan to submit Remediation Work Plan, if appropriate.

VOLUNTARY REMEDIATION AGREEMENT

INTRODUCTION

The statute which establishes the Voluntary Remediation Program (VRP), IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9), provides that "Before the department evaluates a proposed voluntary remediation work plan, the applicant who submitted the work plan and the Commissioner must enter into a voluntary remediation agreement that sets forth the terms and conditions of the evaluation and the implementation of the work plan." The agreement must contain provisions which address the following:

(The applicable sections are in parentheses.)

1. A requirement that the department provide an itemized list of costs that the department estimates it will incur in providing oversight for the remediation. (Section XX, paragraph 51)
2. The recovery of all reasonable costs incurred by the department which exceed the application fee. (Section XX)
3. A schedule for the payment of those costs. (Section XX)
4. Dispute resolution. (Section XVI)
5. Indemnification. (Section XXII)
6. Retention of records. (Section XV)
7. A timetable for the review and approval or disapproval of the work plan by the department. (Section VII)
8. Interagency coordination. (Section X)
9. Any other provisions deemed necessary by the Commissioner or the applicant.

Other provisions which have been deemed necessary by the department are:

1. Section IX, COMPLIANCE WITH APPLICABLE LAWS: This section requires the Applicant to comply with all state, federal and local laws and regulations.
2. Section XII, QUALITY ASSURANCE: This section requires the Applicant to follow certain procedures when collecting and analyzing samples to ensure that the data is reliable.
3. Section XIX, RESERVATION OF RIGHTS: This section reserves certain rights for the department, such as the right to terminate the agreement if the site poses an imminent and substantial threat to the human health and the environment.
4. Section XXV, TERMINATION AND SATISFACTION: This section provides that the Governor shall give the Applicant a covenant not to sue upon the successful completion of the remediation as set out in the work plan.

Other provisions which may be included in the Voluntary Remediation Agreement as the agency deems appropriate are:

1. LEAKING UNDERGROUND STORAGE TANKS: This section will be inserted where appropriate and deals with the Department's obligations under various federal grants in the Underground Storage Tank section. It also states that Applicants will be eligible for reimbursement under the Indiana Underground Petroleum Storage Tank Excess Liability Fund under certain conditions.

2. **NATURAL RESOURCE DAMAGES:** Either the agency or the Applicant can propose that the Work Plan address natural resource damages. If both Parties agree to address the damages, then Applicant must expressly agree that all costs for any pre-assessment screen will be reimbursed.

3. **INVESTIGATION WORK PLAN and REMEDY SELECTION:** This language will be used where an Applicant has not done a complete investigation or wishes to have IDEM oversight of its investigation. Both of these sections should be used in either instance. Neither should be used alone.

VOLUNTARY REMEDIATION AGREEMENT
Relating to (Site)

Company)
, Indiana)
))
Company)
Applicant)
))
Voluntary Remediation of:)
(site))
IDEM Site #)
))
Proceeding under)
the Environmental)
Management Act)
(Indiana Code 13-25-5))
(prior to July 1, 1996, IC 13-7-8.9))

I. INTRODUCTION

1. The Indiana Department of Environmental Management (“IDEM”), by its Commissioner (“Commissioner”), and _____ (“Applicant”) hereby enter into this Voluntary Remediation Agreement ("Agreement"), pursuant to IC 13-25-5-8 (prior to July 1, 1996, IC 13-7-8.9-13) for the purpose of remediating the release of hazardous substances or petroleum at (site, city, county) Indiana.

II. JURISDICTION

2. This Agreement is entered into by and between applicant and the IDEM, by its Commissioner, pursuant to IC 13-25-5-8 (prior to July 1, 1996, IC 13-7-8.9-13), hereafter collectively referred to as the “Parties.”

3. The Parties agree to the following terms and conditions for the evaluation and implementation of the Voluntary Remediation Work Plan (Work Plan) and to waive their rights to administrative and judicial review of the binding effect and enforceability of the Agreement and agree not to contest the jurisdiction of IDEM to enter into this Agreement. However, the Applicant reserves all rights it may have under common law, the Indiana Code and federal statutes to seek contribution or indemnity from others not signatories to this Agreement.

4. By entering into this Agreement, the Applicant neither admits nor denies liability.

III. STATEMENT OF ELIGIBILITY

5. The Commissioner has determined that the application submitted by Applicant is complete and that Applicant is eligible to participate in the voluntary remediation program established under IC 13-25-

5 (prior to July 1, 1996, IC 13-7-8.9). However, neither the Commissioner's determination of eligibility nor the entry into this Agreement precludes any finding by the Commissioner at a later date that the site poses an imminent and substantial threat to human health or the environment within the meaning of IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9). In addition, if it is determined that Applicant withheld or misrepresented information that would be relevant to the Applicant's eligibility, the Commissioner may withdraw from this Agreement.

(The following language will be used when an application is submitted for the remediation of a leaking underground storage tank (LUST).)

The Commissioner has determined that this site is appropriate for acceptance into the voluntary remediation program, subject to the reservation of rights contained in Section XVIII. In addition, if at any time, the Commissioner determines that an enforcement action is required at this site under the provisions of certain federal grants provided to the IDEM, the approval of the Work Plan may be withdrawn and this Agreement terminated, pursuant to IC 13-25-5-5(a)(2) (prior to July 1, 1996, IC 13-7-8.9-10(a)(2)). If it is determined that Applicant is eligible for the Indiana Underground Petroleum Storage Tank Excess Liability Fund pursuant to IC 13-23-1 (prior to July 1, 1996, IC 13-7-20) and all applicable rules, Applicant may apply for reimbursement from this Fund of the costs of the remediation required by this Agreement. However, Applicant expressly waives the right to claim reimbursement for costs paid to IDEM as Administrative Costs, as described in Section XX and for the application fee as provided in IC 13-25-5-2 (prior to July 1, 1996, IC 13-7-8.9-7).

Applicant shall comply with all applicable state and federal requirements for corrective action. For purposes of determining compliance with applicable state and federal requirements for corrective action and for determining eligibility for the Indiana Underground Petroleum Storage Tank Excess Liability Fund, approval of a previously submitted corrective action plan shall constitute approval of the Voluntary Remediation Work Plan.

IV. PARTIES BOUND

6. This Agreement shall apply to and be binding upon the Applicant, its officers, directors, principals, employees, agents, successors, subsidiaries and assigns and upon IDEM, its employees, agents and successors. The signatories to this Agreement certify that they are fully authorized to execute and legally bind the Parties they represent. No change in ownership, corporate, or partnership status of the Applicant shall in any way alter its status or responsibilities under this Agreement unless Applicant or IDEM withdraws from this Program.

7. The Applicant shall provide a copy of this Agreement to any subsequent owners or successors before ownership rights are transferred. The Applicant shall provide a copy of this Agreement to all contractors, sub-contractors, laboratories, and consultants which are retained to conduct any work performed under this Agreement, within fourteen (14) days after the effective date of this Agreement or within fourteen (14) days of the date of retaining their services.

V. DEFINITIONS

8. "Day" or "calendar day" shall be defined as the 24-hour period between 12:00 A.M. - 12:00 A.M..
9. "Site" shall be used in the manner as defined by IC 13-11-2-203(a) (prior to July 1, 1996, IC 13-7-8.9-6); which includes the legal description of the site located at (address), (city), (county), Indiana.
10. All other terms contained in this Agreement shall be used in the manner as defined by IC 13-11-2 (prior to July 1, 1996, IC 13-7-8.9).

VI. STATEMENT OF PURPOSE

11. This Agreement sets forth the terms and conditions of evaluation and implementation of a Voluntary Remediation Work Plan proposed by the Applicant for the remediation of the release or threatened release of petroleum or hazardous substances from the site.

12. The activities conducted by the Applicant under this Agreement are subject to approval by IDEM. Applicant shall provide all necessary information for a Work Plan for the site. The activities conducted by the Applicant shall be consistent with this Agreement, all applicable laws and regulations and any appropriate guidance documents. Applicant shall employ sound scientific, engineering and construction practices.

VII. WORK TO BE PERFORMED

13. All work to be performed by the Applicant pursuant to this Agreement shall be under the direction and supervision of a Certified Professional Engineer or Certified Professional Geologist or other qualified persons with expertise in hazardous substance or petroleum site investigation and remediation. This individual may or may not be designated by Applicant as Applicant's Project Manager pursuant to Paragraph 24. Prior to the initiation of site work, the Applicant shall notify IDEM, in writing, regarding the name, title, and qualification of such engineer or geologist and of any contractors and/or subcontractors to be used in carrying out the terms of this Agreement. Selection of any such engineer or geologist or contractor and/or subcontractor shall be subject to disapproval by IDEM.

This language will be used when there has not been sufficient investigation done on the site to fully determine the nature and extent of the contamination and such an investigation is necessary before the Applicant can make a recommendation as to the remedy.

The Applicant shall submit a complete Investigation Work Plan for the investigation of the nature and extent of the contamination at the site and the feasibility study to IDEM. The Investigation Work Plan shall be developed in accordance with any pertinent guidance documents provided by IDEM.

The Investigation Work Plan submittal shall include, but not be limited to, the following project plans; (1) a quality assurance project plan; (2) a sampling and analysis plan; (3) a health and safety plan; (4) a community relations plan; (5) a schedule for implementation of all tasks set forth in the

Investigation Work Plan; and (6) data management plan.

The IDEM may require Applicant to submit additional or corrected information pursuant to IC 13-25-5-9 (b) (prior to July 1, 1996, IC 13-7-8.9-14(b)).

The Investigation Work Plan shall be subject to review and evaluation by IDEM for any other provisions provided for in IC 13-25-5-9 (prior to July 1, 1996, IC 13-7-8.9-14). The IDEM Project Manager shall review and evaluate the Investigation Work Plan within sixty (60) calendar days of receipt. The Investigation Work Plan shall be deemed incorporated into and made an enforceable part of this Agreement.

14. Applicant shall submit a Voluntary Remediation Work Plan which contains a recommendation as to the remedial actions Applicant intends to perform at the site. The remedial actions shall be selected using any U.S.EPA or IDEM guidance documents selected by IDEM as appropriate.

15. The Voluntary Remediation Work Plan submittal shall include, (1) a detailed description of the investigation conducted by the Applicant in preparing the Voluntary Remediation Work Plan and a description of the work to be performed by the Applicant to determine the nature and extent of the actual or threatened release, (2) a proposed statement of work to accomplish the remediation in accordance with guidelines established by the department; and (3) the following project plans; (a) a quality assurance project plan; (b) a sampling and analysis plan; (c) a health and safety plan; (d) a community relations plan; (e) a schedule for implementation of all tasks set forth in the Voluntary Remediation Work Plan; and (f) data management plan.

16. The IDEM may request Applicant to submit additional or corrected information pursuant to IC 13-25-5-9 (b) (prior to July 1, 1996, IC 13-7-8.9-14(b)). The Applicant may comply with the request or withdraw the proposed plan from consideration.

17. The Voluntary Remediation Work Plan shall be subject to review and evaluation by IDEM pursuant to IC 13-25-5-9(a) (prior to July 1, 1996, IC 13-7-8.9-14(a)) within sixty (60) days of receipt of the Work Plan. Additionally, the department may request the applicant to supply additional information or corrected information pursuant to IC 13-25-5-9(b) (prior to July 1, 1996, IC 13-7-8.9-14(b)). This time period shall not include the time required for public comment under IC 13-25-5-11 (prior to July 1, 1996, IC 13-7-8.9-15(b)).

18. The Commissioner shall make a determination concerning the approval, modification and approval, or rejection of the Voluntary Remediation Work Plan within thirty (30) calendar days of close of the public comment period provided for in IC 13-25-5-11 (prior to July 1, 1996, IC 13-7-8.9-15(b)) and notify the Applicant as provided in IC 13-25-5-12 (prior to July 1, 1996, IC 13-7-8.9-15(c)) or 13-25-5-13 (prior to July 1, 1996, IC 13-7-8.9-15(d)).

19. If the Applicant desires to proceed with the implementation of the approved Work Plan, the Applicant must notify the Commissioner in writing not more than 60 days after the Work Plan is approved. After providing such notice, the Applicant shall initiate the work detailed in the Voluntary Remediation Work Plan according to the schedule as set forth in the Commissioner's Notice of Approval.

Upon the Commissioner's receipt of notice that the Applicant intends to proceed, the fully approved Voluntary Remediation Work Plan shall be deemed incorporated into and made an enforceable part of this Agreement.

VIII. ADDRESSES FOR ALL CORRESPONDENCE

20. Documents, including reports, approvals, notifications, disapprovals, and other correspondence, to be submitted under this Agreement, may be sent by certified mail, return receipt requested, hand delivery, overnight mail or by courier service to the following addresses or to such addresses as the Applicant or IDEM may designate in writing.

Documents to be submitted to IDEM should be sent to:

M. _____
Voluntary Cleanup Project Manager
P.O. Box 6015
Indianapolis, Indiana 46206-6015
(317) 308 - ____

Documents to be submitted to the Applicant should be sent to:

(Applicant supplied information)

IX. COMPLIANCE WITH APPLICABLE LAWS

21. All work undertaken by the Applicant pursuant to this Agreement shall be performed in compliance with all applicable Federal, state and local laws, ordinances and regulations, including, but not limited to, all Occupational Safety and Health Administration, Department of Transportation and Resource Conservation and Recovery Act regulations. In the event of a conflict in the application of Federal, state, or local laws, ordinances and regulations, the Applicant shall comply with the more/most stringent such laws, ordinances, or regulations, unless provided otherwise in writing by IDEM. As provided by IC 13-25-4-26 (prior to July 1, 1996, IC 13-7-8.7-14), no state or local permit shall be required for any portion of the work conducted entirely on-site. However, where it is determined that such a permit is required under federal law, Applicant shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals. The Applicant shall be responsible for obtaining all Federal permits which are necessary for the performance of any work hereunder.

22. Nothing in this Agreement or in IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9) relieves Applicant of its obligations or responsibilities under the Resource Conservation and Recovery Act, 42 U.S.C. 6901 et seq., including the duty to meet any permit conditions including, but not limited to, financial responsibility, closure, post-closure or corrective action. The Covenant Not to Sue shall not be construed to relieve applicant of any duty to perform closure, post-closure or corrective action regardless of whether the Work Plan addressed the contaminants or property at issue.

X. INTERAGENCY COORDINATION

23. The following agencies may have an interest in the Work Plan because of coexisting or contiguous natural resources or concurrent jurisdiction over the site:

1. Indiana Department of Natural Resources
2. Indiana State Department of Health
3. Fire Prevention and Building Safety Commission

Applicant shall provide notice to these agencies of the submission of the Work Plan. Any of the above named agencies that wish to review the Work Plan shall be given an opportunity by the Commissioner to comment during the time IDEM is reviewing the Plan. The Commissioner shall consider any comments from state agencies that are received at least thirty (30) days prior to the deadline established in this Agreement for approval or rejection of the Work Plan.

(The following language will be inserted into the Voluntary Remediation Agreement when appropriate for Natural Resources Damages)

Respondent shall notify the Indiana and Federal Natural Resources Trustees of this Action within 30 days of the effective date of this Agreement. This section shall not release Applicant or any person from liability to the federal government for claims of natural resource damages under any federal law.

The Natural Resources Trustees shall perform the pre-assessment screen for injury to, destruction of, or loss of natural resources. The Applicant expressly agrees to reimburse IDEM for any and all costs incurred by either IDEM or the Department of Natural Resources in performing the pre-assessment screen. The Applicant will perform the assessment of damages based on the pre-assessment screen.

A Certificate of Completion and Covenant Not to Sue issued under Section XXV shall release Applicant from liability for claims for natural resources damages if Applicant devises and carries out a plan for restoration, rehabilitation, replacement or acquisition of equivalent natural resources or pays to the State the value of the natural resources, as determined by the Trustees. The plan shall be developed and implemented as part of the Remediation Work Plan.

XI. DESIGNATED PROJECT MANAGER

24. On or before the effective date of this Agreement, IDEM and the Applicant shall each designate a Project Manager. Each Project Manager shall be responsible for overseeing the implementation of this Agreement. The IDEM Project Manager will be the IDEM designated representative at the site. To the maximum extent possible, communications between the Applicant and IDEM and all documents (including reports, approvals, and other correspondence) concerning the activities performed pursuant to the terms and conditions of this Agreement shall be directed through the Project Managers. During implementation of this Agreement, the Project Managers shall, whenever possible, operate by consensus and shall attempt in good faith to resolve disputes informally through discussion of the issues. Each Party has the right to change its respective Project Manager by notifying the other Party in writing at least five (5) calendar days prior to the change.

25. The IDEM Project Manager shall have the authority to halt, conduct, or direct any work required by this Agreement and/or any response actions or portions thereof when conditions may present an imminent and substantial threat to human health or the environment. In the event that the IDEM Project Manager halts work pursuant to this paragraph, the schedule of work described in the Work Plan and this Agreement shall be modified accordingly or the IDEM may withdraw its approval of the Work Plan pursuant to Section XVIII.

26. The absence of the Applicant's or IDEM's Project Manager from the site shall not be cause for the stoppage of work. The Applicant's Project Manager or his supervisor shall reasonably be available by telephone while the field investigation is being performed. The Applicant's Project Manager shall designate a person to be in charge who will be available on-site when field work is being performed.

XII. QUALITY ASSURANCE

27. The Applicant shall use quality assurance, quality control, and chain of custody procedures in accordance with the Quality Assurance Project Plan approved for use by IDEM, throughout any Work Plan sample collection and analysis activities under this Agreement, unless IDEM agrees otherwise.

28. Applicant shall provide the IDEM Project Manager with reasonable advance notice of all sampling and analysis as detailed in the Work Plan. To provide quality assurance and maintain quality control, the Applicant shall:

- (a) allow IDEM personnel and/or IDEM authorized representatives reasonable access to laboratories and personnel utilized by the Applicant for analyses;
- (b) ensure that all sampling and analyses are performed according to U.S. EPA methods, the approved Quality Assurance Project Plan, or other methods deemed satisfactory by IDEM; and,
- (c) ensure that any laboratories used by the Applicant for analyses participate in a documented Quality Assurance/Quality Control program that complies with U.S. EPA guidance documents. As part of such a program, and upon request by IDEM, such laboratories shall perform analyses of samples provided by IDEM to demonstrate the quality of analytical data for each such laboratory.

29. In the event any laboratory fails to perform the activities required above, IDEM reserves the right to reject any data not gathered pursuant to the requirements listed above, and to require that the Applicant utilize a different laboratory.

XIII. SAMPLING AND DATA/DOCUMENT AVAILABILITY

30. The Applicant shall, upon request, make the results of all sampling, including raw data, and/or tests or other data generated by the Applicant, or on the Applicant's behalf, available to IDEM. IDEM will make available to the Applicant the quality assured results of sampling and/or tests or other data similarly generated by IDEM.

31. At the request of IDEM, the Applicant shall provide split or duplicate samples to IDEM and/or its authorized representative, of any samples collected by the Applicant pursuant to the implementation of this Agreement. At the request of the Applicant, IDEM or its authorized representative, shall provide

split or duplicate samples to the Applicant of any samples collected by IDEM and/or its authorized representative pursuant to the implementation of this Agreement. Each Party shall notify the other in advance of any sample collection activity.

XIV. ACCESS

32. To the extent that the site or other areas where work is to be performed hereunder is presently owned or controlled by Parties other than those bound by this Agreement, the Applicant shall obtain, or shall use its best efforts to obtain access agreements from the present owners. Best efforts shall include at a minimum, a certified letter from Applicant to the present owner of such property requesting access agreements to permit Applicant, IDEM and their authorized representatives access to such property. Any such access agreements shall be incorporated by reference into this Agreement. Such agreements shall provide access for IDEM and authorized representatives of IDEM, as specified below. In the event that such access agreements are not obtained, the Applicant shall so notify IDEM, which may then, at its discretion, assist the Applicant in gaining access. IDEM reserves the right to withdraw or modify, as necessary, this Agreement, should the Applicant's inability to gain access to the site or other areas materially affect the Applicant's ability to perform the work required herein.

33. The Applicant shall provide authorized representatives of IDEM access to the site and other areas where work is to be performed at all reasonable times. Such access shall be related solely to the work being performed on the Site and shall include, but not be limited to: inspecting records, operating logs and contracts related to the site; reviewing the progress of the Applicant in carrying out the terms of this Agreement; conducting such tests, inspections, and sampling as IDEM may deem necessary; using a camera, sound recording, or other documentary type equipment for field activities; and, verifying the data submitted to IDEM by the Applicant hereunder. The Applicant shall permit IDEM's authorized representatives to inspect and copy all records, files, photographs, documents, and other writings, including all sampling and monitoring data, which pertain to this Agreement and over which the Applicant exercises control. All persons with access to the site pursuant to this Agreement shall comply with approved health and safety plans.

34. Nothing herein shall be construed as restricting the inspection or access authority of IDEM under any law or regulation.

XV. RECORD PRESERVATION

35. The Applicant agrees to preserve, during the pendency of this Agreement and for a minimum of six (6) years after its termination, all records and documents in the Applicant's possession or in the possession of its employees, agents, accountants, contractors, which relate in any way to the subject matters covered by this Agreement. Upon request by IDEM, the Applicant shall make available to IDEM such records, or copies of any such records. After this six year period, the Applicant shall notify IDEM in writing thirty (30) calendar days prior to the destruction of any such documents. At that time, if IDEM requests that some or all documents be preserved for a longer period of time, the Applicant shall provide IDEM with the documents that IDEM wishes to preserve.

36. Applicant may assert a confidentiality claim, pursuant to applicable laws and rules IC 13-14-11-

1 thru IC 13-14-11-5 (prior to July 1, 1996, IC 13-7-6-6 and IC 13-7-16-3), and 5-14-3) with respect to any or all of the information requested or submitted pursuant to this Agreement. Any assertion of confidentiality shall be adequately substantiated by Applicant when the assertion is made. Information determined to be confidential by the IDEM shall be disclosed only to the extent permitted by IC 13-14-11-1 (prior to July 1, 1996, IC 13-7-6-6) and IC 5-14-3. If no such confidentiality claim accompanies the information when it is submitted to the IDEM, it may be made available to the public by the IDEM without further notice to the Applicant. Applicant agrees not to assert any confidentiality claim with regard to any physical or analytical data.

XVI. DISPUTE RESOLUTION

37. This section (Dispute Resolution) shall apply to any dispute arising under any section of this Agreement, unless specifically excepted.

38. The Parties shall use their best efforts to, in good faith, resolve all disputes or differences of opinion informally. If, however, disputes arise concerning this Agreement which the Parties are unable to resolve informally, the Applicant may present written notice of such dispute to IDEM and set forth specific points of dispute and the position of the Applicant. This written notice shall be submitted no later than five (5) calendar days after the Applicant discovers the Project Managers are unable to resolve the dispute. The Applicant's Project Manager will notify IDEM's Project Manager immediately by phone or other appropriate method of communication, prior to written notice, when s/he believes the Parties are unable to resolve a dispute.

39. Within ten (10) calendar days of receipt of such a written notice, IDEM shall provide a written response to the Applicant setting forth its position and the basis therefore. During the five (5) calendar days following the receipt of the response, the Parties shall attempt to negotiate in good faith a resolution of their differences.

40. (a) Following the expiration of the time periods described in the immediately preceding paragraph, if IDEM concurs with the position of the Applicant, the Applicant shall be notified in writing and this Agreement shall be modified to include any necessary extensions of time or variances of work. If IDEM does not concur with the position of the Applicant, IDEM, through the Commissioner or his/her designate, shall make a determination regarding the dispute, based upon and consistent with the terms of this Agreement, and shall provide written determination of such resolution to the Applicant.

(b) In the event that such determination is not acceptable to either Party, the dispute may be submitted to an impartial third Party for mediation in the following manner:

(1) The Parties shall select a mediator from the Indiana Supreme Court's approved list of mediators as established by the Indiana Rules of Alternative Dispute Resolution (ADR Rules) within five (5) calendar days of Applicant's receipt of the Commissioner's determination. In the event such a list does not exist or does not contain mediators which the Parties agree are qualified to mediate environmental disputes, the Parties shall use a mutually acceptable list and select a mediator within five (5) calendar days of compilation of such other mutually acceptable list. In addition to the qualifications required by the ADR Rules, the mediator shall have experience in environmental issues.

(2) The dispute shall be initially submitted to the mediator via a written request for dispute resolution through mediation; the written request shall be issued within 10 days after notification of the Parties of IDEM's final determination of the dispute, as provided by paragraph 40(a) of this section. The request for assistance shall include the written determination of the Commissioner issued pursuant to paragraph 40(a) and the documents specified in paragraphs 38 and 39 of this section. A copy of the written request shall be delivered to the other Parties at the time the request is made.

(3) The Party which submitted the dispute to mediation may make a written submission in support of its position to the mediator, if the mediator so requests, within 10 days of the mediator's selection, and any other Party may make a written response in support of its position within 7 days thereafter. The mediator shall immediately thereafter contact all Parties and determine the course of the mediation, including scheduling any meetings deemed necessary.

(4) The mediation process shall be conducted in accordance with Indiana Rules of Alternative Dispute Resolution in any aspect not covered by this Agreement.

(5) The mediator and the Parties shall proceed with all due speed to resolve the dispute.

(6) All communications, whether oral or written, between the mediator and the Parties, shall be kept confidential in accordance with the Indiana Rules for Alternative Dispute Resolution, Rule 2.12.

41. If either Party determines or the mediator declares that the dispute cannot be resolved through the mediation process, the Parties retain all rights under the Indiana Administrative Orders and Procedures Act, IC 4-21.5.

42. Until the dispute is resolved, any actions concerning that element of work in dispute shall be halted. The resolution of the dispute shall be incorporated into the Work Plan and made an enforceable part thereof. The time schedule for the work in dispute shall be extended by the amount of time needed for resolution. Elements of work and/or obligations not affected by the dispute shall be completed in accordance with the schedule contained in the Work Plan.

43. Elements of work and any actions required as a result of such dispute resolution shall immediately be incorporated, if necessary, into the appropriate plan or procedure, and into this Agreement. The Applicant shall proceed with all remaining work according to the modified plan or procedure.

XVII. FORCE MAJEURE

44. The Applicant shall cause all work or required reporting to be performed within the time limits set forth herein, unless performance is delayed by events which constitute a force majeure. For purposes of this Agreement, a force majeure is an event arising from circumstances beyond the reasonable control of the Applicant which delays performance of any obligations required by this Agreement. Increases of costs shall not be considered an event of force majeure.

45. The Applicant shall notify IDEM by calling within three (3) calendar days and by writing no later than seven (7) calendar days after any event which the Applicant contends is a force majeure. Such notification shall describe the anticipated length of the delay, the cause or causes of the delay, the measures taken or to be taken by the Applicant to minimize the delay, and the timetable by which these measures will be implemented. The Applicant shall have the burden of demonstrating that the event is a force majeure. The decision of whether an event is a force majeure shall be made by the Assistant Commissioner, or his/her designate, of the Office of Environmental Response. Said decision shall be immediately communicated to Applicant.

46. If a delay is attributable to a force majeure, the time period for performance under this Agreement shall be extended, in writing, by the amount of time that is attributable to the event constituting the force majeure.

XVIII. RESERVATION OF RIGHTS

47. IDEM and Applicant reserve all rights and defenses they may have pursuant to any available legal authority unless expressly waived herein.

48. Nothing herein is intended to release, discharge, or in any way affect any claims, causes of action or demands in law or equity which the Parties may have against any person, firm, partnership or corporation, not a Party to this Agreement for any liability it may have arising out of, or relating in any way to, the generation, storage, treatment, handling, transportation, release or disposal of any materials, hazardous substances, hazardous waste, contaminants, or pollutants at, to, or from the site. The Parties to this Agreement expressly reserve all rights, claims, demands, and causes of action they have against any and all other persons and entities who are not Parties to this Agreement, and as to each other for matters not covered hereby.

49. The Applicant reserves the right to seek contribution, indemnity, or any other available remedy against any person other than IDEM found to be responsible or liable for contributions, indemnity, or otherwise for any amounts which have been or will be expended by the Applicant in connection with the site.

50. The IDEM reserves the right to bring an action, including an administrative action, against Applicant for any violations of statutes or regulations except for the specific violations or releases that are being remediated in the Work Plan.

51. Pursuant to IC 13-25-5 (prior to July 1, 1996, IC 13-7-8.9), the IDEM reserves the right to withdraw its approval of the Work Plan at any time during the implementation of the Work Plan if:

- (a) IDEM determines that the Applicant has failed to substantially comply with the terms and conditions of this Agreement or the Work Plan;
- (b) the Applicant declines to implement the Work Plan after being notified of its approval by the IDEM; or

- (c) IDEM determines that a hazardous substance or petroleum has become an imminent or substantial threat to human health or the environment.

Upon withdrawal of its approval, this Agreement shall be terminated and IDEM reserves the right to bring any action to enforce any statute or regulation under Title 13 of the Indiana Code including an action regarding the violations or releases that were the subject of this Agreement.

52. IDEM acknowledges that, pursuant to IC 13-25-5-20(b) (prior to July 1, 1996, IC 13-7-8.9-20(b)), Applicant, upon receipt of the Certificate of Completion, is not liable for claims for contribution concerning matters addressed in the Voluntary Remediation Work Plan.

XIX. ADMINISTRATIVE COSTS

53. Applicant agrees to reimburse IDEM for all of its administrative costs associated with implementation of this agreement. Attachment A contains an itemized list of estimated costs that IDEM expects to incur under this Agreement. The estimated costs may include the preparation of the itemized list of administrative costs. This estimate is not intended to bind IDEM to a maximum cost it is entitled to bill the Applicant under this Agreement. The estimate is merely provided as a courtesy to the Applicant.

54. IDEM shall send periodically an accounting of contractor, subcontractor and laboratory costs to Applicant. Applicant shall pay said amount within thirty (30) days of receipt of the accounting. IDEM shall also send periodically an accounting of IDEM's staff costs to Applicant. Said accounting shall itemize all costs incurred by IDEM for time, salary, benefits and travel costs of IDEM staff personnel and associated indirect costs. Applicant shall pay said amount within thirty (30) days of receipt of the accounting.

55. Checks should be made payable to the Voluntary Remediation Fund and be mailed along with a transmittal letter stating the site name and address to the Indiana Department of Environmental Management; Attention: Cashier; 100 North Senate Avenue; P.O. Box 7060; Indianapolis, Indiana 46207-7060. In addition, a copy of the check and transmittal letter shall be mailed to the IDEM Project Manager.

56. Administrative costs shall include all reasonable costs, direct and indirect, of IDEM's oversight arrangement for this Agreement and the Work Plan including, but not limited to, time, salary, benefits and travel costs of IDEM personnel and its contractors and associated indirect costs, contractor costs, compliance monitoring, including the collection and analysis of split or duplicate samples, inspection of Applicant's activities, site visits, discussions regarding disputes that may arise as a result of this Agreement, review and approval or disapproval of reports, and the costs of dispute resolution. Such costs shall also include the costs incurred by IDEM in having a qualified person oversee the conduct of the Applicant under this Agreement and the Work Plan. In addition, Applicant shall be assessed an additional amount not to exceed ten (10) % of the total administrative costs paid to IDEM. This amount will ensure that the IDEM meets its obligations under IC 13-25-5-22 (prior to July 1, 1996, IC 13-7-8.9-22) and all other expenses not covered above. Said amount must be paid before the Certificate of Completion will be issued by the IDEM.

57. In the event that this agreement is terminated for any reason, Applicant agrees to reimburse IDEM for all of its administrative costs reasonably incurred to the time of termination. IDEM agrees to reimburse Applicant any unused portion of the application fee in accordance with IC 13-25-5-8 (b) (2) (prior to July 1, 1996, IC 13-7-8.9-13 (b) (2)).

XX. COMMUNITY RELATIONS

58. The Applicant will cooperate with IDEM in providing information about the Work Plan to the public. IDEM will give the Applicant reasonable advance notice of and may require the Applicant's or its agent's attendance at any such public meetings it may hold or sponsor at times and locations which are agreed upon by IDEM and the Applicant.

59. A public information file shall be maintained by IDEM at a public repository near the site. Applicant shall be notified of the location of said public place.

60. Before the Commissioner may approve or disapprove the Work Plan, the Commissioner shall provide opportunities for public comment pursuant to IC 13-25-5-11 (prior to July 1, 1996, IC 13-7-8.9-15(b)).

XXI. NOTICE OF BANKRUPTCY

61. As soon as Applicant has knowledge of its intention to file bankruptcy or no later than 7 days prior to the actual filing of a voluntary or involuntary bankruptcy petition, Applicant shall notify IDEM of its intention to file a bankruptcy petition.

XXII. INDEMNIFICATION

62. The Applicant agrees to indemnify and save and hold the State of Indiana, its agencies, departments, agents, and employees, harmless from any and all claims or causes of action arising from, or on account of, acts or omissions of the Applicant, its officers, employees, receivers, trustees, agents, or assigns, in carrying out the activities pursuant to this Agreement.

XXIII. EFFECTIVE DATE AND SUBSEQUENT MODIFICATION

63. The effective date of this Agreement shall be the date on which this Agreement is signed by the Commissioner of IDEM.

64. This Agreement may be amended by mutual agreement of IDEM and the Applicant. Amendments shall be in writing and shall be effective when signed by the Commissioner of IDEM.

XXIV. EXTENSIONS OF TIME PERIODS

65. Any written response shall be deemed timely performed if hand delivered or postmarked by the last day of any time period prescribed herein. Whenever a Party has the right or is required to do some act or make some response within a prescribed period after the service of a notice or other paper on it and

the notice or paper is served upon it by mail, three (3) days shall be added to the prescribed period.

66. Whenever any Party is called upon to respond or otherwise act in a certain number of days, and if the final day occurs on a Saturday, Sunday or legal holiday (whether state or national), such time limitation shall automatically extend to the next business day after such Saturday, Sunday or holiday.

67. Any time periods specified in this Agreement may be extended only by agreement of the Parties.

XXV. TERMINATION AND SATISFACTION

68. The provisions of this Agreement shall be satisfied when IDEM gives the Applicant written notice in the form of a Certificate of Completion that the Applicant has demonstrated to IDEM's satisfaction that all of the terms of this Agreement have been completed, including the selection and implementation of a remedial action. This notice shall exclude the provisions of Section XV, Record Preservation.

69. Nothing in this Agreement shall restrict the State of Indiana from seeking other appropriate relief to protect human health or the environment from pollution or contamination at or from this site not remediated in accordance with this Agreement.

70. After IDEM issues the Certificate of Completion, the Governor shall provide Applicant with a Covenant Not to Sue pursuant to IC 13-25-5-18 (prior to July 1, 1996, IC 13-7-8.9-18). The Covenant Not To Sue shall contain a listing of the specific work and contaminants covered.

XXVI. PRECEDENCE OF AGREEMENT

71. In the event that conflict arises among the terms and conditions of this Agreement, the Statement of Work, or the approved Work Plan, this Agreement shall govern and the terms and conditions hereunder shall determine the Parties' rights and responsibilities.

TECHNICAL RECOMMENDATION:

APPROVED FOR LEGALITY AND FORM:

By: _____
Assistant Commissioner
Office of Environmental Response
IDEM

By: _____
Attorney for IDEM
Office of Legal Counsel

Date: _____

Date: _____

Applicant (type)

Attorney for Applicant (type)

By: _____

By: _____

Title: _____

Title: _____

Date: _____

Date: _____

Approved and adopted by the Indiana Department of Environmental Management

this ___ day of _____, 19 ___.

IDEM Commissioner

REMEDIATION WORK PLAN

The primary purpose of the Remediation Work Plan is to provide a basis for IDEM to evaluate the remedy being proposed for a Voluntary Remediation Program site. In addition, the Remediation Work Plan is subject to a 30-day public notice period, and so serves as a vehicle to inform interested Parties of remedial plans for the site. The Remediation Work Plan also establishes the schedule for implementation of remedial activities, which allows IDEM to coordinate oversight activities with the applicant. Please submit four (4) copies to IDEM for complete review.

1.0 EXECUTIVE SUMMARY

To facilitate review of the Remediation Work Plan, applicants must provide an Executive Summary. The Executive Summary must contain brief statements identifying the sources of contamination; potential exposure pathways; potentially exposed human and ecological populations; additional investigation needs, if applicable; proposed cleanup criteria; the proposed remedy or remedies; and implementation milestones (e.g., start date, treatment system start-up, end date).

Brief statements of the following:

- A. Sources of contamination.
- B. Exposure pathways.
- C. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.).
- D. Need for additional investigation, if applicable.
- E. Proposed cleanup criteria.
- F. Proposed remedial alternative(s).
- G. Implementation milestones (e.g., start date, treatment system start-up date, end date).

2.0 INTRODUCTION

The Introduction must include the site's name and address, a brief description of site operations, and a brief discussion of the site's history, including the events which led to preparation of the Remediation Work Plan. A site location map and site layout drawing must also be included. A U.S. Geological Survey map excerpt may be used as a site location map. The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; and any surface water bodies or water wells on or bordering the property.

The Introduction must also include a summary of Phase II Site Investigation results. The summary must identify and briefly characterize the contaminants of concern (e.g. toxicity, mobility), and their potential sources (e.g. aerial extent, media impacted).

Potentially affected sensitive areas (e.g. wetlands, riparian areas, parks, etc.) and wildlife or aquatic populations must be identified. The summary must also include a brief characterization of site hydrogeology. The vertical and horizontal extent of contamination must be described and shown on a map drawn to the appropriate scale.

2.1 SITE BACKGROUND

2.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.
- C. Site map depicting property lines, building outlines, raw materials and bulk storage, tanks, roads, loading/unloading areas, on-site waste storage, treatment and disposal, surface water bodies, and water supply wells.
- D. Brief summary of the site history and activities leading up to the Work Plan.

2.1.2 SITE DOCUMENTATION

- A. Identification of previous reports prepared for the site.
- B. Description of available data and/or other documentation regarding the site.

2.2 SUMMARY OF SITE INVESTIGATION ACTIVITIES

2.2.1 SOURCES AND EXTENT OF CONTAMINATION

- A. Discussion of potential sources of contamination identified in Phase II Investigation.
- B. Description of contaminants of concern and their concentration levels found in environmental media at the site.
- C. Contaminant characteristics (e.g., toxicity, solubility, mobility, etc.)
- D. Description of the horizontal and vertical extent of contamination in soil, groundwater, surface water, sediment, and air. If historical data is available, contamination trends must be discussed.
- E. Table(s) presenting analysis results for contaminants of concern.

2.2.2 ECOLOGICAL ASSESSMENT RESULTS

- A. Summary of aquatic life, wildlife, and environmentally sensitive areas.
- B. Summary of the potential ecological risks associated with the site.

2.2.3 BASELINE HYDROGEOLOGIC ASSESSMENT RESULTS

- A. Summary of results of baseline hydrogeologic assessment.

3.0 CLEANUP CRITERIA SELECTION

The Voluntary Remediation Program has a three-tiered framework for establishing cleanup levels. "Tier I" cleanup levels are background concentrations in the case of naturally occurring constituents or constituents for which background concentrations have been established through a site-specific background investigation. For constituents with no natural or site-specific background occurrence, Tier I cleanup levels are laboratory detection levels.

"Tier II" cleanup levels are derived from standard equations used in the federal Superfund and Resource Conservation and Recovery Act (RCRA) corrective action programs. "Tier III" cleanup levels are based on a site-specific Risk Assessment performed by the applicant. Different cleanup level options may be

chosen for different contaminants or media at the same site.

Applicants must state the proposed cleanup levels for the voluntary remediation and present the rationale for their selection in the Cleanup Criteria Selection section of the Remediation Work Plan. If calculations are necessary to arrive at the cleanup levels, they must be shown. If Tier III levels are proposed for any contaminants or media, applicants will need to complete the Risk Assessment section of the Plan.

- A. Proposed cleanup criteria for each of the contaminants of concern (identify residential and nonresidential criteria).
- B. Rationale for proposed criteria.

4.0 STATEMENT OF WORK

The Statement of Work must contain a clear statement of remediation objectives. The objectives must address all affected areas, contaminants and media. Applicants must also list the major remediation tasks which will be undertaken.

4.1 OBJECTIVES OF REMEDIAL ACTION

- A. Statement of remediation objectives for all affected media, contaminants, and exposure pathways.

4.2 SUMMARY

- A. List of the work items that are planned for the remediation of contamination at the site.

4.3 SITE SAFETY PLAN

IDEM must be able to verify that site remediation work will be conducted in a safe manner. A Site Safety Plan indicating the precautions which will be taken during remediation must be furnished as part of the Remediation Work Plan. IDEM recommends that applicants follow the Site Safety Plan guidelines provided in [Appendix A](#) (page 47). Remediation work must be conducted in a manner which conforms to the training and other requirements of the Occupational Safety and Health Administration's (OSHA) hazardous waste site worker protection rules in 29 CFR 1910.120 as applicable.

- A. Attach a completed Site Safety Plan.

4.4 QUALITY ASSURANCE PROJECT PLAN

IDEM must also be able to verify that additional investigation work, Risk Assessments, confirmatory sampling and other remediation tasks will be conducted in a manner which will ensure reliable analytical results. Applicants must follow the Quality Assurance Project Plan (QAPP) guidelines provided in [Appendix B](#) (page 51) to prepare a site-specific QAPP for proposed remediation work. The QAPP guidelines contain recommended quality assurance procedures for sample collection and analysis. Any proposed exceptions to standard QAPP procedures must be discussed in the Remediation Work Plan.

- A. Attach a completed Quality Assurance Project Plan.

5.0 RISK ASSESSMENT (IF APPLICABLE, ATTACH TO THE REMEDIATION WORK PLAN)

If the applicant is proposing Tier III cleanup levels for any contaminants, the Remediation Work Plan **must** include a site-specific Risk Assessment Report with proposed cleanup levels that follow the “Risk Assessment Guidance for Superfund,” (RAGS). The Risk Assessment must address site-specific human health risks and may also address ecological risks if warranted. The contaminants to be addressed must be clearly identified. The discussion must include a description of data collection and evaluation techniques, including identification of any additional sampling needs.

If Environmental Fate and Transport modeling is planned, the proposed model(s) must be identified. Proposed exposure assumptions must be clearly stated, and must address future, as well as current land uses. The discussion must also include a summary of what is known regarding potentially exposed populations and exposure pathways.

- A. List of parameters to be addressed by Risk Assessment.
- B. Description of proposed Risk Assessment methodologies (e.g., types of modeling).
- C. Identification of potential pathways of exposure.
- D. Identification of exposure assumptions.
- E. Environmental Fate and Transport data development procedures.
- F. Summary table listing parameters and calculated cleanup levels.

6.0 REMEDIATION PLAN

6.1 ADDITIONAL FIELD INVESTIGATION

If additional sampling or other field work beyond that completed during the Phase II Site Investigation is proposed, applicants must describe the additional tasks and indicate why each is necessary.

- A. Identification of any additional field investigations that will be needed to effectively complete the design of the remediation system.
- B. Reason for the additional investigation.
- C. Complete description of the additional investigation.

6.2 REMEDIATION ALTERNATIVES

IDEM is charged with evaluating the proposed remedy for each Voluntary Remediation Program site. Voluntary Cleanup Program applicants must be able to demonstrate that the remedy(s) represent an effective choice for the site. The selected remedy(s) must be identified, and the rationale for selection discussed. A complete description of the selected remedy must be given, including discussion of the proposed extent of remediation, the anticipated volume of contaminated material, proposed treatment systems, transportation distances, and other relevant factors.

6.2.1 EVALUATION OF REMEDIAL ALTERNATIVES

- A. Screening of potentially applicable technologies including evaluation of technical feasibility, protectiveness of human health and the environment, cost, the need for treatability testing, ability to achieve proposed cleanup criteria, and community acceptance.

6.2.2 RECOMMENDED REMEDIAL ALTERNATIVE(S)

- A. Identification of selected remedial alternative(s).
- B. Rationale for selection of alternative(s).
- C. Description of selected alternative(s) including extent of remediation, anticipated volume of contaminated material, size of major technologies, process parameters, cleanup time frames, transportation distances, and special considerations.

6.3 REMEDIATION SYSTEM

If more than one remedial alternative will be used to address different areas on-site, applicants must describe how the remediation system as a whole will work. A block flow diagram, conceptual sketch or other device should be used to illustrate the components of the proposed remediation system. Major equipment (e.g. pumps, air strippers, in-situ treatment equipment) must be listed. A site map showing the areas to be remediated, and the proposed locations of major equipment must also be provided.

If a treatability study is planned, the proposed study methodology must be discussed. The discussion must include a clear statement of treatability study objectives; the proposed scale of the study (e.g. bench-scale, pilot-scale); data requirements and proposed data evaluation methods; pilot plant start-up, operation and maintenance (if applicable); and the anticipated date the study report will be submitted.

State and local permits are waived for remediation projects being undertaken in accordance with a Voluntary Remediation Agreement, however, the substantive provisions of the permits must be met. Applicants must identify any federal permits necessary in order to complete the proposed remedial activities in the Remediation Work Plan. Proposed disposal arrangements for wastes generated during remediation must be described. Any approvals, hazardous waste manifests or other necessary documentation must be identified.

6.3.1 PROJECT DESCRIPTION

- A. Site map depicting area(s) to be remediated.
- B. Overall description of the remediation system and planned implementation.
- C. Drawing depicting locations of remediation equipment.

6.3.2 TREATABILITY STUDY/WASTE CHARACTERIZATION (IF APPLICABLE)

- A. Objectives of treatability study or waste characterization to be performed.
- B. Description of remedial technologies to be tested and equipment required.
- C. Methodology of treatability study (e.g., bench-scale or pilot-scale).
- D. Data requirements and analytical methods to be employed.
- E. Installation and start-up procedures for pilot plants.
- F. Pilot plant operation and maintenance.
- G. Proposed data analysis and interpretation procedures.
- H. Proposed application of the technology at full scale and identification of limitations/optimum operating conditions.

- I. Statement of intention to submit a report detailing the results of the treatability study.
- J. Description of the review and evaluation of the treatability study results.

6.3.3 PRELIMINARY DESIGN

- A. Conceptual design illustrating the components of the remediation system (e.g., block flow diagram).
- B. List of major equipment to be installed for the remediation system.

6.3.4 PERMIT REQUIREMENTS/DISPOSAL APPROVAL

- A. Identification of federal permit requirements for the remediation system.
Note: State and local permit requirements will be waived.
- B. Waste disposal approvals needed for implementation of the remediation system.

6.4 MONITORING/CONFIRMATION SAMPLING PLAN (Please refer to [Appendix D](#), page 87)

Applicants must include a proposed sampling plan for confirming that cleanup levels have been achieved. For example, if the proposed remedy for contaminated soil is excavation and removal, the sampling plan must identify the proposed number and locations of soil samples to be collected following excavation. The proposed analytical methods to be used on the samples must also be identified.

If intermediate monitoring is proposed, for example, in the case of a treatment system, the plan must also address the proposed monitoring frequencies, parameters, locations and analytical methods. The applicant should notify IDEM at least 3 days in advance of project completion sampling. Advanced notice must be given to IDEM before any confirmatory sampling takes place. This will allow IDEM to observe the sampling activity and possibly obtain duplicate samples.

- A. Description of the monitoring/confirmation sampling to be performed.
- B. Frequency of sampling.
- C. Analytical parameters and methods.

6.5 DATA MANAGEMENT

Depending upon the complexity of the proposed remediation project, additional investigation work, treatment system monitoring and/or confirmation sampling may generate a large volume of data. Well-organized, well-presented data contributes significantly to efficient review and oversight of remediation projects. Applicants should consider and describe how they propose to manage and present the data generated during implementation of the Remediation Work Plan. Tabular formats are preferred wherever possible. The discussion must address the frequency, content and format of progress reports to be submitted to IDEM during implementation of the Plan.

- A. Description of how the monitoring/confirmation sampling data will be documented and reported.
- B. Proposed format of progress reports.

7.0 OPERATION AND MAINTENANCE PLAN (IF APPLICABLE)

If one or more treatment systems are proposed for the site, their operation and maintenance (O&M) must be addressed in the Remediation Work Plan. Applicants should list necessary operation and maintenance tasks, and characterize optimum operating conditions for the system(s). Planned maintenance and replacement events must be identified, and the proposed inspection schedule presented. Potential problems and their proposed remedies should be anticipated. A contingency plan indicating how the applicant plans to respond in the event of a system failure must also be presented.

7.1 NORMAL O&M

7.1.1 SYSTEM OPERATION

- A. List of operation tasks.
- B. List of inspection tasks.
- C. Description of optimum operating conditions.

7.1.2 SYSTEM MAINTENANCE

- A. List of maintenance tasks.
- B. Frequency of maintenance tasks and replacement schedule.
- C. List of maintenance inspection tasks.

7.1.3 INSPECTION SCHEDULE

- A. Schedule for regular operation inspections.
- B. Schedule for regular maintenance inspections.

7.2 POTENTIAL OPERATING PROBLEMS

- A. Description of potential sources of problems or failure of the system.
- B. Description of common remedies of problems or alternatives.

7.3 CONTINGENCY O&M

- A. Description of alternate operation procedures to prevent undue hazard should the system fail.
- B. Notification procedures in the event of system shut-down or failure.
- C. Procedures to follow for system modifications.

8.0 COMMUNITY RELATIONS

The Remediation Work Plan is subject to a 30-day public notice and comment period prior to the Commissioner's decision. If IDEM receives at least one request for a public hearing during this period, a public hearing may also be held, at IDEM's discretion. Applicants may wish to undertake additional public notice activities, such as holding meetings with neighborhood groups or mailing letters to adjacent residents.

If any activities of this kind are planned, the proposed activities must be described, and a tentative schedule outlined. Proposed procedures for gaining off-site access to complete additional investigation work or remediation activities must also be addressed in this section.

8.1 MAILING LISTS

- A. Mailing list of affected residents; interested community groups; and local, state, and national officials (e.g., mayor, local newspaper, county health department, representatives, and senators).
- B. Name and address of local library that will be the repository for the Remedial Work Plan during the public notice period.

8.2 PUBLIC MEETINGS

- A. Discussion of plans to hold public informational meetings about the proposed remediation process.
- B. Format of meetings.
- C. Proposed public meeting schedule and notification procedures.

8.3 INFORMATION BULLETINS

- A. Discussion of plans to prepare and distribute information bulletins regarding the remediation system.
- B. Description of the format and types of information included in the bulletins.

8.4 MEDIA USE

- A. Description of the types of media that will be used to inform the general public (newspaper, radio, etc.).
- B. Description of the type of information that will be released to the media.

9.0 COMPLETION OF REMEDIAL ACTION

Applicants must commit to submission of a Remediation Completion Report when all remedial activities are complete and cleanup levels are achieved. This section must also state the expected future use(s) of the site following remediation.

9.1 COMPLETION REPORT

- A. Statement that a Completion Report detailing the remediation system and confirmation sampling will be submitted upon completion of the remediation to the cleanup criteria.

9.2 FUTURE USE OF SITE

- A. Clear statement of the expected future uses of the site after remediation is completed (e.g., residential or nonresidential).

10.0 SCHEDULE

It is critical that the Remediation Work Plan include a detailed schedule for implementation of the Plan. This will enable IDEM to coordinate implementation oversight activities and the final site inspection with the applicant. The schedule must address all significant remediation milestones (e.g. start date, completion of Risk Assessment and/or treatability studies, equipment ordering, construction start-up, treatment system start-up, etc.), and include a proposed progress reporting schedule. The proposed schedule should either allow sufficient time for review, public notice and approval of the Plan by IDEM before work begins, or be expressed in terms of the anticipated duration of each task, rather than in

calendar terms, so that start-up is contingent upon receiving the approval notice.

- A. Full schedule of the remedial activities planned, including investigation items, selection of remedial alternatives, treatability study report, design, equipment specifications, permit application and/or disposal approval submittal, monitoring/confirmation sampling, progress reports, equipment certification, O&M Plan, community relations activities, and the Completion Report.

11.0 COST ESTIMATE

Applicants should include an estimate of total remediation costs. IDEM will use this information to provide estimates of review and oversight costs and to evaluate site progress.

- A. Written estimate of current costs of completing the remediation and any monitoring to be performed.

REMEDIATION WORK PLAN FOR SITES WHERE PHASE II INVESTIGATION RESULTS ARE BELOW TIER I OR TIER II LEVELS

The primary purpose of the Remediation Work Plan is to provide a basis for IDEM to evaluate the remedy being proposed for a Voluntary Remediation Program site. In addition, the Remediation Work Plan is subject to a 30-day public notice period, and so serves as a vehicle to inform interested Parties of remedial plans for the site. The Remediation Work Plan also establishes the schedule for implementation of remedial activities, which allows IDEM to coordinate oversight activities with the applicant. Please submit three (3) copies to IDEM for complete review.

1.0 EXECUTIVE SUMMARY

To facilitate review of the Remediation Work Plan, applicants must provide an Executive Summary. The Executive Summary must contain brief statements of the following:

- A. Sources of contamination.
- B. Exposure pathways.
- C. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.)
- D. Proposed cleanup criteria.
- E. Proposed remedial alternative(s).

2.0 INTRODUCTION

The Introduction must include the site's name and address, a brief description of site operations, and a brief discussion of the site's history, including the events which led to preparation of the Remediation Work Plan. A site location map and site layout drawing must also be included. A U.S. Geological Survey map excerpt may be used as a site location map. The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; and any surface water bodies or water wells on or bordering the property.

The Introduction must also include a summary of Phase II Site Investigation results. The summary must identify and briefly characterize the contaminants of concern (e.g. toxicity, mobility), and their potential sources (e.g., aerial extent and media impacted).

Potentially affected sensitive areas (e.g. wetlands, riparian areas, parks, etc.) and wildlife or aquatic populations must be identified. The summary must also include a brief characterization of site hydrogeology. The vertical and horizontal extent of contamination must be described and shown on a map drawn to the appropriate scale.

2.1 SITE BACKGROUND

2.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.

- C. Site map depicting property lines, building outlines, raw materials and bulk storage, tanks, roads, loading/unloading areas, on-site waste storage, treatment and disposal, surface water bodies, and water supply wells.
- D. Brief summary of the site history and activities leading up to the Work Plan.
- E. Map depicting facilities and land use within one mile radius (e.g. agricultural, commercial, residential, etc.)

2.1.2 SITE DOCUMENTATION

- A. Identification of previous reports prepared for the site.
- B. Description of available data and/or other documentation regarding the site.

2.2 SUMMARY OF SITE INVESTIGATION ACTIVITIES

2.2.1 SOURCES AND EXTENT OF CONTAMINATION

- A. Discussion of potential sources of contamination identified in Phase II Investigation.
- B. Description of contaminants of concern and their concentration levels found in environmental media at the site.
- C. Contaminant characteristics (e.g., toxicity, solubility, mobility, etc.)
- D. Description of the horizontal and vertical extent of contamination in soil, groundwater, surface water, sediment, and air. If historical data is available, contamination trends must be discussed.
- E. Table(s) presenting analysis results for contaminants of concern.

2.2.2 ECOLOGICAL ASSESSMENT RESULTS

- A. Summary of aquatic life, wildlife, and environmentally sensitive areas.
- B. Summary of the potential ecological risks associated with the site.

2.2.3 BASELINE HYDROGEOLOGIC ASSESSMENT RESULTS

- A. Summary of results of baseline hydrogeologic assessment.

3.0 CLEANUP CRITERIA SELECTION

The Voluntary Remediation Program has a three-tiered framework for establishing cleanup levels. "Tier I" cleanup levels are background concentrations in the case of naturally occurring constituents or constituents for which background concentrations have been established through a site-specific background investigation. For constituents with no natural or site-specific background occurrence, Tier I cleanup levels are laboratory detection levels. "Tier II" cleanup levels are derived from standard equations used in the federal Superfund and Resource Conservation and Recovery Act (RCRA) corrective action programs. "Tier III" cleanup levels would require following the full Remediation Work Plan Guidance.

Applicants must state the proposed cleanup levels for the voluntary remediation and present the rationale for their selection in the Cleanup Criteria Selection section of the Remediation Work Plan. If calculations

are necessary to arrive at the cleanup levels, they must be shown.

- A. Proposed cleanup criteria for each of the contaminants of concern (identify residential and nonresidential criteria).
- B. Rationale for proposed criteria if different than "Tier II" levels.

4.0 STATEMENT OF WORK

The Statement of Work must contain a clear statement of remediation objectives. The objectives must address all affected areas, contaminants and media.

4.1 OBJECTIVES OF REMEDIAL ACTION

- A. Discussion of the rationale of why remedial activities will not be conducted.

5.0 COMMUNITY RELATIONS

The Remediation Work Plan is subject to a 30-day public notice and comment period prior to the Commissioner's decision. If IDEM receives at least one request for a public hearing during this period, a public hearing may also be held, at IDEM's discretion. Site owners and operators may wish to undertake additional public notice activities, such as holding meetings with neighborhood groups or mailing letters to adjacent residents.

If any activities of this kind are planned, the proposed activities must be described, and a tentative schedule outlined. Proposed procedures for gaining off-site access to complete additional investigation work or remediation activities must also be addressed in this section.

5.1 MAILING LISTS

- A. Mailing list of affected residents; interested community groups; and local, state, and national officials (e.g., mayor, local newspaper, county health department, representatives, and senators).
- B. Name and address of local library that will be the repository for the Remedial Work Plan during the public notice period.

5.2 PUBLIC MEETINGS

- A. Discussion of plans to hold public informational meetings about the proposed remediation process.
- B. Format of meetings.
- C. Proposed public meeting schedule and notification procedures.

5.3 INFORMATION BULLETINS

- A. Discussion of plans to prepare and distribute information bulletins regarding the remediation system.
- B. Description of the format and types of information included in the bulletins.

5.4 MEDIA USE

- A. Description of the types of media that will be used to inform the general public (newspaper, radio, etc.).

- B. Description of the type of information that will be released to the media.

6.0 FUTURE USE OF SITE

This section must state the expected future use(s) of the site.

- A. Clear statement of the expected future uses of the site (e.g., residential, nonresidential, commercial, and recreational).

7.0 COST ESTIMATE

Applicants must include an estimate of total remediation costs. IDEM will use this information to provide estimates of review and oversight costs and to evaluate site progress.

- A. Written estimate of site costs.

REMEDIATION COMPLETION REPORT

The primary purpose of the Remediation Completion Report is to document the completion of the activities identified in the approved Remediation Work Plan. The Report also provides important information about the performance of the remediation system, and indicates how the site was restored following remediation. Please submit two (2) copies to IDEM for complete review.

Upon receipt of the Remediation Completion Report, IDEM will schedule a site inspection. If the report and site inspection confirm that remediation is complete, IDEM will issue a Certificate of Completion, and the Governor's Office will issue a Covenant Not to Sue covering the remediated areas and activities.

1.0 INTRODUCTION

The Introduction section of the Remediation Completion Report must include the site's name and address, a brief description of site operations, and a brief discussion of the site's history, including the events which led to participation in the Voluntary Cleanup Program. A site location map and site layout drawing must also be included. A U.S. Geological Survey map excerpt may be used as a site location map.

The site layout drawing must indicate property boundaries; building outlines; the locations of any aboveground or underground storage tanks; any exterior areas where raw materials, wastes, or products are loaded or unloaded; any on-site waste storage, treatment or disposal areas; surface water bodies or water wells on or bordering the property; remediated areas; and the location(s) of major remediation equipment.

- A. Brief overview of the purpose of this report and the events leading up to it.
- B. Brief summary of the report contents.

1.1 SITE BACKGROUND

1.1.1 SITE LOCATION AND HISTORY

- A. Facility name and address.
- B. Facility description.
- C. Brief description of site history.
- D. Site map(s) depicting property lines, building outlines, raw materials and bulk storage, tanks, roads, loading/unloading areas, work areas, surface water bodies, water supply wells, soil borings, monitoring wells, other sampling locations, and other remediation equipment.

1.1.2 SITE DOCUMENTATION

- A. List of previous reports regarding the site.
- B. Description of available data and/or other documentation regarding the site.

2.0 REMEDIAL ACTION

2.1 PROJECT DESCRIPTION SUMMARY

The Remediation Completion Report must include a brief summary of the remediation project. The summary must include a list or brief description of the major remedial activities undertaken; a discussion

of the amounts and disposal arrangements for remediation wastes; and the time required to complete the project.

- A. Summary of remedial activities performed at the site.
- B. Discussion of wastes generated during remedial activities including totals and final disposition.
- C. Description of the time required to achieve the full remediation.

2.2 REMEDIATION SYSTEM DETAILS

Applicants must evaluate the overall performance of the remediation system, noting any significant problems which occurred and how they were addressed. The procedures used to measure and document system performance must be described. The discussion should include a block flow diagram or other conceptual illustration of the system as installed, and a list of the major equipment used or installed. If any equipment was or will be dismantled and/or removed from the site following use, a discussion of decontamination procedures must also be included.

2.2.1 EQUIPMENT USED/INSTALLED

- A. Block flow diagram or description of remediation system as installed.
- B. List of the major equipment used and/or installed for the remediation system.

2.2.2 DECONTAMINATION PROCEDURES (if applicable)

- A. Description of the procedures used to decontaminate equipment.
- B. Description of decontamination verification sampling.
- C. Waste disposal.

2.2.3 SYSTEM OPERATION AND DOCUMENTATION

- A. Description of the operation of the remediation system.
- B. Evaluation of overall effectiveness of the system.
- C. Description of the documentation procedures followed in evaluating the system operation.
- D. Discussion of problems encountered during the remediation and how they were addressed.

2.3 CONFIRMATION SAMPLING (Please refer to [Appendix D](#); page 87)

The Remediation Completion Report must include a description of confirmatory sampling procedures as they were actually implemented. The actual number and locations of confirmatory samples must be shown on a map. Sample analysis results must be presented in tabular form, addressing all sampling locations, affected media and contaminants. The name, address and telephone number of the laboratory (or laboratories) which performed the analyses must be identified. Copies of laboratory reports and chain-of-custody forms should be attached as Appendices.

Applicants should explicitly compare confirmatory sampling results with the agreed upon cleanup levels, preferably in tabular format.

2.3.1 DATA COLLECTION AND EVALUATION

- A. Description of confirmatory sample, the collection procedures, and/or other measures used to confirm that cleanup has been completed.
- B. Confirmatory sample location map.
- C. Rationale for sample locations and number of samples.
- D. Description of how confirmatory data was evaluated.
- E. Chain-of-Custody Forms attached.

2.3.2 SAMPLE ANALYSIS RESULTS

- A. Tabulated and/or graphical representation of results (affected media, contaminants, concentrations.)
- B. Laboratory reports attached (in Appendix).
- C. List of analytical methods used and associated parameters.
- D. Name, address, and phone number of laboratory performing the analyses.

2.3.3 COMPARISON OF DATA TO CLEANUP CRITERIA

- A. Table comparing confirmation sample results to cleanup criteria.
- B. Discussion of sample results compared to cleanup criteria, demonstrating that acceptable levels have been attained.

2.4 SITE RESTORATION (if applicable)

Site owners and operators must indicate how disturbed areas of the site have been or will be restored following remediation. For example, excavated areas should be backfilled with clean soil and repaved or reseeded as soon as possible.

- A. Description of how the site was restored following remediation activities.
- B. Site map depicting the conditions following remediation and restoration activities.

APPENDIX A: HEALTH AND SAFETY PLAN OUTLINE**GENERIC HASP OUTLINE: To comply with OSHA (29 CFR 1910.120(b))****INDEX****LIST OF ACRONYMS****CHAPTER 1: INTRODUCTION**

Defines general applicability and general responsibilities with respect to compliance with health and safety programs.

CHAPTER 2: KEY PERSONNEL/IDENTIFICATION OF HEALTH AND SAFETY OFFICER**SITE SUPERVISOR****KEY ORGANIZATIONS****HEALTH AND SAFETY OFFICER****ALTERNATE HEALTH AND SAFETY OFFICER****ORGANIZATIONAL RESPONSIBILITIES**

List the personnel and organizations that are critical to the planned activities at the site.

CHAPTER 3: TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS**HISTORICAL REFERENCES****SITE NARRATIVE****RESPONSE ACTIVITY****TASK/CHEMICAL SELECTION****LEVEL OF PROTECTION****CHEMICAL HAZARD TEXT**

Simple risk analyses for each site task can be conducted based on the chemical contaminants of concern, the affected media, concentrations, and potential routes of exposure. These elements are essential to any analysis of health risks. OSHA-PELs and IDLH levels should be provided at a minimum for compounds, which have the potential to become airborne.

The HASP also must incorporate some safety risk analyses to address anticipated on-site operations. It should be kept in mind that certain field operations may be less safe when conducted at a hazardous waste site than if conducted in a more conventional environment. Methods and procedures for reducing safety hazards must be provided in the HASP.

CHAPTER 4: PERSONNEL TRAINING REQUIREMENTS

Provides information on the training required for field personnel. This information is consistent with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response. The employee's initial health and safety training, annual health and safety refresher training, on-the-job training (where applicable), first-aid training, CPR training, and other training relevant to the performance of hazardous waste site operations must be indicated in the HASP for all individuals

involved in on-site activities.

CHAPTER 5: PERSONAL PROTECTIVE EQUIPMENT TO BE USED

Describes the general requirements of the OSHA designated levels of protection, and the specific levels of protection required for each task at the site. Identify the types of personal protective equipment that will be used for each task.

Engineering controls and work practices should be first explored as methods to protect workers before personal protective equipment is used. The OSHA standard describes PPE ensembles as Level A, B, C, and D. PPE ensembles themselves may create additional hazards such as heat stress under extreme conditions. The HASP will need to include a written PPE program specific to site operations that addresses site hazards, duration of site activity, limitations of PPE during temperature extremes, and PPE selection, use, maintenance and storage, training and proper fitting, donning and doffing procedures, inspection, and in-use monitoring. Depending on what the designated level of protection (determined in Chapter 3) is, you will need to specify the material type to be used for inner gloves, the boots, and the outer garments.

CHAPTER 6: MEDICAL SURVEILLANCE REQUIREMENTS

Defines the medical surveillance programs designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions prior to potential exposures. Medical monitoring is required for those personnel who potentially are exposed to hazardous substances in the field and who wear respirators 30 days or more in a year. The program must include initial and periodic medical examinations, examinations upon termination of employment, and medical record keeping.

CHAPTER 7: FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING

Addresses the monitoring that will be performed during site activities. The purpose of air monitoring is to identify and quantify airborne contaminants. Initial screening for identification is often qualitative, using real-time air monitoring equipment. A comprehensive, site-specific air monitoring program must evaluate the exposure potential of all identified and suspected chemical contaminants that could result from all site activities. Typically, such a program consists of two types of air monitoring. First, OSHA has published specific personal exposure monitoring requirements for 23 chemical substances including benzene and formaldehyde. The site-specific air monitoring program must meet any applicable requirements as described therein. The program must characterize representative personal exposures. This is referred to as Personal Air Monitoring.

Second, the program must describe real time air monitoring protocols using direct reading instruments for each site activity as appropriate. These monitoring protocols must describe the frequency and location of all real-time monitoring activity, based upon the nature of the site activity. Periodic real-time monitoring must be performed, at a minimum, whenever site work begins, operations change, work begins on a different portion of the site, any invasive site activity begins, contaminants other than those previously identified are being handled, personnel begin to handle obviously contaminated materials or

personnel are handling leaking drums or containers. Monitoring efforts should focus on personnel most likely to receive the highest exposures and on all personnel likely to be exposed to any substance above the OSHA-Permissible Exposure Limit (OSHA-PEL).

CHAPTER 8: SITE CONTROL MEASURES

A site control program is required by 29 CFR 1910.120(d). It should include a site map, work zones, site communications, safe work practices, individuals qualified to perform CPR and identification of the nearest medical assistance. The "buddy system" should be used throughout site operations.

CHAPTER 9: DECONTAMINATION PLAN

Decontamination involves the safe removal of chemical contaminants from employees and equipment. Decontamination procedures should be chosen to match the anticipated contaminants for the site and be monitored by the site health and safety officer.

CHAPTER 10: EMERGENCY RESPONSE/CONTINGENCY PLAN

Hazardous waste sites can present high hazard environments. Therefore, a program addressing potential emergency situations must be included in the HASP. Such a contingency plan should be communicated to employees on-site through the HASP, as well as through safety meetings and briefings. The emergency response plan portion of the HASP should be sufficiently detailed to insure prompt, safe evacuation of all employees from the site in the event of an emergency. This section will need to address such elements as pre-emergency planning, coordination with local emergency response officials, personnel roles, lines of authority, communication, emergency recognition and prevention, safe distances, site control and security, evacuation routes and procedures, decontamination procedures not covered in other parts of the HASP, emergency medical treatment and first aid, emergency alerting and response procedures, PPE and emergency equipment (e.g., escape packs), site topography, layout, and a method to determine prevailing weather conditions.

CHAPTER 11: CONFINED SPACE ENTRY PROCEDURES

If confined space entries are anticipated during site activities, then confined space entry procedures will need to be detailed in the HASP. Entry into an abandoned building, storage vessel, pit, or any other structure which is not designed for human occupancy and has limited means of entry and exit are examples of confined space entries. OSHA's final confined space entry standard (January 1993) would apply.

CHAPTER 12: SPILL CONTAINMENT PROGRAM

In case of a spill or release of a hazardous chemical on-site, the HASP should contain detailed information in a spill containment program. Though not complete, some of the elements that may need to be addressed in the spill containment program include:

Drum and container storage
Drum and container handling
Opening of drums and containers
Material Handling equipment
Radioactive wastes
Shock sensitive wastes
Laboratory waste packs
Sampling of drum and container contents
Shipping and transport of drums and containers
Spill response procedures

CHAPTER 13: HAZARD COMMUNICATION

Standard to be followed is listed in 29 CFR 1910.1200, Hazard Communication. All employees should be briefed on the hazard communication program and have a written copy for review.

APPENDIX B: QUALITY ASSURANCE PROJECT PLAN (QAPP)

The Voluntary Remediation Program (VRP), was initiated to allow responsible and potentially responsible Parties the opportunity to have a documented record of remediation efforts towards the cleanup of petroleum and hazardous substances that have been released into the environment. To better serve applicants in the program, the Indiana Department of Environmental Management (IDEM), has provided this model Quality Assurance Project Plan (QAPP). The purpose of this document is to set guidelines for meeting the important parameters necessary to produce information that is technically and legally sound.

The following is a model QAPP. In producing a QAPP, we suggest that you follow this format as closely as possible. This model is intended to be usable for the preparation of a QAPP for all types of sites.

It should be noted that some criteria in this model are required for the VRP, if the Covenant Not to Sue is to remain a viable result; others are recommended or suggested. Along with quite a bit of "boiler-plate" language, this model contains site-specific example language from previously approved QAPPs. This example language is intended as a guide to the QAPP writer, to show the level of detail that is typically needed to gain IDEM approval. The portions of the mini-QAPP which are example language are indicated in regular print. During preparation of a site-specific QAPP, these portions should, of course, be deleted and replaced with the pertinent information for your site. Some of the language in this QAPP is applicable to a broad range of sites, and may be considered "boiler-plate". "Boiler-plate" language is indicated by a dark background, such as you see here. The "boiler-plate" language should be of wide-ranging applicability, and has been pre-approved by the Region V Quality Assurance Section. General notes are indicated in **bold print**.

INTRODUCTION

The Indiana Department of Environmental Management (IDEM) requires that all environmental monitoring and measurement efforts participate in a centrally managed quality assurance (QA) program.

Any Party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and document. To ensure the responsibility is met uniformly, each Party must prepare a written QA Project Plan (QAPP) covering each project it is to perform.

This QAPP presents the organization, objectives, functional activities and specific quality assurance (QA) and quality control (QC) activities associated with the Remedial Investigation/Feasibility Study (RI/FS) (or RD/RA, etc.) for the ____ site. This QAPP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain of custody, and laboratory (and field) analysis.

All QA/QC procedures will be in accordance with applicable professional technical standards, IDEM requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by _____ in accordance with all IDEM QAPP guidance documents and this model

QAPP. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAMS-005-80), and the Region V Model QAPP (1991).

On the next few pages is a listing of commonly used terms and acronyms to assure that the terms utilized are common to all Parties using this model.

QUALITY ASSURANCE/QUALITY CONTROL TERMS AND ACRONYMS

The following is an alphabetical list of definitions for terms and acronyms encountered in the QA/QC process or in interactions with organizations performing sampling, laboratory, or regulatory functions. Most, but not all, are referred to in the Guidelines, below. Those not used are included for informational purposes.

ACCURACY	The closeness of agreement between an observed value and an accepted reference value.
ACS	American Chemical Society.
APPENDIX VIII	RCRA Hazardous Constituents List. 40 CFR 261, Appendix VIII.
APPENDIX IX	RCRA Groundwater Monitoring List. 40 CFR 264, Appendix IX.
ARARS	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials. Organization which develops and publishes standard methods of analysis and standards for materials and procedures. Also refers to standards published by society.
BATCH	A group of samples of the same matrix from the same site, not to exceed twenty, and which are processed as a unit at the laboratory. If the total number of samples of a particular matrix from a site number more than twenty, each group of twenty or fewer samples is treated as a separate batch.
BIAS	The deviation, due to matrix effects, of the measured value of an analyte from the "true" value. In the laboratory this is determined from the difference between the measured value of the analyte and the known spiked amount.
BLANK	Special "samples" analyzed to determine if all or a portion of an analyte detected in an environmental sample is the result of external contamination due to handling or other factors in the field or the laboratory, and not actually representative of site conditions. See EQUIPMENT BLANK, FIELD BLANK, METHOD BLANK, AND TRIP BLANK.
BNA	Base-Neutral-Acid Extractables. (Semi-volatile organic compounds)

CALIBRATION	Routine QC procedures performed daily or more frequently to maintain the accuracy of analytical instruments or measuring equipment by adjusting instrument response to solutions of known concentrations or to known conditions to the appropriate value; preparation of analytical curve.
CALIBRATION STANDARD	Standards prepared by successive dilution of a standard solution working standards covering the full concentration range required, and expected to be seen in the samples, for the organic or inorganic analytical method. Must be prepared using the same type of acid or solvent used to prepare samples for analysis.
CCC	Calibration Check Compound.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended. (Superfund)
CONTINUING CALIBRATION	Analytical standard run periodically, as specified by method, to verify calibration of system.
CLP	U.S. EPA's Contract Laboratory Program. Refers to laboratory specifications, analytical methods, and QA/QC protocols required for Superfund and related activities.
CRDL	Contract Required Detection Limit. Method detection limit required for a given analyte in a given matrix in the CLP SOW; generally refers to inorganic analysis.
CRQL	Contract Required Quantitation Limit. Similar to CRDL but for organic analysis.
CONTROL SAMPLE	A QC sample introduced into a data collection process to monitor the performance of the system.
DATA QUALITY OBJECTIVES	The quality of data and documentation required to support decisions made in the various phases of the data collection or clean-up project (e.g., screening, characterization, risk assessment, and monitoring). They are dependent on the end uses of the data to be collected and are expressed in terms of objectives for precision, accuracy, bias, and comparability.
DL	Detection Limit
DQOs	Data Quality Objectives. (See Above.)
DUPLICATE	A split sample or an independent second sample taken from the same sample location for the purpose of documenting precision. See FIELD DUPLICATE,

MATRIX DUPLICATE, and MATRIX SPIKE DUPLICATE.

EQUIPMENT BLANK	Also called the Equipment Rinsate. A sample of analyte-free reagent water which has been used to rinse the sampling equipment. It is collected after completion of decontamination and prior to sampling at the next sample location. It is used to document adequate decontamination: to ensure that analytes from one sample location have not contaminated a sample from the next location.
FIELD BLANK	Analyte-free reagent water taken to the sampling site, transferred into a sample container on site and then analyzed by the laboratory for the same parameters as the investigative samples. This sample is used to check for procedural contamination of samples.
FIELD DUPLICATE	Independent samples which are collected from the same location or source, as closely as possible to the same point in space and time. They are stored in separate containers and analyzed separately for the purpose of documenting the precision of the sampling process. (Laboratory variability will also be introduced into the samples' results.)
FSP	Field Sampling Plan. Site-specific plan detailing sampling rationale and protocols and analyses planned per sample type.
HAZARDOUS CONSTITUENT	Compound or element designated as a constituent of hazardous waste in the RCRA program and listed in 40 CFR 261, Appendix VIII.
HAZARDOUS SUBSTANCE	Compound or element listed in CERCLA Hazardous Substance List, 40 CFR 302.4.
HAZARDOUS WASTE	Any solid waste determined to be a hazardous waste, pursuant to 40 CFR 261.3, under RCRA Subtitle C.
HOLDING TIME	Elapsed time, expressed in days, from the date of sampling until the date of analysis.
INTERFERENCE	An element, compound, or other matrix effect present in a sample which interferes with detection of a target analyte leading to inaccurate concentration results for the target analyte.
INTERNAL STANDARDS	Known compounds of known concentration added to a sample by the laboratory prior to analysis to assist in quantifying the target analytes.
LABORATORY CONTROL	A known matrix spiked with compounds representative of the target analytes and used to document SAMPLE laboratory performance.

MATRIX	The substrate containing the analyte of interest. Examples are soil, sediment, sludge, groundwater, surface water, drinking water, and air. Sometimes matrix types are condensed to soils, waters, and air.
MATRIX DUPLICATE	A duplicate field sample used to document the DUPLICATE precision of sampling and homogeneity of a given sample matrix. (Same as field duplicate).
MATRIX SPIKE	An aliquot of sample spiked with a known concentration of target analytes for the purpose of documenting the bias of a method in a particular matrix. The spiking occurs prior to sample preparation and analysis.
MATRIX SPIKE DUPLICATE	A split sample, both portions of which are spiked with identical concentrations of target analytes, for the purpose of determining the bias <i>and precision</i> of a method in a particular sample matrix.
MCL	Maximum Contaminant Level. Maximum concentration of a contaminant allowed in drinking water systems by the National Primary Drinking Water regulations: 40 CFR 141.11 (inorganic chemicals) and 141.12 (organic chemicals).
METHOD BLANK	An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank is carried through the complete sample preparation and analytical procedure and is used to document contamination resulting from the analytical process. (Also called Reagent Blank or Preparation Blank.)
METHOD DETECTION	The minimum concentration of an analyte that can be measured and reported with 99% confidence. It is determined by analysis of a samples with known concentrations at various dilutions. This limit is matrix specific. (i.e., soils, vs. waters)
MS/MSD	Matrix Spike/Matrix Spike Duplicate. (See above).
ORGANIC-FREE	For volatile and semi-volatile analysis. Water REAGENT WATER prepared so that interferants or contaminants are observed below the method detection limit of the compounds of interest. Methods of preparation include passing tap water through a carbon filter containing about one pound of activated carbon or using a water purification system to generate organic-free deionized water.
PRECISION	The agreement among a set of replicate measurements without consideration of the "true" or accurate value; variability between measurements of the same material for the same analyte.
PREPARATION	The process used by the lab to prepare a sample for analysis.

PRIORITY POLLUTANTS	List of inorganic and organic analytes commonly tested for in the NPDES (water) program.
PROJECT	Single or multiple data collection activities (or remediation activities) that are related through the same planning sequence.
QA	Quality Assurance. (See below.)
QAPP	Quality Assurance Project Plan.
QUALITY	The management procedures and controls used to ASSURANCE ensure data quality through the sampling and analysis stages. Sometimes refers to the entire QA/QC program.
QC	Quality Control. (See below.)
QUALITY CONTROL	The day-to-day operational measures used in the CONTROL field during sampling and in the laboratory during analysis to ensure data quality.
RAS	Routine Analytical Services. Analytical procedures used exactly as written in the CLP SOW and used in the Superfund program.
RCRA	The Resource Conservation and Recovery Act of 1976, as amended.
REAGENT BLANK	Same as Method Blank. (See above.)
REAGENT GRADE	Chemical reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society. Also referred to as Analytical reagent (AR) grade and ACS reagent grade.
REAGENT WATER	For analysis of inorganics. Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water.
REFERENCE	A material containing known quantities of target MATERIAL analytes in solution or in a homogeneous matrix. Sometimes referred to as a "standard." It is used to document the bias of the analytical process.
RELATIVE PERCENT DIFFERENCE	A measurement of precision which compares the measurement of a target analyte, spiked analyte, or surrogate to an identical measurement in a replicate sample. Especially used when sample population is small.
SAP	Sampling and Analysis Plan. Site-specific plan detailing sampling rationale and protocols and analyses planned per sample type.

SAS	Special Analytical Services. Used by the CLP to denote non-standard or specialized analytical protocols, perhaps requiring method development.
SOW	Statement of Work. A detailed procedure.
SPIKE	A known volume of a solution of target analyte(s) of known concentration added to a sample before analysis and used to document bias and accuracy in inorganic analyses. Also called analytical spike.
SPLIT SAMPLES	Aliquots of sample taken from the same container and analyzed independently, usually after mixing or compositing. They are used to document precision.
STANDARD ADDITION	The practice of adding a known amount of an analyte to a sample immediately prior to analysis used to evaluate interferences.
STANDARD CURVE	A plot of concentrations of known analyte standards versus the instrument response to the analyte.
SURROGATE	An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Used to document bias and accuracy in organic analyses.
SVOA	Semi-Volatile Organic Analysis.
SVOC	Semi-Volatile Organic Compound. BNA; extractable organic compound.
SW-846	U.S. EPA "Test Methods for Evaluating Solid Waste," 1986 (Third Edition), plus Updates. Standard methods of analysis, sampling techniques, and QA/QC procedures.
TAL	Target Analyte List. Inorganic elements (metals) and "miscellaneous" analytes (cyanide, sulfide) included in the CLP SOW ILM02.1 as Routine Analytical Services.
TCL	Target Compound List. Organic compounds (VOCs, SVOCs, PCBs, Pesticides) included in the CLP SOW OLM01.8 as Routine Analytical Services.
TRIP BLANK	A sample of analyte-free media (organic-free reagent water) taken from the laboratory to the sampling site and returned to the laboratory unopened and analyzed. It is used to document contamination resulting from migration of volatile organic compounds during shipping and field handling.
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

MODEL QAPP**1. TABLE OF CONTENTS**

<u>SECTION</u>	<u>PAGE</u>
TITLE PAGE	
TABLE OF CONTENTS	
INTRODUCTION	
1. PROJECT DESCRIPTION	
1.1 SITE/FACILITY LOCATION HISTORY/BACKGROUND INFORMATION	
1.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS	
1.3 PROJECT SCOPE AND OBJECTIVE	
1.4 SAMPLE NETWORK DESIGN AND RATIONALE	
1.5 PARAMETERS TO BE TESTED AND FREQUENCY	
1.6 INTENDED DATA USAGE AND DATA QUALITY OBJECTIVES	
1.7 PROJECT SCHEDULE	
2. PROJECT ORGANIZATION AND RESPONSIBILITY	
3. QUALITY ASSURANCE OBJECTIVE FOR MEASUREMENT DATA	
3.1 LEVEL OF QUALITY CONTROL EFFORT	
3.2 ACCURACY, PRECISION AND SENSITIVITY OF ANALYSIS	
3.3 COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY	
4. SAMPLING PROCEDURES	
5. SAMPLE CUSTODY	
5.1 FIELD SPECIFIC CUSTODY PROCEDURES	
5.1.1 INITIATION OF CHAIN OF CUSTODY FIELD PROCEDURES	
5.1.2 FIELD LOGBOOKS/DOCUMENTATION	
5.1.3 TRANSFER OF CUSTODY AND SHIPMENT PROCEDURES	
5.2 LABORATORY CHAIN OF CUSTODY PROCEDURES	
5.3 FINAL EVIDENCE FILE CUSTODY PROCEDURE	
6. CALIBRATION PROCEDURES AND FREQUENCY	

- 6.1 FIELD INSTRUMENTS/EQUIPMENT
- 6.2 LABORATORY INSTRUMENTS
- 7. ANALYTICAL PROCEDURES
 - 7.1 NON-CONTRACT LABORATORY PROGRAM ANALYTICAL METHODS
 - 7.2 FIELD SCREENING ANALYTICAL PROTOCOL
 - 7.3 LABORATORY PROCEDURES
- 8. INTERNAL QUALITY CONTROL CHECKS
 - 8.1 FIELD MEASUREMENTS
 - 8.2 LABORATORY ANALYSIS
- 9. DATA REDUCTION, VALIDATION, AND REPORTING
 - 9.1 DATA REDUCTION
 - 9.2 DATA VALIDATION
 - 9.3 DATA REPORTING
- 10. PERFORMANCE AND SYSTEM AUDITS
 - 10.1 INTERNAL AUDITS OF FIELD ACTIVITY
 - 10.2 INTERNAL LABORATORY AUDIT
 - 10.3 EXTERNAL FIELD AUDIT
 - 10.4 EXTERNAL LABORATORY AUDIT
- 11. PREVENTIVE MAINTENANCE
 - 11.1 ROUTINE PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES
 - 11.2 FIELD INSTRUMENTS/EQUIPMENT
 - 11.3 LABORATORY INSTRUMENTS
- 12. SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS
 - 12.1 FIELD MEASUREMENT DATA
 - 12.1.1 PRECISION
 - 12.2 LABORATORY DATA
 - 12.2.1 PRECISION
 - 12.2.2 ACCURACY
 - 12.2.3 COMPLETENESS
 - 12.2.4 SENSITIVITY
- 13. CORRECTIVE ACTIONS

- 13.1 SAMPLE COLLECTION/FIELD MEASUREMENT
- 13.2 LABORATORY ANALYSIS

14. QUALITY ASSURANCE REPORTS TO MANAGEMENT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS/ABBREVIATIONS

1.0 PROJECT DESCRIPTION. The project description should include or reference the following: (A technical person unfamiliar with the project must be able to understand what you have written.)

- Statement of the decision to be made or the question to be answered,
 - Description of the site, facility, process, or operating parameters to be studied,
 - Anticipated uses of the results,
 - A list of all measurements to be performed,
 - A project schedule, indicating when samples are expected to be submitted to the laboratory,
 - A summary table covering the following for each sampling location:
 - Type of sample (air, water, soil, etc.)
 - All measurements planned for each sample
 - A list of all measurements to be performed, differentiating, where applicable, the critical measurements (those necessary to achieve project objectives), from the non-critical measurements.
- A. A narrative describing site history, operation, and background information, including knowledge of past spills or releases, and regulatory history should be prepared. Past data collections efforts, environmental investigations, or remediation activities should be included. This includes a general description of contamination suspected at the site and a general summary of previous analytical results. A detailed map of the facility and a map of the area in which the facility is located with the facility marked should be included.
- B. Statement of the purpose and scope of the project should be made: the decision to be made, question to be answered, or problem to be solved by the data collection effort, regarding type or level of contamination.
- C. A list of all measurements to be performed should be provided, including a project schedule; indicating when samples are expected to be submitted to the laboratory.
- D. A summary table should be provided for each sampling location. These tables should include: a listing of the total number of samples (including primary samples, and quality control samples) type of sample matrix (air, water, soil, etc.) all analysis planned for each sample differentiating critical measurements, and DQO level. A detailed map must be provided, which clearly identifies each sample location by the unique sample number.
- E. Data Quality Objectives (DQOs) should be identified. What are the anticipated end uses of data generated? (e.g., screening, characterization, risk assessment, etc.) What analysis will accurately and adequately identify the contaminants of concern? Will the analysis selected be able to achieve quantitation limits less than or equal to the target cleanup levels? For these purposes, the following DQO have been developed:

Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to ARARs, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench scale tests). These types of data include those generated on-site through the use of HNu, pH, conductivity, and other real-time monitoring equipment at the site.

Field Analyses (DQO Level 2): This provides rapid results and better quality than in Level 1. This level may include mobile lab generated data depending on the level of quality control exercised.

Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation).

Confirmational (DQO Level 4): This provides the highest level of data quality and is used for purposes of risk assessment, evaluation of remedial alternatives and verification that cleanup standards have been met. These analyses require full analytical and data validation procedures in accordance with EPA recognized protocol.

Non-Standard (DQO Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY.

This section should include:

- A. A detailed organizational chart showing management structure and lines of communication to be used for this project.
- B. A brief discussion of project organization and responsibilities.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

Site specific conditions, especially known or suspected releases of contaminants, will determine the exact parameters to be measured at a particular site. This section should include the following:

- A. Summary table and/or discussion of quantitative QA objective
 - i. method of analysis number
 - ii. parameters to be analyzed for
 - iii. practical quantitation limit for each matrix (PQL)
 - iv. precision
 - v. accuracy
 - vi. completeness (as required to meet a specific) statistical level of confidence
- B. Discussion of qualitative QA objective
 - i. representativeness
 - ii. comparability

For purposes of disposal of contaminated media, VRP applicants should also be prepared to perform RCRA characteristic analyses for ignitability, corrosivity, and reactivity and the Toxic Characteristic Leaching Procedure (TCLP).

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, preventive maintenance of field equipment, and corrective action are described in other sections of these Model. The purpose of this section is to state the specific, required QA objectives for accuracy, precision, and representativeness.

A. QA Objectives Defined

1. **Accuracy** is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error. Laboratories assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards," materials of accepted reference value.

Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy can be measured and expressed in terms of the recovery of surrogate compounds (organic analyses) or recovery of spiked compounds (inorganic analyses). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds.

2. **Precision** is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e, variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.
3. **Representativeness** expresses the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and the laboratory quality control protocol.

In developing a sampling rationale (including grid network and sampling points), consideration should be given to past waste disposal practices at the site, knowledge of locations of past releases of contaminants, existing analytical data, and the physical setting and processes. It is recommended that a separate Field Sampling Plan (FSP) or Sampling and Analysis Plan (SAP) be prepared which explains the sampling rationale and sampling methods to be used in detail. The QAPP should refer to the FSP (or SAP) and briefly note the rationale for sampling locations. If no FSP is prepared, the QAPP should provide more detail about both rationale and sampling technique. The proper design of the sampling program; using appropriate sampling, handling, and analytical techniques; and maintaining sufficient QA/QC practices will ensure representativeness of the data to the degree it is possible.

B. Level of Quality Control Effort

It is required that field blanks, trip blanks, field duplicates, and matrix spike samples are analyzed to assess the quality of the data resulting from the field sampling program. It is recommended that laboratory duplicates (investigative samples split by the laboratory *in addition to* MS/MSD samples) are also analyzed. Field and trip blanks, consisting of distilled water, should be submitted to the analytical laboratory with the field samples. Field blanks are analyzed to check for procedural contamination at the site which may cause sample contamination. Trip blanks are used to assess the potential for volatile organic contamination of samples due to contaminant migration during sample shipment and storage. Field duplicate samples are analyzed as a check of sampling and analytical reproducibility; laboratory duplicates provide an estimate of the reproducibility of measurement. Matrix spikes provide information about the effect of the sample matrix on digestion and measurement methodology. All matrix spikes should be performed in duplicate.

C. Level of Effort by the Laboratories.

The following are the *required* minimum QA/QC measures for DQO level 2 data:

1. A field blank must be submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples. The minimum required is one per every ten investigative samples.
2. A trip blank must be taken to the site and then analyzed by the laboratory for VOCs for all sites at which VOA is one of the analytical parameters. The trip blank consists of distilled deionized ultra pure water placed in two VOA vials, which are transported to the sampling site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. One trip blank is required for each shipping container.
3. Field duplicates must be provided for *each matrix* sampled. The field duplicate will be analyzed for all parameters for which the investigative samples of that matrix are analyzed. The *minimum* number of field duplicates required is one per every ten samples, or *if there are fewer than ten samples per matrix*, one per matrix.
4. A matrix spike/matrix spike duplicate sample set must be analyzed, one for every twenty samples or if fewer than twenty samples per matrix, one for *each matrix* sampled. The MS/MSD is an investigative sample which (for each applicable analytical parameter for that sample matrix) is split by the laboratory, spiked with target analytes for that analytical procedure, and analyzed with the other samples of that matrix. Samples chosen as MS/MSD should be selected prior to the sampling event so that sufficient sample volume is acquired; double volume is required for organic analyses.
5. The laboratory must run a method (preparation) blank at the beginning of each analytical run. If not all samples are completed in one day, a minimum of one method blank per sample matrix per analytical method must be run at the beginning of each sample batch analyzed each day.
6. Upon initiation of an analytical run, the laboratory must perform calibration procedures as instructed by the analytical method(s) used and, where applicable, according to instrument manufacturer specifications. During the length of the run, continuing calibrations must be performed at the frequency specified. Where applicable, calibration blanks must be included in the calibration procedure.

7. Surrogate standards must be added to all samples for organic analysis (VOA, SVOA, Pesticides/PCBs). Surrogate recovery will be used to assess accuracy of organic analyses.
8. Accuracy of inorganic analysis will be assessed by the percent recovery of spiked analytes.
9. At a minimum, precision will be estimated by calculating the RPD between MS and MSD samples and the RPD between duplicate samples. Statistical evaluation, in lieu of the RPD above, is encouraged if the number of samples per matrix is sufficient and if the VRP applicant opts to obtain a quantity of field duplicates and MS/MSD samples above the minimal requirements.
10. Sample chain-of-custody must be maintained and documented as outlined in Section 5.0 of this Model. Copies of the chain-of-custody sheets must be submitted to the IDEM with the data sheets.
11. Data, documentation, reports, and other project records must be maintained for a *minimum* of three years after the date of submission of the final report or as required by applicable regulations, whichever is *longer*.
12. The control limits used, as outlined in the analytic method, must be maintained. Additional quality control limits or measures specified in the analytical methods used must also be maintained.

D. Control Limits

Control limits are the maximum and/or minimum values defining a range for a specific parameter, as outlined within each analytical procedure, is considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is or becomes out-of-control, corrective action must be taken to bring the analysis back into control. The corrective action must include: (1) finding the cause of the problem, (2) correcting the problem, (3) demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples, and (4) repeating the analyses of any investigative samples that may have been affected by the control problem

Exceptions will be made, on a case-specific basis. If the control limit is technically impracticable for a particular sample or analysis, documentation and narrative explanation should be submitted with the data report and raw data. The documentation must include evidence that a good faith effort was made to meet the control limit; this will generally include two attempts to analyze the sample.

4.0 SAMPLING PROCEDURES

A detailed Field Sampling Plan (FSP) should be prepared explaining the sampling rationale, identifying sampling points, and precisely delineating sampling methods and equipment to be used. Alternatively, this detail may be included in the QAPP under Sampling Procedures. The general sampling strategy should aim to document the extent of migration on site, possibility of off-site migration, and concentration levels of contamination. This section of this Model is not intended to provide or mandate detailed sampling procedures or specify equipment to be used; its purpose is to state general requirements and considerations applicable to the VRP. A variety of guidance documents on sampling plans and techniques are available. Table IV-A provides a

partial list of such documents and their sources.

A. QA and Background Samples. As indicated in Section 3.B, above, a field blank and/or trip blank must be provided, a sufficient number of field duplicate samples must be taken, and at least one MS/MSD sample must be designated per matrix. Additionally, a background or upgradient sample must be provided for each matrix sampled. The background samples should be taken from areas that are not impacted by site contamination but that are as close to the site as possible. If background samples must be taken on facility property, they should be taken from uncontaminated areas, or areas least likely to be impacted from releases, at the facility. Consideration should be given to groundwater and surface water flow gradients, as well as to meteorological, geologic, and hydrogeologic factors and the effects of manmade structures in trying to determine unimpacted or least impacted locations.

Four subsurface soil samples will be required to establish background for solid media. For a surface water sample medium, at least one upstream sample is required. For groundwater, a sample from at least one upgradient well is required. Background samples must be tested for all the same parameters for which investigative samples of that medium will be analyzed. The background samples are used to establish naturally occurring concentrations of target analytes and compounds and, therefore, whether or not the concentration of a particular analyte in an investigative sample represents a release. They also help to determine if certain contaminants have migrated from other sources rather than having a source on site.

B. Sample Volume. Care should be taken that sufficient sample volume is provided for all necessary analyses to be performed. This applies to field blanks, background samples, field duplicates, and MS/MSD samples as well as for investigative samples. This is most easily guaranteed by specifying that samples are collected in specific sizes and types of containers which provide sufficient volume (and meet other necessary criteria) for the particular types of analyses that will be performed. The laboratory conducting the analysis should be consulted for their required sample volume. Samples designated for use as the MS/MSD generally require double volume for organics analysis. For example, if a particular sample matrix is to be submitted for VOA, then the sample designated as the MS/MSD will require *four* 40 ml vials rather than the usual two.

C. Sample Preservation and Holding Times. It is recommended that all samples are iced to 4°C, but chemical preservatives should only be used for aqueous samples. If an aqueous sample is suspected to be strongly alkaline or acidic, a chemical preservative should not be used. For correct sample preservation and holding times, the method of analysis should be referred to for guidance.

D. Field Documentation of Sampling and Site Observations. Field records provide the direct evidence and support for the necessary technical interpretations, judgments, and discussions concerning project activities as well as historical evidence for later reviews and analyses. It is important that they are accurate, complete, legible, identifiable, retrievable, and protected against deterioration or loss. Field records generally consist of bound field notebooks with prenumbered pages, sample collection forms, sample location maps, sample analysis request forms, and chain-of-

custody forms. If field analysis or screening is done, they must also include equipment maintenance and calibration forms. Depending on project-specific requirements and organizational protocols, other field records may be kept, such as personnel qualification and training forms and field change request forms. IDEM field records requirements are discussed briefly below:

1. **General.** Field records must be written in indelible ink. Exact field documentation protocols are left up to the discretion of the VRP applicant organization or project manager. However, procedures for reviewing, approving, and revising field records must be clearly defined and stated in the FSP, SAP, or QAPP. At a minimum, all documentation errors shall be corrected by drawing a single line through the error so that it remains legible; the error must then be initialed by the responsible individual and the date of the change noted. The correction shall be written adjacent to the error.
2. **Sample Collection.** Sample collection information may be recorded in a bound field notebook with prenumbered pages, on a pre-printed form, or by other means. (Note that if a strict U.S. EPA chain-of-custody protocol will be followed, a bound field notebook is required. The following information must be documented:
 - a. *For sampling event:* the site name and location, date, starting and ending times, weather, names of all people involved in sampling activities, level of personal protection used, documentation of adherence to protocol, any changes made to planned protocol, names of visitors to the site during sampling and reason for their visit, unusual observations, and signature of the person recording the information.
 - b. *For each individual sample:* a detailed description of location, any measurements made, the unique sample number assigned, the time the sample was taken, physical description of sample, depth from which sample was collected, whether grab or composite (if composite, how composited), equipment used to collect the sample, volume and number of sample containers, how sample is preserved, and signature of sampler. Each field duplicate must be given its own unique sample number; the description should include the unique sample number of its duplicate.

Forms IV-A, IV-B, and IV-C, at the end of this section, are provided as examples of how the mandatory information might be recorded.

3. **Maps and Drawings.** A site map accurately documenting sample collection points and locations of monitoring wells must be included. A vicinity map showing the location of the facility in the community and in relation to nearby population centers and surface water bodies is highly recommended.
4. **Chain-of-Custody Records.** Sample custody will be discussed in detail in Section 5, below. Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or

composite; (4) signatures of individuals involved in sample; and (5) if applicable, air bill or other shipping number.

5. Calibration Records & Traceability of Standards/Reagents. If field or mobile laboratory analyses are performed, calibrations must be performed and documented. Calibration is a reproducible reference point to which all sample measurements can be correlated. A sound calibration program shall include provisions for documentation of frequency, conditions, standards, and records reflecting the calibration history of a measurement system. The accuracy of the calibration standards is important because all data will be in reference to the standards used. A program for verifying and documenting the accuracy of all working standards against primary grade standards shall be routinely followed.

TABLE IV-A- IDEM SAMPLING REFERENCES AND SOURCES**SAMPLING (AND RELATED) SOURCES WITH DOCUMENT NUMBERS**SW-846/RCRA General

SW-846, Third Edition, Test Methods for Evaluating Solid Waste,
Volume Two, Chapter Nine: "Sampling Plan."

SW-846, Third Edition, Test Methods for Evaluating Solid Waste,
Volume Two, Chapter Ten: "Sampling Methods."

CLP/Superfund General

"Sampler's Guide to the Contract Laboratory Program," December,
1990. EPA/540P-90/006

"User's Guide to the Contract Laboratory Program," December, 1988.
EPA/9240.0-1 (Call EPA Sample Mgmt. Office at (703) 557-2490.)

"Data Quality Objectives for Remedial Response Activities -
Development Process." March, 1987. EPA/540/G-87/003

"A Compendium of Superfund Field Operations Methods." December,
1987. NTIS PB88-181557; EPA/540/P-87/001

"Guidance for Conducting Remedial Investigations and Feasibility
Under CERCLA. October, 1988. NTIS PB89-184626;
EPA/540/G-89/004

"Superfund Analytical Review and Oversight." October, 1988.
NTIS PB90-249541; EPA/9240.0-03

General Sampling and Data Guidance - U.S. EPA

"Standard Operating Procedures for Field Samplers." March, 1986
EPA Region VIII, Environmental Services Division, Denver, CO.

"Field Screening Methods Catalog: User's Guide." September, 1988.
NTIS PB89-134159; EPA/540/2-88/005

"Quality Assurance/Quality Control Guidance for Removal Activities,
Sampling QA/QC Plan and Data Validation Procedures," Interim Final. April, 1990.
NTIS PB90-274481/CCE; EPA/540/G-90/004

General Sampling and Data Guidance (continued)

"Guidance for Data Useability in Risk Assessment," Interim Final.
October, 1990. NTIS PB91-921208/CCE; EPA/540/G-90/008

Sample Custody: "NEIC Policies and Procedures," Revised June 1985. EPA-330/9-78-DDI-R

Groundwater Sampling and Monitoring.

SW-846, Third Edition, Test Methods for Evaluating Solid Waste,
Volume Two, Chapter Eleven: "Ground Water Monitoring."

"Resource Conservation and Recovery Act (RCRA) Ground-Water
Monitoring Technical Enforcement Guidance Document." September, 1986.
NTIS PB87-107751; EPA/600/2-85/104.

"Practical Guide for Ground-Water Sampling." September, 1985.
NTIS PB86-137304

"Protection of Public Water Supplies from Ground-Water
Contamination." September, 1985. (Call CERL to order.)

Handbook - Ground Water. March, 1987. EPA/625/6-87/016

"Compendium of ERT Groundwater Sampling Procedures." January,
1991. EPA/540/P-91/007

Surface Waters

Kitrell, F. W. 1969. "A Practical Guide to Water Quality Studies
of Streams." NTIS PB-196367

"Compendium of ERT Surface Water and Sediment Sampling Procedures."
January, 1991. EPA/540/P-91/005

Geophysical Methods

"Geophysical Techniques for Sensing Buried Wastes and Waste
Migration." June, 1984. NTIS PB84-198449; EPA-600/7-84-064

"Geophysical Methods for Locating Abandoned Wells." July, 1984.
NTIS PB84-212711

"Compendium of ERT Soil Sampling and Surface Geophysics
Procedures." January, 1991. EPA/540/P-91/006

Soils and Sediments

"Sediment Sampling Quality Assurance User's Guide." July, 1985.
NTIS PB85-233542; EPA/600/4-85/048

"Guidance Document for Cleanup of Surface Impoundment Sites."
June, 1986. NTIS PB87-110664; EPA/9380.0-06

Methods for Evaluating the Attainment of Cleanup Standards -

Volume 1: Soils and Solid Media. February, 1989.
NTIS PB89-234959.

"Compendium of ERT Soil Sampling and Surface Geophysics
Procedures." January, 1991. EPA/540/P-91/006

"Compendium of ERT Surface Water and Sediment Sampling Procedures."
January, 1991. EPA/540/P-91/005

Drums/Hazardous Waste

"Guidance Document for Cleanup of Surface Tank and Drum Sites."
May, 1985. NTIS PB87-110672; EPA/9380.0-03

"Drum Handling Practices at Hazardous Waste Sites." January, 1986.
NTIS PB86-165362; EPA/600/2-86/013

"Handbook for Stabilization/Solidification of Hazardous Wastes."
June, 1986. EPA/540/2-86/001

"Compendium of ERT Waste Sampling Procedures." January, 1991.
EPA/540/P-91/008

Sources of Documents

Center for Environmental Research Information (CERI) (no charge)

Center for Environmental Research Information (CERI)
ORD Publications
26 West Martin Luther King Drive
Cincinnati, OH 45268
(513) 569-7562

Public Information Center (PIC) (no charge)

U. S. Environmental Protection Agency
Public Information Center (PIC)
PM-211B
401 M Street, S.W.
Washington, DC 20460
(202) 382-2080

Superfund Docket and Information Center (SDIC) (no charge)

U.S. Environmental Protection Agency
Superfund Docket and Information Center (SDIC)
OS-245
401 M Street, S.W.
Washington, DC 20460
(202) 382-6940

National Technical Information Services (NTIS) (cost varies)

National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

FORM IV-B: SAMPLE INFORMATION SHEET

Facility Name: _____

Sample I.D.: _____ Sample Control No.: _____

Sample Location: _____

Sample Date: ____/____/____

Time Sampled: ____:____ AM/PM

Field Test(s)

Performed Result

Well _____

Sediment _____

Waste _____

Other _____

Sample Types (circle all applicable):

Mon. Well Res. Well Mun. Well Ind.

Leachate Creek River Ditch

Lagoon Lake Pond

Soil Sludge Sand Ind.

Solid Oil

Blank (Equipment/Trip/Field) Background

Containers

1 L plastic _____

1 L glass _____

500 ml glass _____

40 ml vial _____

250 ml plastic _____

1L amber glass _____

Other _____

No.

Preservatives

H₂SO₄ (50%) _____

HNO₃ (conc.) _____

NaOH (50%) _____

Zinc Acetate (2N)

Other _____

Lab/Lot No.

Additional Sample Location Information:

Additional Sample Observations (e.g.: depth taken, color, odor, size, clarity, density, suspended solids, colloidal, etc.): _____

Sampling Equipment Used: _____

Deviations from Sampling Plan: _____

Signature of Sampler: _____

FORM IV-C: GROUNDWATER SAMPLE INFORMATION SHEET

Facility Name/Location: _____

Sample I.D.: _____ Sample Control No.: _____

Sample Location: _____

Sample Date: ____/____/____ Time Sampled: ____:____ AM/PM

Field Test(s)

<u>Performed</u>	<u>Result</u>
Temperature	_____ EC
pH	_____
Spec. Cond.	_____ μmhos
_____	_____
_____	_____

Sample Types (circle all applicable):

Monitoring Well	Other _____
Residential Well	Grab/Composite
Municipal Well	Split Sample
Duplicate of _____	Background
Blank (Equipment/Trip/Field)	

<u>Containers</u>	<u>No.</u>	<u>Preservatives</u>	<u>Lab/Lot No.</u>
1 L plastic	_____	H ₂ SO ₄ (50%) _____	_____
1 L glass	_____	HNO ₃ (conc.) _____	_____
500 ml glass	_____	NaOH (50%) _____	_____
40 ml vial	_____	Zinc Acetate (2N) _____	_____
250 ml plastic	_____	Other _____	_____
Other _____	_____	Sample Iced: yes / no	

Monitoring Well Data

Well Ident. _____	<u>Purged with:</u> PUMP / BAILER
Reference point on (steel/ plastic) casing top _____	PUMP - type _____ size _____ make _____
Casing Stickup _____	BAILER - (PVC/SS/Teflon/other _____) diam. _____ length _____ capacity _____
Depth to Water _____	rope material _____
Well Material (PVC/SS/Teflon) _____	<u>Filtration Method:</u> gravity/vacuum/pressure
Depth of Well _____	Filter: (cartridge/paper)
Inside Diam., in. (1 2 4 6) _____	type _____ size _____ pore _____
Time to recharge 1 well vol: < (1 4 8 24 48) or >48 hrs.	pH Meter _____ S.C. Meter _____

Other Observations

Was Sample filtered prior to preservation? YES NO
 Color of water before filtration: _____ After filtration: _____
 Reaction upon addition of preservatives? YES NO
 (explain reaction: _____)
 Appearance of Water: (Clear / Slightly Turbid / Very Turbid)
 Well purged (< / >) (1 2 4 6 12 24 48) hours prior to sampling.
 Purged approximately to dryness (1 2 3 4 5 8 10 or >10) well volumes.
 Signature: _____ Date: _____

5.0 SAMPLE CUSTODY

Following a strict chain-of-custody protocol assists in tracking samples through the shipment and analysis process and provides protection in the event of federal action or third Party liability. Unlike data submitted in relation to regulatory issues such as enforcement cases or compliance with permits, data reported to the IDEM by applicants in the VRP will not be invalidated for reasons such as a chain-of-custody form being filled out improperly or an incorrect date being entered. However, a minimal chain-of-custody effort will be required. Because of the question of potential third Party liability which would necessitate legal defensibility, it is strongly recommended that applicants in the IDEM VRP maintain a *strict* chain-of-custody protocol.

A. Custody Defined

The custody sequence can be divided into three major segments: collection (field), laboratory analysis, and final evidence files. Within any of these segments, a sample or evidence file is in someone's custody if:

1. It is in his/her actual physical possession;
2. It is in his/her view, after being in his/her physical possession;
3. It is in his/her physical possession, and he/she has placed it in a secure (locked) location;
or
4. It is in a designated secure area.

For each segment in the sequence, the following states the minimal custody documentation required by the VRP.

B. Field Chain-of-Custody Procedures. VRP Field Custody Requirements.

- a. The field sampler is personally responsible for the care and custody of the samples until transferred.
- b. The sampler will keep a written record of the sampling operation and samples' identities. This documentation must include the following:
 - (1) Information equivalent to that requested on the example Site Information Sheet, Form IV-A above.
 - (2) A site map as described in Section 4.D.3., above accurately indicating sample collection points.
 - (3) Information equivalent to that requested on the example Sample Information Sheet or the example Groundwater Sample Information Sheet, Forms IV-B and IV-C, above, for *each* sample collected including blanks, spikes, and duplicates.
 - (4) A chain-of-custody document providing all information, signatures, dates, etc., equivalent to the example Chain-of-Custody sheet provided as Form V-A, below.

- c. Each sample will be placed in a container with a completed sample label attached. The sample label must include, at a minimum: the sample number, the date and time sampled, the sample location, the parameters for which the sample is to be analyzed, and the sampler's signature.
- d. Samples remain in the custody of the sampler until transfer of custody is completed. This consists of:
 - (1) Delivery of samples to the laboratory sample custodian, and
 - (2) Signature of laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.
 - (3) If a carrier is used to take samples between the sampler and the laboratory, the carrier must also sign the chain-of-custody form (as receiver from sampler and relinquisher to laboratory).

C. Laboratory Chain-of-Custody Procedures VRP Laboratory Custody Requirements.

The following procedures must be followed by the laboratory:

- a. All samples will be handled by the minimum number of people possible.
- b. The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room. This room should be capable of being locked if deemed necessary.
- c. A specific person or persons will be designated custodian(s). All incoming samples must be received by the custodian who will indicate receipt by signing the chain-of-custody form.
- d. The sample custodian will maintain a bound logbook or other official record keeping system to record the following information for each sample: person delivering sample, person receiving sample, date and time received, source of sample, sample identification of log number, mode of transportation to laboratory, and condition in which sample received. A standardized format must be maintained.
- e. The custodian will ensure that samples which are heat-sensitive, light-sensitive, or radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis.
- f. The analytical area will be restricted to authorized personnel only.
- g. After sample analyses are complete, the laboratory may discard samples only with the concurrence of the sampler. If sample is discarded, time and date must be recorded. Analytical data is to be kept secured and released to authorized personnel only.

C. Final Evidence Files Chain-of-Custody Procedures

The minimal final evidence files chain-of custody requirements will be as follows:

The facility participating in the IDEM VRP or its designated contractor is the custodian of the evidence file. The evidence file is to include all reports; logs; field notebooks and other field records; pictures; contractor and subcontractor reports; correspondence; originals of laboratory reports, notebooks, and data; chain-of-custody documents; IDEM communications; and other records relevant to the VRP project. The applicant must maintain the evidence file in a secured, limited access area until all submittals for the VRP project, including the final report:

- (1) have been reviewed and approved by the IDEM, and
 - (2) for a minimum of three years past the submittal date of the final report.
- Securing the evidence file for a longer period of time is at the discretion of the applicant.

FORM V-A: CHAIN OF CUSTODY

I certify that the following samples were collected by me or in my presence.

Sampler's Signature: _____

Lab. Sample No.	Internal Sample No.	Mon. Well No./ Sampling Point Identification	No. of Containers (glass/plastic)	Date and Time of Collection
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm
_____	_____	_____	_____	__-__-__; __ am/pm

Maximum and Minimum Temperatures During Collection and Transport: Max. ___ EC Min. ___ EC
 Temperature at Exchange of Custody: (1) ___ EC (2) ___ EC (3) ___ EC

TRANSFER OF CUSTODY

I certify that I received the above samples.

Relinquished By:
 (Signature) _____ Date & Time _____ (Signature)

Received By:
 _____ Date & Time _____

Title: _____ : __ am/pm

Title: _____ : __ am/pm

Title: _____ : __ am/pm

Title: _____ : __ am/pm

Title: _____ : __ am/pm

Title: _____ : __ am/pm

LABORATORY RECEIPT OF SAMPLES

I certify that I received the above samples. After receipt is officially recorded, they will remain in the custody of competent lab personnel or will be secured in a locked area at all times.

Signature _____
 Date _____

Laboratory _____
 Time _____

6. CALIBRATION PROCEDURES AND FREQUENCY

A. General

This section of the QAPP describes procedures for maintaining the accuracy of all instruments and measuring equipment used for conducting field tests and laboratory analyses. The instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

Equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency (specify the frequency) and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specification.

Equipment to be used doing the field sampling will be examined to certify that it is operating condition. This includes checking the manufacturing's operating manual and the instruction and the instructions for each instrument to ensure that maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. A spare electrode will be sent with each pH meter to be used for field measurements. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required.

Calibration of field instruments is governed by the specific Standard Operating Procedure (SOP) for the applicable field analysis method, and such procedures take precedence over the following general discussion.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a pH meter, thermometer, nephelometer, specific conductivity meter, portable gas chromatograph, and Organic Vapor analyzer (OVA) or Organic Vapor Photoionization Detector (PID). In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

All applicants must include the following information regarding analytical methodology and calibration in the Calibration Procedures section of the QAPP or, when applicable, the Sampling and Analysis portion of the Workplan:

1. **The analytical methods to be used should be listed.**
 - (a) **Standard, non-modified U.S. EPA need only be referenced.**
 - (b) **Non-standard or modified methods must be described.**
 - (c) **Any and all field methods or mobile laboratory methods must be described.**
2. **For any non-standard, modified, field, or mobile laboratory methods planned for use detailed, instrument-specific calibration SOPs must be appended. This also applies to any referenced standard methods which do not include detailed calibration procedures.**

3. **Standards to be used for calibration must be listed. Information regarding standards' source(s), traceability, and purity checks must be provided.**
4. **Frequency of initial and continuing calibration checks must be provided.**
5. **Specific acceptance criteria for all calibration measurements must be defined.**

B. VRP Program Recommendations and Requirements

1. SW-846 or CLP

Applicants wishing to insure against third Party liability, or who wish to follow strict RCRA or Superfund protocols for other reasons, may elect to use only SW-846 (RCRA) or CLP SOW (Superfund) analytical methods and adhere to specified calibration procedures and acceptance criteria exactly. Each SW-846 and CLP SOW method provides a detailed calibration procedure with specified acceptance criteria.

2. VRP Program Requirements

For applicants not electing to follow strict SW-846 or CLP protocols, calibration procedures and frequencies must meet or exceed the guidelines listed in the analytic method utilized for analysis. In addition, special attention should be given to describing analytical methodology and calibration procedures as requested in paragraphs 6.A.1. and 6.A.2, above; this is especially important for field and mobile laboratory methods.

7.0 ANALYTICAL PROCEDURES

This section of the QAPP (or, when applicable, the Sampling and Analysis portion of the Workplan) should identify and provide detailed information about all analytical methods to be used for both critical and non-critical parameters for all sample matrices. Information regarding sample preparation and cleanup methods should be included. The name and location of the laboratory performing the analyses should also be provided.

If U.S. EPA standard methods are used without major modifications, they need merely be referenced. However, preparatory methods should also be indicated. If minor modifications must be made to accommodate site-specific conditions (e.g., detection limits, sample preparation procedures, data validation procedures), such modifications should be described.

If standard methods are not used, a description of the cleanup, preparation, and analytical methods should be described, and detailed SOPs of each, including and internal quality control checks, should be appended to the QAPP.

A table summarizing preparatory and analytical methods should be included within this section indicating any matrix specific differences.

8.0 INTERNAL QUALITY CONTROL CHECKS

This section should include the following:

- A. An identification of all stages in the sampling and analytical process where the QC activity will occur.
- B. What Quality Control will be utilized (i.e., MS/MSD, blanks mass tuning, etc.) as appropriate for each analytic method?

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

A. General

This section of the QAPP should include the following information:

1. Data Reduction
 - a. Identification of responsibility for data reduction,
 - b. Summary of data reduction procedures, and
 - c. Summary of statistical approach for reducing data, if used.
 2. Data Validation
 - a. Identification of responsibility for data validation,
 - b. Procedures for determining outlines and flagging data, and
 - c. Identification of critical control points.
 3. Data Reporting
 - a. Identification of responsibility for data reporting and
 - b. Identification of critical control points.
- B. VRP Requirements

10.0 PERFORMANCE AND SYSTEM AUDITS

A. Audit Recommendations. Quality audits in the field and in the laboratory will ensure that all QA requirements are met. Audits can be performed by internal personnel and/or by external assessors. For the purposes of the VRP, only internal audits will be addressed. Any analytical laboratory chosen should include internal performance and system audits as part of its documented QA/QC program. In the field, the Field QA Officer or Sampling Team Leader should conduct system audits; for the purposes of the VRP, performance audits will not apply to the field.

B. Audits Defined

1. A Performance Audit is an independent check by a person or an audit team designated by management (i.e., the QA Officer or QA group) to evaluate the data produced by a laboratory's analytical system. It is sometimes categorized as a *quantitative appraisal of quality*.

Performance audits will include data reviews and may consist of the following:

- a. Analysis worksheet reviews,
- b. On-site analyst work review/observation,
- c. Intralaboratory check sample or "blind" sample analysis and review,

- d. Interlaboratory check sample or "round robin" samples' analysis and review,
 - e. Analyst proficiency test sample analysis review.
2. A System Audit is an on-site inspection and review of a laboratory's or field operation's quality control system and procedures. It is sometimes categorized as a *qualitative appraisal of quality*. It will cover the operational elements of the QA program.
- a. In the field the system audit may include:
 - (1) examination of sampling records,
 - (2) field instrument operating records,
 - (3) maintenance of QA procedures in sampling practices and obtaining QC samples, and
 - (4) chain-of-custody documentation, etc.

If field analyses or mobile lab analyses are performed, field audits will be expanded to include review of field measurement records, instrumentation calibration and maintenance records, and review to ensure QA procedures such as MS/MSD analyses have been performed.
 - b. In the laboratory the system audit may include:
 - (1) sample handling: receipt, documentation, and storage procedures;
 - (2) sample preparation and analysis: existence and adherence to written SOPs;
 - (3) records control;
 - (4) chain-of-custody procedures and documentation;
 - (5) examination of instrument records, including preventive maintenance; and
 - (6) Staffing concerns: workload, training, proficiency testing, personnel practices.

11.0 PREVENTIVE MAINTENANCE

Preventive maintenance of field and laboratory equipment includes routine procedures to be carried out with each use, routine procedures to be carried out at scheduled intervals, and procedures to be carried out on an as needed basis. Each instrument should have a bound logbook in which all scheduled and unscheduled maintenance is recorded in detail.

12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS.

13.0 CORRECTIVE ACTIONS

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Note: This Section should include the following:

- Individuals submitting and receiving reports
- Type of Report
- Written or oral frequency
- Interim or final QA/QC reporting is required in final reports
- Contents of various reports
- Summary of QA/QC programs, training and accomplishments
- Results of technical systems and performance evaluation
- Significant QA/QC problems, recommended solutions, and results of corrective actions
- Data quality assessment in terms of precision, accuracy, representativeness, completeness, comparability, and method detection limit
- Indication of whether the QA objectives were met
- Limitations on use of the measurement data

APPENDIX C: BASELINE ECOLOGICAL ASSESSMENT

Selection of appropriate cleanup criteria for sites in the voluntary remediation program will be based, in part, on ecological concerns. A baseline ecological assessment will be completed as part of the Phase II Investigation for all sites. Use of Tier II (human health based) criteria to remediate a site will depend on results of the baseline ecological assessment; use of Tier I (background) criteria should not be impacted by results of the baseline ecological assessment.

The baseline ecological assessment will be conducted primarily as a desktop review and walk through inspection to determine if critical habitats are present at the site or if critical habitats could potentially be impacted by contaminants associated with the site. Table C-1 provides a listing of critical habitats that should be considered in making the decision of Tier selection.

If no critical habitat(s) is (are) present at the site and if there is no potential for habitat impacts from the site, Tier II criteria can be used. If there is a potential for habitat impacts from the site and the applicant wishes to use Tier II criteria, an investigation will be needed to determine if the habitat has been impacted. If impacts are discovered, then Tier II criteria will not apply. If no impacts are discovered, a determination will need to be made if the Tier II remedy will be protective of the habitat. A limited ecological risk assessment which is site specific, contaminant of concern specific and critical habitat of concern specific is anticipated to answer the question of Tier II acceptability. A flow chart of steps in the determination of the appropriate Tier (cleanup criteria) is presented in Figure C-1.

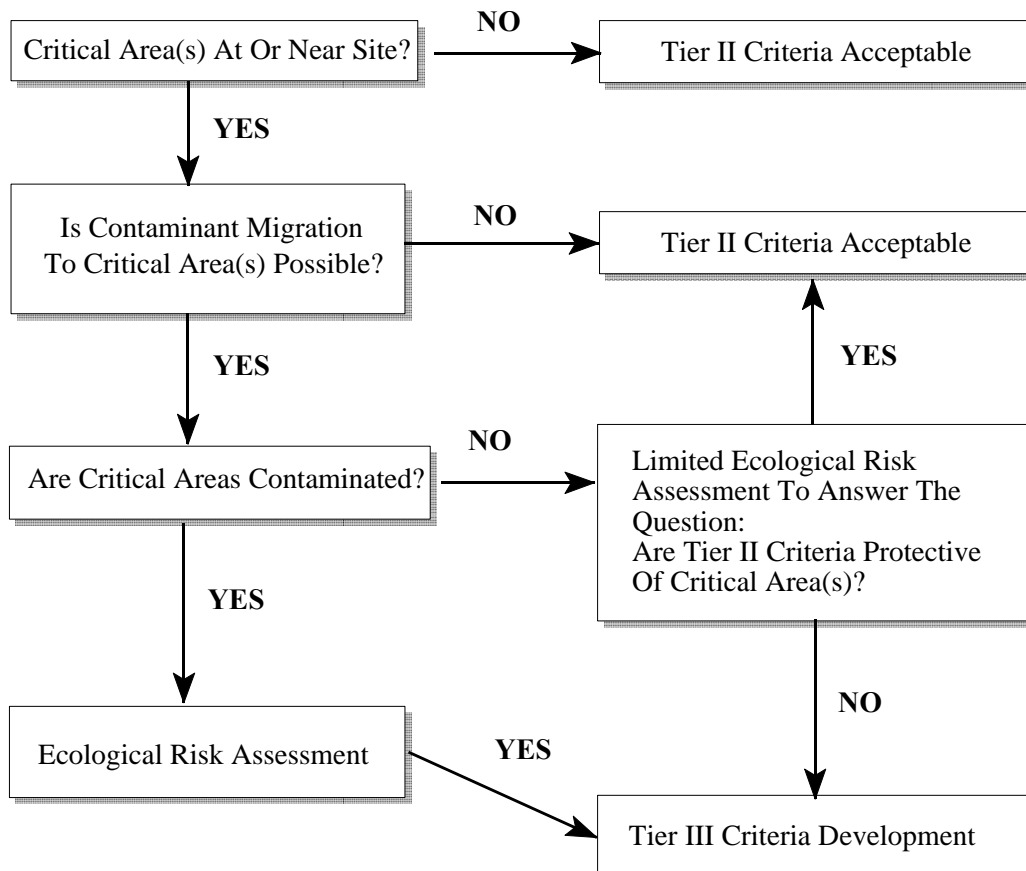
TABLE C-1. CRITICAL HABITATS TO BE CONSIDERED IN CHOICE OF APPROPRIATE CLEANUP CRITERIA (TIER) FOR THE VOLUNTARY REMEDIATION PROGRAM.¹

Surface waters (streams and lakes or ponds);
 Wetlands;
 Critical Habitat for endangered/threatened plant and animal species;
 Habitat used by designated or proposed endangered/threatened plant and animal species;
 Riparian areas (stream banks);²
 Breeding areas for forest nesting birds, aquatic birds, aquatic mammals, amphibians, or reptiles;
 Migratory stopover areas for migrant shorebirds, aquatic birds, raptors or passerines;
 Wintering areas for migratory waterfowl or other aquatic birds;
 Forest Areas;
 Sinkholes or Karst channel re-charge areas;
 Hatcheries;
 Parks;
 Nature Preserves or Reserves;
 Fish and Wildlife Management, Conservation, Refuge, or Research Areas;
 Nongame Conservation Areas;
 Designated Natural Areas;
 Reservoir Areas;
 Recreation Areas;
 Prairie Areas;
 Dune Areas (Lake Michigan near shore areas);
 Other Designated Critical Biological Resource Areas

¹ Use of Tier I cleanup criteria (background) is considered appropriate for all sites regardless of presence of critical areas.

² Floodplains - Federal and State Laws contain regulations for activities in Floodplains.

**INDIANA VOLUNTARY REMEDIATION PROGRAM
FLOWCHART FOR TIER II OR TIER III**



**FLOWCHART OF DECISIONS NECESSARY TO DETERMINE ACCEPTABILITY OF TIER II OR NECESSITY TO DEVELOP TIER III CLEANUP CRITERIA FOR THE INDIANA VOLUNTARY REMEDIATION PROGRAM
CRITICAL AREA DETERMINATION WILL BE RESULT OF BASELINE ECOLOGICAL ASSESSMENT**

FIGURE C-1: TIER II OR TIER III FLOWCHART

APPENDIX D : PROJECT COMPLETION SAMPLING

In order to ascertain cleanup goal achievement or if long term control devices are working, a final sampling or monitoring plan needs to be implemented. This plan will cover a minimum of one of the following matrices:

- soils
- ground water
- surface water
- sediments

In addition there are some program specific guidance that may need to be followed. Any underground storage tank cleanups will need to follow the criteria outlined in the UST Site Closure Guidelines and RCRA cleanups will need to follow that protocol. The following is designed to be followed in a generic sense whenever other program directives are not applicable.

SOILS

Following the completion of the remediation, a soil confirmation sampling program should be implemented. The purpose of this program is to verify that the remediation is complete and that constituents of concern are not present above the cleanup objectives.

No less than 4 samples shall be taken from areas where soils have been excavated or treated regardless of the size of the cleanup area. Samples shall not be composited and shall be taken from areas representative over the site. In addition any discolored soils that will be left in place shall be sampled to determine if cleanup levels were attained. The samples need to be taken at the bottom of any excavation and from the side walls to delimit the cleanup zone. Samples should be from a horizon no more than 6" into the base or sidewall of the excavation.

If only surface soils are removed or treated the samples should be aerially placed and representative. All samples are to be taken within the same 6" depth. No individual sample should be submitted from greater than a 6" horizon. If a large amount of material is needed multiple scoops can be taken from the same general area.

The analytical parameters to be tested for from each location are those for which the applicant wishes a Covenant Not to Sue.

However, based on sampling conducted prior to remediation, the number of parameters may be reduced. For instance, if the site investigation demonstrated that semivolatile organic compounds are not present, the confirmation sampling need not include them even though the covenant not to sue will cover these compounds.

The selection of the number and location of soil confirmation samples is a site-specific issue. For remediations involving soil excavation, the confirmation sampling may be conducted using a random sampling technique as outlined below. However, applicants may submit alternative sampling procedures

or a different number of samples per quadrant or section, which is better suited for their facility. Applicants proposing alternative sampling procedures should provide a technical justification.

It should be noted that while random sampling may be appropriate for confirmation sampling, it may not be appropriate for sampling conducted during investigations. During investigations directed sampling may be more appropriate.

Guidance for random soil sampling is as follows:

1. Make a diagram of the site or facility and divide the area to be sampled into sections of equal area. If the area is under 40,000 square feet, then it should be divided into four equal quadrants. If the area is over 40,000 square feet, it should be divided into sections of not more than 10,000 square feet.
2. Divide each quadrant or section into an imaginary 10 X 10 grid to get 100 squares (or rectangles) of equal size. Number the grid lines in each dimension from 0 to 9.
3. Four samples per section or quadrant should be collected at random locations if the area to be remediated is greater than 2,500 square feet. If the area is less than 2,500 square feet, 2 samples per quadrant should be collected at random locations.
4. Select a two-digit number using a random number table. Repeat this procedure until you have one two-digit number for each sampling point in each section. (Random number tables are available in any introductory statistics text or in SW-846.)
5. Locate the grid intersections whose coordinates correspond to each of the two-digit random numbers. These intersections are the locations of the randomly selected sampling points.
6. The area should also be inspected for visual or olfactory evidence that contamination remains. If discolored soil, soil emitting a noticeable odor, or other evidence that contamination remains are present, additional samples should be obtained from the areas emitting the odor or showing a visual impact.

The sampling method, container, and preservative should be consistent with those outlined in SW-846. Samples for volatile and semi-volatile organic compounds should not be mixed or stirred before being placed in the sampling container.

Unless pre-remediation sampling has clearly defined the horizontal extent of contamination, confirmation samples should also be obtained along the excavation wall. Sample locations should be every 50 feet along the excavation perimeter. At each location, samples should be obtained for each five feet of depth of the excavation. The depths where samples are obtained must be those which represent the preferred migration pathway.

Soil samples should be collected from discreet six-inch intervals. If the volume of soil required for testing exceeds that of the six-inch interval, the interval may be extended or samples may be obtained from directly adjacent soils. Under no conditions should soils being tested for volatile or semi-volatile organic compounds be homogenized prior to being placed in containers.

In-situ remediations may require a sampling strategy different from that outlined above.

DETERMINING SOIL BACKGROUND CONCENTRATIONS

Background concentrations of naturally occurring compounds or compounds not related to the site are determined by collecting samples from a minimum of four locations. Locations must not be impacted by the site or the facility. Background is defined as the sample mean plus three standard deviations. If the excavation extends downward through several soil horizons, background concentrations must be determined for each horizon.

GROUND WATER

Ground water samples need to be taken over a period of time to determine if a cleanup has been effective and contamination is in fact decreasing. Preference to sampling quarterly over a one year period should be given. At a minimum all monitoring wells that were impacted need to have concentrations that are below action levels for four consecutive quarters. If asymptotic levels are to be considered samples must be taken over eight consecutive quarters. If contaminant values are at or below action levels for four straight months an exception to quarterly sampling can be made. All ground water analysis submitted must be from unfiltered sampling.

SURFACE WATER

Surface water samples should be taken from down stream of any out fall or discharge point using National Pollutant Discharge Elimination Systems (NPDES) or Ambient Water Quality Criteria (AWQC) protocol.

SEDIMENTS

Sediments are a compilation of heterogenous materials found in fresh and marine waters: Solids composed of organic and inorganic materials which grade from very coarse (gravel) to very fine (clay) grained; Interstitial fluid, (water which fills the pore spaces between grains); A benthic community; and Contaminants derived from surface runoff, ground water discharge and chemical precipitation.

The dynamics of sediment formation and characterization preclude requiring one particular sampling or classification method. In general, samples should be taken in a manner that will cause the least amount of disturbance. Loss of fine materials and interstitial water need to be minimized because these fractions may contain contaminants of most interest. Rather than list all of the various test and classification methods the following sources are given for reference and guidance in sampling, testing and classifying sediments:

- Burton, G. Allen. "Sediment Toxicity Assessment". Lewis Publishers, Inc. Chelsea, MI 48118 (1992).
- USEPA/USACE. 1991. United States Environmental Protection Agency/United States Army Core of Engineers. Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual). February 1991. United States Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington DC 20460. USEPA-503/8-91/001.
- USEPA. 1992. United States Environmental Protection Agency. Sediments Classification Methods Compendium. September 1992. United States Environmental Protection Agency, Office of Science and Technology, Washington DC 20460. EPA-823-R-92-006.

APPENDIX E: TECHNICAL STANDARDS

INTRODUCTION

A technical standards subcommittee was formed by the Indiana Department of Environmental Management (IDEM) to provide guidance and recommendations to the agency on technical issues affecting implementation of the Voluntary Remediation Program (VRP). The VRP was established by the 1992 Indiana General Assembly in Senate Enrolled Act 392 and required IDEM to establish the VRP by July 1, 1993. The technical standards subcommittee was composed of volunteers from IDEM, industry, consultants, attorneys and environmental groups who met monthly to develop these recommendations. This summary encapsulates the work performed by this group and the individual volunteers. Along with this summary is a list of policy issues which the subcommittee was not able to resolve before the July 1, 1993 deadline.

BACKGROUND

The goals of the subcommittee were to establish technical guidelines and instructions for applying to the VRP and preparing and reviewing VRP work plans. To accomplish the work plan goals, the subcommittee reviewed and commented on draft work plan Guidance prepared by the IDEM implementation contractor and developed recommendations regarding cleanup criteria. As a part of the work on cleanup criteria, the subcommittee prepared guidance for laboratory testing in the Quality Assurance Project Plan (QAPP) provided in Appendix B, page 51. Cleanup criteria recommendations represent the bulk of the work conducted by the subcommittee. The final subcommittee recommendations are summarized below.

RECOMMENDATIONS

The recommendations developed by the subcommittee were developed from a review of cleanup programs established by other states modified slightly by local conditions. This summary does not review the mechanisms, iterations or consensus building that was undertaken to develop the final recommendations, however, the recommendations do address the vast majority of the comments received by the subcommittee. In developing the recommendations, it became apparent that a series of definitions would be required to ensure that agency and applicant exceptions were known. The recommendations therefore begin with definitions followed by a summary of the cleanup criteria with a final summary of the means for demonstrating compliance with the criteria.

DEFINITIONS

Aquifer - a geologic formation, group of formations, or part of a formation capable of yielding a significant amount of groundwater to wells or springs.³

Contaminant - any solid, semisolid, liquid, or gaseous matter, or any odor, radioactive material, pollutant as defined in the Federal Waste Pollution Control Act, hazardous waste as defined by the Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.), as amended, or any combination thereof, from whatever source, that: (A) is injurious to human health, plant or animal life, or property;

(B) interferes unreasonably with the enjoyment of life or property; or (C) is otherwise violative of this article or rules adopted under this article.⁴

Free Product - the separate phase material present in concentrations greater than a contaminant's residual saturation point.⁶

Groundwater - subsurface water in a zone of saturation, which can be brought to the surface of the ground or to surface waters, through wells, springs, seepage, or other discharge areas. A zone of saturation is where all the voids and pore spaces in the rock, soil or geological materials are filled with water.²

Hazard Quotient - the ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.⁷

Hazardous Substance - "Hazardous Substance" means any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. Or any substance designated by EPA to be reported if a designated quantity of the substance is spilled in the waters of the United States or if otherwise emitted to the environment.¹

Institution Controls - a mechanism used, as a supplement to engineering controls, to limit human activities at or near a contaminated site, or to ensure the effectiveness of the remedial action over time, when contaminants remain at a site in concentrations either above the cleanup standards that would be applicable if the site were residential property, or that may otherwise present an unacceptable risk to human health or the environment. Institutional controls may include, without limitation, structure, land and natural resource (for example, water) use and deed restrictions, well restriction areas, deed notices and access controls.⁶

Non-Residential Property - any real property, at which activities are being conducted, having the primary Standard Industrial Classification(SIC) major group numbers 01-48 inclusive, 49 except 4941, 50-67 inclusive, 72-79 inclusive, 80 except 8051, 8059, 8062, 8063, 8069, 81 and 82 except 8211, 8221, 8222, 83 except 8351, 8361, 84-86 except 8661, 87, 89-91 inclusive, 92 except 9223, and 93-97 inclusive. Non-residential property includes all of the block(s) and lot(s) controlled by the same owner or operator that are vacant land, or that are used in conjunction with such business. For leased properties non-residential property includes the leasehold and any external tank, surface impoundment, septic system, or any other structure, vessel, contrivance, or unit that provides, or is utilized for the management of contaminants to or from the leasehold.^{5,9}

Petroleum - petroleum asphalt and crude oil or any part of petroleum asphalt or crude oil that is liquid at standard conditions of temperature and pressure (sixty (60) degrees Fahrenheit) and fourteen and seven-tenths (14.7) pounds per square inch absolute.¹

Practical Quantitation Limit - the lowest level at which a chemical may be accurately and reproducibly quantitated. Usually equal to the detection limit multiplied by a factor of 3 to 5, but varies between chemicals and between samples.⁷

RCRA - the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended, 42 U.S.C. 6907, et seq.³

Receptor - any human, ecosystem or part thereof, surface water, well (other than a monitoring well), structure (for example, a basement), which is or may be affected by a contaminant from a site.⁶

Release - any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, including the abandonment or discarding of barrels, containers, or other closed receptacles containing any hazardous substance or petroleum.¹

Residential Property - any property that does not exclusively meet the definition of non-residential property. Residential property includes any otherwise non-residential property that is used in part for residential activities, such as a day care center at a non-residential property.⁵

Remediation - any of the following:

- (1) Actions necessary to prevent, minimize, or mitigate damages to the public health or welfare or to the environment, which may otherwise result from a release or threat of a release.
- (2) Actions consistent with a permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance or petroleum into the environment to eliminate the release of hazardous substances or petroleum so that the hazardous substances or petroleum do not migrate to cause substantial danger to present or future public health or welfare to the environment.
- (3) The cleanup or removal of released hazardous substances or petroleum from the environment.¹

Sediment - a compilation of heterogenous materials found in fresh and marine waters: Solids composed of organic and inorganic materials which grade from coarse (gravel) to very fine (clay) grained; Interstitial fluid, water which fills the pore spaces between grains; A benthic community; and Contaminants derived from surface runoff, ground water discharge and chemical precipitation.⁸

Site - a parcel of real estate for which an application has been submitted. Specifically that portion of the real estate which will be subjected to investigation or remediation under this program.¹

Soil - the unconsolidated mineral and organic matter on the surface of the earth that has been subjected to and influenced by geological and other environmental factors.⁶

Soil Layer - all soil within a common geologic horizon that is at least three feet thick and has a common United States Department of Agriculture textural classification.⁸

Subsurface Soil - the soil more than two feet below grade and extending downward to the top of the seasonally high water table.⁶

Surface Soil - the top two feet of soil below grade.⁶

Total Organic Contaminants - those analytes determined from the summation, of all analytes and from their respective concentrations, as determined from all pertinent organic analytical methodologies employed.⁶

Total Petroleum Hydrocarbons - those materials which can be extracted from sample matrices with Freon 113 having chemical characterizations which allow passage of the extract through a silica gel column with detection at $2,970\text{ cm}^{-1}\pm 150$ wave number using either a fixed wave length or scanning wavelength infrared detector. Petroleum hydrocarbons may also be characterized by gas chromatography fingerprint analysis.⁶

Total Volatile Organic Contaminants - analytes whose vapor pressure is $> 1\text{ mm Hg}$ at normal temperature (20 degrees C) and pressure (1 atm) and may be sampled by static and dynamic heated and ambient temperature headspace analysis, direct injection, and thermal desorption of the sample or sampling media, separated by either packed or capillary columns and analyzed by specific detectors (such as Hall, PID, FID, TCD, or PFD) or a universal detector (such as a mass spectrometry).⁶

Water Table - the upper surface at which the fluid pressure of the ground is equal to atmospheric pressure.⁴

Wetlands - those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.⁴

CLEANUP CRITERIA

Cleanup criteria for sites within this program is recommended to consist of a combination of performance and quantitative standards. The performance standards will essentially apply to all cleanups, however, a caveat will apply to sites which cannot comply with the performance standards because of practical considerations or technological limitations. Quantitative standards will be based on a three tiered approach which consists of background levels, generic risk based standards and site specific risk based standards.

PERFORMANCE STANDARD

Remediation shall prevent or minimize future releases and migration of hazardous substances and petroleum in the environment. Prevention and minimization of releases shall be accomplished to the extent practical and technologically feasible by removing and/or controlling the source of the release and any free product associated with the release. Remediation shall provide long-term care or management, where necessary, including but not limited to monitoring, operation and maintenance, as appropriate.

QUANTITATIVE STANDARDS

Quantitative standards have been developed which provide guideline limits for various chemicals in soil

and groundwater. An applicant may select any one of three tiers of cleanup criteria: Tier I, Tier II or Tier III.

TIER I

Tier I levels will be established on a site specific basis using the same procedures required for determining background levels at RCRA regulated cleanups. Tier I levels for synthetic organic chemicals (SOC) will be the practical quantitation limit. Tier I levels for soil contaminated with chemicals other than SOCs soils will be established by collecting a minimum of four samples and computing the mean and standard deviation of this data. The Tier I cleanup level will be equal to the background mean value plus three times the standard deviation.

The database for computation of Tier I levels for surface soils will consist of laboratory analyses of samples collected from the upper two feet of soil at a minimum of four locations in the vicinity of the site. Samples should be collected at six inch intervals (0-6", 6-12", 12-18" and 18-24") and the depth intervals should be combined into one composite sample from each location for laboratory analysis. The laboratory results from the four (or more) composite samples will then serve as the database for statistical computation.

The database for computation of Tier I levels for subsurface soils will consist of laboratory analyses of samples collected from the same soil layer slated for investigation or remediation. If multiple soil layers will be subjected to investigation or remediation, then samples must be collected from each layer. A minimum of four samples must be collected from different locations within each layer. The samples must then be subjected to laboratory analysis and these results will serve as the database for statistical computation. Tier I levels will be established for each appropriate soil layer using these techniques. Tier I levels for groundwater will be established by collecting groundwater samples from a location which is hydraulically upgradient of the site and which is unaffected by site contamination. The samples must be collected from the same aquifer and aquifer interval (i.e. top, middle or base, as appropriate) which will be subjected to investigation or remediation. If multiple aquifers (or aquifer intervals) are slated for investigation or remediation Tier I levels must be established for each. A minimum of four groundwater samples must be collected and subjected to laboratory analysis. At a minimum, the samples must be collected monthly over a four month period, although quarterly sampling over one year is preferable. The four periods of background data will be used to compute the background mean and standard deviation.

TIER II

Tier II levels will be established using standard equations for risk assessment as established by the USEPA for risk assessments under Superfund. IDEM has established default values for the equations. A detailed discussion of the derivation of Tier II levels is provided in Appendix F (page 99) along with a table of Tier II levels.

Since the Tier II levels are based solely on human exposures, the levels may not be sufficiently protective of ecological impacts. Guidance on determining potential ecological impacts provided in the Section entitled "Selecting Cleanup Levels".

The use of Tier II levels for industrial properties will result in a use restriction that will be placed on the Covenant Not to Sue.

TIER III

Tier III levels will be established on a site specific basis using methodology that is provided in the applicant's work plan. Tier III levels may be required for a unique type of contaminant, an environmentally sensitive site or other unique site-specific conditions. Tier III levels can be based on a site specific risk assessment or any other technique proposed by the applicant. Tier III can also be used to modify default values used in Tier II computations if site conditions are different than the Tier II assumptions. Tier III can also be used for contaminants for which no Tier II levels have been computed because of lack of toxicological data. IDEM will be responsible for reviewing and approving all Tier III proposals for establishing cleanup levels.

SELECTING CLEANUP LEVELS

The applicant is responsible for proposing the cleanup levels to be used for the site. IDEM is responsible for reviewing and approving the use of the levels as proposed. As a part of the selection processes, the applicant will be required to perform a baseline ecological assessment to determine if potential ecological impacts are associated with the site that could invalidate the use of the Tier II criteria. The requirements for baseline ecological assessment are included in Appendix C, page 85.

DEMONSTRATING COMPLIANCE

In order to receive a Certificate of Completion, an applicant must demonstrate compliance with the performance and quantitative standards.

PERFORMANCE STANDARD

Compliance with the performance standards will require submittal of evidence that the source of the contamination has either been removed or controlled by the implemented remediation. Evidence will also have to be submitted that all free product has been removed from the site or that a system is in place to remove all free product from the site. If it is technologically infeasible or impractical to achieve these performance standards, evidence must be submitted to prove this assertion.

QUANTITATIVE STANDARDS

Demonstrating compliance with the quantitative standards will require submittal of sampling and analytical results from project completion sampling. Details of the minimum requirements for project completion sampling are provided in Appendix D. If the arithmetic mean of all project completion soil samples is below the cleanup levels and no sample contains contaminants at concentrations greater than 10 times the cleanup level, it will be concluded that the remediation complied with the soil cleanup level. Compliance with the groundwater cleanup levels will be considered after completion of a statistically valid comparison between the cleanup standard and the project completion sampling results indicates no statistically significant difference between the two data sets.

POINT OF COMPLIANCE

Project completion sampling must be performed at the point of compliance to demonstrate compliance with the quantitative standards. The point of compliance for soil contamination is throughout the soil layers which have been subjected to investigation or remediation. The point of compliance for groundwater contamination is the downgradient limit of the site within the aquifer(s) or aquifer intervals that have been subjected to investigation or remediation. Alternative points of compliance may be considered for Tier III criteria depending on unique contaminant or site characteristics.

REFERENCES

#1 Senate Act #392

#2 Groundwater Task Force

#3 329 IAC 3-1-7

#4 329-IAC 2-2-1

#5 Texas Register, December 18, 1992, 31 TAC 335.552

#6 New Jersey Register, February 3, 1992, NJAC 7.26D-1.7

#7 Environmental Acronyms, Abbreviations and Glossary of Terms. Source: United States Environmental Protection Agency Information Resources Directory, Spring 1989 OPA 003-89. Published by: Executive Enterprises, Inc.

#8 VRP Technical Subcommittee

#9 Standard Industrial Classification Manual; Executive Office of the President Office of Management and Budget, 1987 NTIS Order no. PB 87-100012.

APPENDIX F: TIER II CLEANUP GOALS - HUMAN HEALTH EVALUATION

Cleanup goals for chemicals in source media for Tier II are calculated based on a human health evaluation using standard risk assessment assumptions. Cleanup goals are determined for one of two possible land use scenarios; residential or nonresidential. The determination of whether cleanup goals based on a residential or nonresidential scenario apply to a particular site depends on the environmental site setting (i.e., onsite and surrounding land use patterns) and projected future use. However, the use of cleanup goals to remediate a site based on a nonresidential scenario will require some land use restrictions to prevent unrestricted future use of the site.

The methodology for calculation of Tier II, health-based cleanup goals was based on EPA's preliminary remediation goals (EPA, 1991), incorporating changes agreed upon by the Voluntary Remediation Program Technical Standards Subcommittee. The methodology for calculation of Tier II cleanup goals is provided in three parts. This first part presents background information and an overview of the health-based approach for determining preliminary remediation goals. Then detailed calculations are provided which outline the approach for calculating health-based goals specifically for the Tier II assessment. Finally, cleanup goals for selected compounds are presented that are applicable for remediation of sites with a Tier II assessment.

OVERVIEW OF EPA APPROACH FOR DETERMINING PRELIMINARY REMEDIATION GOALS

EPA has identified a standardized approach for calculating cleanup goals or preliminary remediation goals (PRGs) for the remedial investigation and feasibility study (RI/FS) process on federal Superfund sites. PRGs are equivalent in concept to Tier II cleanup goals such that they are health-based acceptable concentrations for chemicals of interest in a particular media. They are also derived independently for a site or sites without requiring a site-specific risk assessment (i.e., a Tier III risk assessment). The method for calculating these PRGs was outlined in the document *Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual; Part B, Development of Risk-Based Preliminary Remediation Goals* (EPA, 9285.7-01B, December, 1991), an overview of which is discussed below.

EPA's approach for determining PRGS for a site include either applicable or relevant and appropriate requirements (ARARs) and/or health-based acceptable concentrations. This discussion, however, focuses only on the calculation of risk-based PRGs. Risk-based PRGs are calculated separately by chemical and media. The media evaluated in EPA Part B include soils and groundwater (and/or surface water used as a potable water source). However, for Tier II, soils were divided into two separate media based on their potential for exposure: surface soils and subsurface soils. Surface soils are defined as those soils within the top 2 feet of the surface that would be incidentally contacted by a worker, while working, or by residents while playing (young children) and/or landscaping or gardening (adults). Subsurface soils were defined as soils below 2 feet that would only be contacted directly during excavation or construction activities. The potential for contact to subsurface or deeper soils would be less than for surface soils and would occur under different circumstances (i.e., excavation or construction).

The development of risk-based PRGs begins with the determination of the probable future land use of the site and the potential receptor type that would apply. Potential exposure pathways are then identified using assumptions about the behavior and body parameters of the applicable receptor. For calculation of PRGs for each media, EPA identified applicable exposure pathways specific to the land use scenario evaluated. However, EPA only considered those exposure pathways that contribute significantly to the overall exposure and risk in the calculation of PRGs. Other relevant exposure pathways were assumed to contribute insignificantly to the overall exposure and were not included. Relevant exposure pathways were also assumed to vary according to residential and nonresidential use scenarios. For the residential scenario, the exposure pathways considered applicable for groundwater were ingestion and inhalation of volatiles; and for soil was incidental ingestion. For the nonresidential scenario, the exposure pathways considered applicable for determining PRGs for groundwater was ingestion; and for soil were incidental ingestion and inhalation of volatiles and fugitive dusts.

Once exposure pathways are identified, equations quantifying the health risk to the receptor can be developed. There are two general equations used in calculating potential human health effects in a risk assessment, one for carcinogenic effects, the other for noncarcinogenic effects. They are, for the carcinogenic assessment:

$$R_i = SF (I_i)$$

Equation (1)

where: R_i = excess lifetime cancer risk from exposure pathway i ;
 SF = cancer slope factor (mg/kg/day)⁻¹;
 I_i = total chemical intake from exposure pathway i averaged over a lifetime (mg/kg/day)

and, for the noncarcinogenic assessment:

$$HI_i = \frac{I_i}{RfD}$$

Equation (2)

where: HI_i = hazard index from exposure pathway i ;
 I_i = average daily intake from exposure pathway i averaged over the period of exposure (mg/kg/day);
 RfD = reference dose (mg/kg/day).

Equations 1 and 2 are written in a general form in that chemical intake (I) varies according to exposure pathway and receptor. Total cancer risk and hazard index are then calculated by summing across all exposure pathways to give a total cancer risk (R_{tot}):

$$R_{tot} = \sum R_i$$

Equation (3)

or total hazard index (HI_{tot}):

$$HI_{tot} = \sum HI_i$$

Equation (4)

The equations quantifying the risk from a given chemical concentration in a particular medium can then be inverted to back-calculate a health-based acceptable chemical concentration, given an acceptable risk level. PRGs are then determined by using these equations with standard EPA default exposure factors, available toxicity data and appropriate target health effect levels. EPA designed the PRG methodology to be used initially to calculate PRGs for a site using strictly default parameters, and, at a later time, to be used with site-specific assumptions to update the PRGs. However, application of the PRGs concept for calculating Tier II cleanup goals assumes only the default parameters. Modification based on site-specific data, however, could be implemented as a part of a Tier III risk assessment.

Toxicity data refers to cancer slope factors (SFs) and reference doses (RfDs), collectively termed dose-response factors, used in Equations 1 and 2. Dose-response factors relate the intake or dose of a chemical to a carcinogenic effect or noncarcinogenic systemic effect from exposure to a contaminated medium. Dose-response factors are specific to a chemical and exposure pathway (i.e., oral versus inhalation). SFs and RfDs are obtained first from EPA's Integrated Risk Information System (IRIS), or if not available in IRIS, from EPA's Health Effects Assessment Summary Tables (HEAST).

Target health effect levels refer to the levels of cancer risks or hazard indices that are deemed acceptable by the EPA for a particular site. Target health effect levels are cancer risks and hazards indices below which the potential for effects to human health are assumed to be negligible or inconsequential. Generally, cancer risks are evaluated based on a range of acceptable risk from 1 in 10,000 (10^{-4}) to 1 in a 1,000,000 (10^{-6}). Noncarcinogenic effects are evaluated based on a hazard index of one or below which is generally deemed to be acceptable. The range of acceptable risk for the carcinogenic assessment reflects the range of uncertainty in the analysis and interpretation of the results for a particular site. This range also reflects the range of acceptability for various land uses. For federal Superfund sites investigated under the national contingency plan (NCP), sites with a cumulative total cancer risk level below 10^{-6} for all applicable receptors indicate no remedial action is needed. Whereas, for sites with cancer risk levels above 10^{-4} , some remedial action must be taken to mitigate potential cancer risks. For sites with maximum cancer risks in the range 10^{-4} to 10^{-6} , action is taken on a site-specific basis. Typically on sites with unrestricted future use (i.e., where residential use is possible), the target risk level is closer to 10^{-6} . However, on sites with restricted land uses for current and future nonresidential purposes, target risk levels higher than 10^{-6} are often selected. Therefore, for determining health-based cleanup goals for carcinogens in the Tier II analysis, a "point of departure" for sites with unrestricted future use (i.e., including residential use) was based on a 10^{-6} target cancer risk level. For sites where current and future land use is restricted to nonresidential purposes, the "point of departure" for carcinogens was the 10^{-5} target cancer risk level. The target hazard index used for evaluating noncarcinogenic compounds was 1, for compounds that are not considered bioaccumulative, and 0.2, for compounds that are considered bioaccumulative. Table 1 of Water Quality Criteria for Specific

Substances (Indiana Register, Volume 16, Number 7, April 1, 1993) was the basis for determining whether or not a compound was considered bioaccumulative.

CALCULATION OF HEALTH-BASED CLEANUP GOALS

Health-based cleanup goals were calculated for soils and groundwater according to EPA's PRG approach, with one exception. Cleanup goals for soils were developed separately for surface and subsurface soils since they differ in the potential for direct contact exposure. Cleanup goals for surface soils were based on EPA's PRG approach considering target receptors of either residents, for sites remediated for unrestricted future use, or construction workers, for sites that are remediated for restricted land use for nonresidential purposes. For subsurface or deep soils, applicable receptors are excavation workers (i.e., for utility placement or maintenance) or construction workers. These particular receptors would be exposed to subsurface soils at a higher rate (i.e., higher contact rate per day or event) than a construction worker or resident would be exposed to surface soils, but the exposure would occur over a shorter duration. The following paragraphs provide a discussion of calculating health-based criteria applicable for the nonresidential and residential land use scenarios.

NONRESIDENTIAL LAND USE SCENARIO

Surface Soils: Potential exposure pathways considered applicable for surface soils in the nonresidential scenario were incidental ingestion and inhalation of volatiles and fugitive dusts. The cancer risk, R, and hazard index, HI, for these exposure pathways by a worker are calculated using equations written in the form of Equations 1 and 2, however they are expanded to consider specific formulas for calculating

$$R = \frac{EF (ED (C_s (\{SF_o (IR_{soil} (10^{8.6} \text{ Kg/mg}) \% \{SF_i (IR_{air} ((1/VF \% 1/PEF)\})))))))}{BW (AT (365 \text{ days/yr}))}$$

Equation (5)

intake (I_i) as follows, for carcinogens:

and for noncarcinogens:

$$HI = \frac{EF (ED (C_s (\{1/RfD_o (IR_{soil} (10^{8.6} \text{ Kg/mg}) \% \{1/RfD_i (IR_{air} ((1/VF \% 1/PEF)\}))))))}{BW (AT (365 \text{ days/yr}))}$$

Equation (6)

The variables VF (soil to air volatilization factor) and PEF (particulate emissions factor) relate the exposure concentrations for the chemical in air to source concentration in soil. The values of VF and PEF are calculated according to the following equations:

$$VF (m^3/kg) = \left(\frac{LS (V (DH)}{A} \right) \left(\frac{(3.14 (T)^{1/2}}{2 (D_{ei} (E (K_{sa} (10^{8.3} \text{ kg/g}))))} \right)$$

Equation (7)

where:

$$D \text{ (cm}^2\text{/s)} = \frac{E}{E \% \frac{P_s(1+E)}{K_{sa}}}$$

Equation (8)

and

$$PEF \text{ (m}^3\text{/kg)} = \left(\frac{LS \text{ (V (DH (3600s/h))}{A} \right) \left(\frac{1000\text{g/kg}}{0.036 \text{ ((1&G) ((U_m/U_l)^3 (F(x))} \right)$$

Equation (9)

The definitions of variables in Equations 5 through 9 and their EPA recommended default values are provided in Table 1. Equations 5 and 6 above provide numeric estimates of cancer risk (R) and noncarcinogenic hazard index (HI) as a function of the concentration of a chemical in soil. These equations can be inverted to solve for the soil concentration which becomes the health-based criteria (C_{goal}) for a particular compound, as follows:

$$C_{goal} = \frac{BW \text{ (THI (AT (365days/year} }{EF \text{ (ED ((1/RfD_o) (10}^6\text{kg/mg (IR}_{soil} \% (1/RfD_i) (IR}_{air} \text{ ((} \frac{1}{VF} \% \frac{1}{PEF} \text{))}$$

Equation (10)

and

$$C_{goal} = \frac{BW \text{ (TR (AT (365days/year} }{EF \text{ (ED ((SF_o (10}^6\text{kg/mg (IR}_{soil} \% SF_i \text{ (IR}_{air} \text{ ((} \frac{1}{VF} \% \frac{1}{PEF} \text{))}$$

Equation (11)

where: TR = target cancer risk level; and
 THI = target hazard index.

The above expression allows for the explicit calculation of a soil health-based criteria once target cancer risk and hazard index levels are established.

Under the default assumptions presented in Table 1, and assuming a target cancer risk level (TR) of 10⁻⁵ and target hazard index (THI) of 1 for the nonresidential scenario, the above two equations reduce to:

$$C_{goal} = \frac{2.9(10^{&3})}{5(10^{&5} (SF_o) \% (SF_i (\frac{20}{VF} \% 4.3(10^{&9})))}$$

Equation (12)

and

$$C_{goal} = \frac{102}{5(10^{&5}/RfD_o) \% (1/RfD_i (\frac{20}{VF} \% 4.3(10^{&9})))}$$

Equation (13)

Subsurface Soils: As with surface soils, potential exposure pathways applicable for a construction or excavation worker exposed to subsurface soils are incidental ingestion and inhalation of volatiles and fugitive dusts. The cancer risk and hazard index for constructions workers were calculated and combined for these exposure pathways based on Equation 5 for carcinogens and Equation 6 for noncarcinogens. The parameter definitions for variables specific for construction workers exposed to subsurface soils are provided in Table 2. As with surface soils, health-based criteria (C_{goal}) for subsurface soils are calculated based on inverting Equations 5 and 6 and generating equations similar to 10 and 11.

Under the default assumptions presented in Table 2, and assuming a target cancer risk level (TR) of 10^{-5} and THI of 1 for construction workers in the industrial scenario, Equations 10 and 11 reduce to:

$$C_{goal} = \frac{5.1(10^{&2})}{1(10^{&4} (SF_o) \% (SF_i (\frac{20}{VF} \% 4.3(10^{&9})))}$$

Equation (14)

and

$$C_{goal} = \frac{146}{1(10^{&4}/RfD_o) \% (1/RfD_i (\frac{20}{VF} \% 4.3(10^{&9})))}$$

Equation (15)

Groundwater: The exposure pathway considered applicable for groundwater in the industrial land use scenario is ingestion. Cancer risks and hazard indices from this exposure pathway is calculated in equations that combine these intake assumptions as follows, for potential carcinogens:

$$R = \frac{EF (ED (C_w (SF_o (IR_w }{BW (AT (365 \text{ days/yr}}$$

Equation (16)

and, for noncarcinogens:

$$HI = \frac{EF (ED (C_w (IR_w}{RfD_o (BW (AT (365 \text{ days/yr}}$$

Equation (17)

The definitions of variables in Equations 16 and 17, and the EPA recommended default values are provided in Table 3. Equations 16 and 17 present health effects as a function of concentration of chemical in groundwater. These equations can be inverted to solve for water concentrations or health-based criteria (C_{goal}) for groundwater as follows:

$$C_{goal} = \frac{TR (BW (AT (365 \text{ days/yr}}{EF (ED (SF_o (IR_w}}$$

Equation (18)

and

$$C_{goal} = \frac{THI (RfD_o (BW (AT (365 \text{ days/yr}}{EF (ED (IR_w}}$$

Equation (19)

If the default assumptions presented in Table 3 are used and a target cancer risk of 10^{-5} and target hazard index of 1 are assumed, the above equations reduce to, for carcinogens:

$$C_{goal} = \frac{2.86 (10^{&3}}{SF_o}}$$

Equation (20)

and, for noncarcinogens

$$C_{goal} = 102.2 (RfD_o}}$$

Equation (21)

RESIDENTIAL LAND USE SCENARIO

Surface Soils: The potential exposure pathway applicable for surface soils in the residential scenario was incidental ingestion. The equations of risk to a resident from soil ingestion are slightly different from the nonresidential scenario as the ingestion rate is weighted to account for the change in body weight and ingestion rate as a resident child ages into a resident adult. The equations to be used to calculate cancer risk and hazard index from soil ingestion under a residential scenario are:

$$R_{ing} = \frac{SF_o (C_s (10^{&6} \text{ Kg/mg} (EF (IF_{soil/adj}))))}{AT (365 \text{ days/year})}$$

Equation (22)

and for noncarcinogens:

$$HI_{ing} = \frac{C_s (10^{&6} \text{ Kg/mg} (EF (IF_{soil/adj})))}{RfD_o (AT (365 \text{ days/year}))}$$

Equation (23)

where $IF_{soil/adj}$ is the time-weighted average soil ingestion rate for residents divided body weight. Unlike the soil ingestion rate (IR_{soil}) used for a worker, $IF_{soil/adj}$ is a parameter that accounts for the changing rate of soil intake as a child grows into a young adult in a residential setting. The variable $IF_{soil/adj}$ was calculated by the equation:

$$IF_{soil/adj} (\text{mg&yr/Kg&day}) = \frac{IR_{soil/age1\&6} (ED_{age1\&6})}{BW_{age1\&6}} + \frac{IR_{soil/age7\&31} (ED_{age7\&31})}{BW_{age7\&31}}$$

Equation (24)

The definitions of parameters in Equations 22, 23 and 24, and the EPA recommended default values are provided in Table 4. Equations 22 and 23 specify cancer risks and hazard indices as a function of soil concentration. These equations can be inverted to solve for soil concentrations or health-based criteria (C_{goal}) for surface soil as follows:

$$C_{goal} = \frac{TR (AT (365 \text{ days/year}))}{SF_o (10^{&6} \text{ kg/mg} (EF (IF_{soil/adj})))}$$

Equation (25)

and

$$C_{goal} = \frac{THI (AT (365days/year) }{1/RfD_o (10^{86}kg/mg (EF (IF_{soil/adj})}$$

Equation (26)

where: TR = target cancer risk level; and
THI = target allowable hazard index.

If the default assumptions presented in Table 4 are used and a target cancer risk of 10^{-6} and target hazard index of 1 are assumed, the above equations reduce to:

$$C_{goal} = \frac{0.64}{SF_o}$$

Equation (27)

and

$$C_{goal} = 2.7 (10^5 (RfD_o)$$

Equation (28)

Subsurface Soils: As with subsurface soils in the nonresidential scenario, subsurface soils in the residential scenario are assumed to only be contacted during excavation or construction activities. Therefore, the assumptions and equations determined for the nonresidential scenario would be applicable for the residential scenario. Thus, cleanup goals for subsurface soils in the residential scenario are the same as those determined for the nonresidential scenario.

Groundwater: Potential exposure pathways considered applicable for groundwater in the residential land use scenario include ingestion and inhalation of volatiles. Cancer risks and hazard indices from these two exposure pathways are calculated in equations that combine these intake assumptions as follows, for potential carcinogens:

$$R = \frac{EF (ED (C_w ((SF_o (IR_w)) (SF_i (K (IR_a))) }{BW (AT (365 days/yr)}$$

Equation (29)

and, for noncarcinogens:

$$HI = \frac{EF (ED (C_w ((1/RfD_o (IR_w)) (1/RfD_i (K (IR_a))) }{BW (AT (365 days/yr)}$$

Equation (30)

The definitions of variables in Equations 29 and 30, and the EPA recommended default values are provided in Table 5. Equations 29 and 30 present health effects as a function of concentration of chemical in groundwater. These equations can be inverted to solve for water concentrations or health-based criteria (C_{goal}) for groundwater as follows:

$$C_{goal} = \frac{TR (BW (AT (365 \text{ days/yr})))}{EF (ED ((SF_o (IR_w) \% (SF_i (K (IR_a))))))}$$

Equation (31)

and

$$C_{goal} = \frac{THI (BW (AT (365 \text{ days/yr})))}{EF (ED ((1/RfD_o (IR_w) \% (1/RfD_i (K (IR_a))))))}$$

Equation (32)

If the default assumptions presented in Table 5 are used and a target cancer risk of 10^{-6} and target hazard index of 1 are assumed, the above equations reduce to, for carcinogens:

$$C_{goal} = \frac{1.7 (10^{84})}{(2 (SF_o) \% (7.5 (SF_i)))}$$

Equation (33)

and, for noncarcinogens

$$C_{goal} = \frac{60.8}{(2/RfD_o) \% (7.5/RfD_i) }$$

Equation (34)

TIER II CLEANUP GOALS

Cleanup goals were calculated for a representative set of chemicals for the Tier II Voluntary Remediation Program based on the procedures outlined above. Table 6 presents this list of chemicals along with analytical detection limits and a determination of whether or not the compound is considered bioaccumulative. Table 7 presents appropriate chemical properties and dose-response data used for calculation of health-based criteria. This representative list of chemicals includes semi-volatiles, volatiles, pesticides and PCBs and inorganics (i.e., metals and cyanide). Literature sources for chemical property data include the following:

- @ Howard, P.H. 1989. *Fate and Exposure Data for Organic Chemicals*. Lewis Publishers, Chelsea Michigan.
- @ EPA, 1989. *Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF) - Air Emissions Models*. Appendix D: Properties for Chemicals of Interest. EPA-450/3-87-026. November, 1989.
- @ EPA, 1986. *Superfund Public Health Evaluation Manual*. Appendix A: Summary Tables for Chemical-Specific Data. EPA/540/1-86/060. October, 1986.
- @ PADER, 1990. *Risk Assessment/Fate and Transport Modeling System*. Appendix B: Selected Parameter Values for Common Contaminants. Bureau of Waste Management, Pennsylvania Dept. of Environmental Resources. July 13, 1990.

Dose-response data were obtained from the Integrated Risk Information System (IRIS, 1993), and if not available in IRIS, from the Health Effects Assessment Summary Tables (HEAST, 1992: with Supplemental Updates Nos. 1 and 2). Only dose-response data for chemicals with toxicity data from IRIS (1993) and HEAST (1992) were used with the exception of potentially carcinogenic PAHs. Seven of the priority pollutant PAHs are classified as B2 probable carcinogens (IRIS, 1992) as follows:

- @ benzo(a)pyrene;
- @ chrysene;
- @ benzo(a)anthracene;
- @ benzo(k)fluoranthene;
- @ benzo(b)fluoranthene;
- @ dibenzo(a,h)anthracene; and
- @ indeno(1,2,3-c,d)pyrene.

However, EPA-verified CSFs only exist for benzo(a)pyrene (IRIS, 1992). Therefore, cancer slope factors are needed to perform a carcinogenic assessment for the other 6 potentially carcinogenic PAHs. EPA is currently considering evaluating the carcinogenicity of the other potentially carcinogenic compounds based on a toxicity equivalency factor (TEF) approach relative to carcinogenicity of benzo(a)pyrene. An interim draft policy for evaluating the carcinogenicity of the other PAHs was released in 1990 (EPA, 1990. *Draft Interim Policy for Estimating Carcinogenic Risks Associated With Exposures to Polycyclic Aromatic Hydrocarbons (PAHs)*, OSWER Directive #9285-4-02). This draft interim policy first identified the TEF approach for assessing the carcinogenicity of PAHs other than benzo(a)pyrene. This was further supported by a recent EPA memo from Kenneth A. Poirer, Director of Superfund Health Risk Technical Support Center for Chemical Mixtures and Assessment Branch, concerning PAH toxicity (*Risk Assessment for Polyaromatic Hydrocarbons*, Memo to Sarah Levinson, EPA Region 1, January, 1992). Also, the Environmental Criteria and Assessment Office (ECAO) of EPA in Cincinnati was contacted concerning the appropriate methodology for the carcinogenic assessment of PAHs. Dr. Rita Schoeny, Associate Director of Science for ECAO, stated that a TEF approach is appropriate for evaluating the carcinogenicity for the other six potentially carcinogenic PAH

compounds using the TEF factors relative to that of benzo(a)pyrene. These TEF factors are as follows:

	<u>PAH COMPOUND</u>		<u>TEF</u>	<u>CSF</u>
C	benzo(a)pyrene	-	1	7.3
C	benzo(a)anthracene	-	0.1	0.73
C	benzo(b)fluoranthene	-	0.1	0.73
C	benzo(k)fluoranthene	-	0.01	0.073
C	chrysene	-	0.001	0.0073
C	dibenzo(a,h)anthracene	-	1.0	7.3
C	indeno(1,2,3-c,d)pyrene	-	0.1	0.73

Therefore, with the absence of verified EPA CSFs for PAHs other than benzo(a)pyrene, PAHs carcinogenicity were assessed based on the TEF approach, suggested by EPA and recommended by Dr. Schoeny of EPA's ECAO.

An overview of health-based cleanup goals by scenario (residential and nonresidential) and by media are provided below.

NONRESIDENTIAL SCENARIO

Groundwater: Cleanup goals for groundwater in the nonresidential scenario were determined based on health-based criteria from direct contact using the default Equations 20 and 21. However, for implementation purposes for a site remediation program, health-based concentrations were compared to practical quantitation limits (PQLs) and drinking water criteria (i.e., non-zero maximum contaminant level goals [MCLGs] or maximum contaminant levels [MCLs] from the Safe Drinking Water Act) for determination of the cleanup goal. The practical quantitation limit is the lowest level that can be reliably achieved for a particular analyte within specified limits of precision and accuracy during routine laboratory operating conditions for a particular procedure. PQLs were determined based on *Test Methods for Evaluating Solid Waste* (EPA, 1986; SW-846). Representative test methods considered applicable for compounds in water include:

- @ Method 8270 for semi-volatiles;
- @ Method 8240 for volatiles;
- @ Method 8080 for pesticides and PCBs;
- @ Method Series 200 for metals and inorganics.

However, final PQLs would vary according to the specific analytical method used. Health-based concentrations were first compared to PQLs. For those compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. Finally, health-based concentrations were compared to drinking water quality criteria (i.e., non-zero MCLGs and MCLs). For those compounds with criteria below MCLGs or MCLs, the cleanup goal were based on applicable drinking water criteria.

Table 8 presents applicable drinking water criteria, PQLs and health-based concentrations that were used to determine Tier II cleanup goals for groundwater in the nonresidential scenario (i.e., on sites

remediated for restricted future use). Health-based concentrations for carcinogens in the nonresidential scenario were calculated assuming a 10^{-5} target risk level. Health-based concentrations for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative. Cleanup goals identified as NA for particular compounds indicate appropriate toxicity data is not available or not appropriate for that particular compound. For some compounds, cleanup goals were determined from both the carcinogenic and noncarcinogenic assessment. The appropriate cleanup goal would, therefore, be the lower of the two values. For other compounds, such as lead, no toxicity values were available and therefore, health-based cleanup goals could not be calculated based on this methodology. However, there are data available to assess cleanup goals for compounds such as lead, such as MCLs or other EPA documentation which should be consulted.

Surface Soils: Cleanup goals for surface soils in the nonresidential scenario were determined based on health-based concentrations from direct contact using the default Equations 12 and 13. However, health-based concentrations were compared to practical quantitation limits (PQLs) for determination of the cleanup goal. The consideration of PQLs was considered necessary for application of cleanup goals to site remediation programs. For compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in surface soil according to the following criteria:

- ⊗ total semi-volatile compounds not to exceed 10,000 mg/Kg;
- ⊗ total volatile compounds not to exceed 1,000 mg/Kg;
- ⊗ total cyanide concentrations of 1,000 mg/Kg; and
- ⊗ total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria. No upper limit has been established for metals other than mercury since many are naturally occurring, some of which at high concentrations.

Table 9 presents PQLs and health-based concentrations that were used to determine Tier II cleanup goals for surface soils in the nonresidential land use scenario (i.e., on sites remediated for restricted future use). Cleanup goals for carcinogens in the nonresidential scenario were calculated assuming a 10^{-5} target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

Subsurface Soils: Cleanup goals for subsurface soils in the nonresidential scenario were determined based on two health-based criteria: direct contact using the default Equations 14 and 15; and based on leaching to groundwater and protection of a groundwater criteria or standard. The leaching pathway was not considered in the calculation of PRGs, however, the leaching of chemicals from soils to groundwater and the protection of groundwater was deemed an important consideration for establishing cleanup goals for subsurface soils. Soil concentrations that are considered protective of groundwater via leaching were calculated based on EPA's Organic Leaching Model (OLM) [*Final Organic Leaching Model (OLM)*]; EPA 51 FR 41082, Nov. 13, 1986], which involves the equation:

$$C_l = 0.00221 (C_s^{0.678} (Sol^{0.373})$$

Equation (35)

where: C_l = Concentration in the leachate (mg/L);
 C_s = Concentration in the soil or solid media (mg/Kg); and
 Sol = Aqueous solubility (mg/L).

By substituting a groundwater cleanup goal (C_{gw}) for C_l in Equation 35 and re-arranging term, an acceptable subsurface soil concentration (C_s) is calculated with the equation:

$$C_s = \left(\frac{C_{gw}}{0.00221 (Sol^{0.373})} \right)^{1/0.678}$$

Equation (36)

The health-based criteria was the lower of the either the health-based concentration from the direct contact method or from the leaching method. However, as with surface soils, health-based criteria were compared to practical quantitation limits (PQLs) for determination of the final Tier II cleanup goal. This is necessary for implementation purposes in a remediation program on subsurface soils. For compounds having health-based criteria less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in subsurface soils, based on the discussion provided above for surface soils, including the following:

- total semi-volatile compounds not to exceed 10,000 mg/Kg;
- total volatile compounds not to exceed 1,000 mg/Kg;
- total cyanide concentrations of 1,000 mg/Kg; and
- total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria.

Table 10 presents PQLs and health-based concentrations from the direct contact and leaching methods for determination of Tier II cleanup goals for subsurface soils in the nonresidential land use scenario (i.e., on sites remediated for restricted future use). Cleanup goals for carcinogens in subsurface soils from the nonresidential scenario were calculated assuming a 10^{-5} target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

RESIDENTIAL SCENARIO

Groundwater: Cleanup goals for groundwater in the residential scenario were determined based on health-based criteria from direct contact using the default Equations 33 and 34. Health-based concentrations were compared to practical quantitation limits (PQLs) and non-zero maximum

contaminant level goals (MCLGs) or maximum contaminant levels (MCLs) from the Safe Drinking Water Act, for determination of the cleanup goal. Health-based concentrations were first compared to PQLs. For those compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. Finally, health-based concentrations were compared to drinking water quality criteria (i.e., non-zero MCLGs and MCLs). For those compounds with criteria below MCLGs or MCLs, the cleanup goal were based on applicable drinking water criteria. Analytical test methods for determining concentrations in residential drinking water detection methods must conform to current U.S. EPA drinking water methodology.

Table 11 presents applicable drinking water criteria, PQLs and health-based concentrations that were used to determine Tier II cleanup goals for groundwater in the residential scenario (i.e., on sites remediated for unrestricted future use). Health-based concentrations for carcinogens in the residential scenario were calculated assuming a 10^{-6} target risk level. Health-based concentrations for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

Surface Soils: Cleanup goals for surface soils in the residential scenario were determined based on health-based concentrations from direct contact using the default Equations 27 and 28. Health-based concentrations were compared to practical quantitation limits (PQLs) for determination of the cleanup goal. For compounds having health-based concentrations less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in surface soils which include the following:

- ⊗ total semi-volatile compounds not to exceed 10,000 mg/Kg;
- ⊗ total volatile compounds not to exceed 1,000 mg/Kg;
- ⊗ total cyanide concentrations of 1,000 mg/Kg; and
- ⊗ total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria.

Table 12 presents PQLs and health-based concentrations that were used to determine Tier II cleanup goals for surface soils in the residential land use scenario (i.e., on sites remediated for unrestricted future use). Cleanup goals for carcinogens in the residential scenario were calculated assuming a 10^{-6} target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

Subsurface Soils: Cleanup goals for subsurface soils in the residential scenario were determined based on the discussion provided above for the nonresidential scenario. However, the applicable groundwater criteria for the leaching assessment were based on the groundwater criteria discussed above for the residential scenario. The health-based criteria was the lower of the either the health-based concentration from the direct contact method or from the leaching method. Health-based criteria were then compared to practical quantitation limits (PQLs) for determination of the final Tier II cleanup goal. For compounds having health-based criteria less than the PQL, the PQL was considered the cleanup goal. A maximum upper limit is proposed for each chemical class in subsurface soils which include the

following:

- @ total semi-volatile compounds not to exceed 10,000 mg/Kg;
- @ total volatile compounds not to exceed 1,000 mg/Kg;
- @ total cyanide concentrations of 1,000 mg/Kg; and
- @ total mercury concentrations of 1,000 mg/Kg.

These limits were established to be protective of other potential exposure pathways not evaluated in the calculation of health-based criteria.

Table 13 presents PQLs and health-based concentrations from the direct contact and leaching methods for determination of Tier II cleanup goals for subsurface soils in the residential land use scenario. Cleanup goals for carcinogens in subsurface soils from the residential scenario were calculated assuming a 10^{-6} target risk level. Cleanup goals for noncarcinogens were calculated based on a target hazard index of 1, for non-bioaccumulative compounds, and 0.2 for compounds that are bioaccumulative.

SUMMARY

This section discussed the calculation of cleanup goals for Tier II in the Voluntary Remediation Program. Cleanup goals were presented for surface soils, subsurface soils and groundwater separately for a residential and nonresidential land use scenario. Tier II cleanup goals were presented for representative compounds. Tables 14 and 15 present cleanup goals for the residential and nonresidential scenarios, respectively. Cleanup goals were determined based on health-based concentrations from a human health risk assessment. However, the determination of cleanup goals also considered practical quantitation limits (PQLs) based on available analytical methods for soils and groundwater. PQLs must be considered when establishing definable cleanup goals to be met in a site remediation program.

TABLE 1
INTAKE ASSUMPTIONS FOR EXPOSURE TO SURFACE SOILS IN THE NONRESIDENTIAL
SCENARIO

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions For Calculation of Cleanup Goals for Surface Soil</i>		
C_s	chemical concentration in soil (mg/Kg)	-
TR	target excess individual lifetime cancer risk (unitless)	10^{-5} (industrial)
THI	target acceptable hazard index (unitless)	1
Sf_o	oral cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
Sf_i	inhalation cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
RfD _o	oral reference dose (mg/Kg/day)	chemical-specific
RfD _i	inhalation reference dose (mg/Kg/day)	chemical-specific
AT	averaging time (yr)	70yr - carcinogenic 25yr - noncarcinogenic
EF	exposure frequency (days/yr)	50 days/yr
ED	exposure duration (yr)	25 yr
Ir _{soil}	soil ingestion rate (mg/day)	50 mg/day
Ir _{air}	inhalation rate (m ³ /day)	20 m ³ /day
VF	volatilization factor (m ³ /Kg)	(see Equation 7 and factors below)
PEF	particulate emissions factor (m ³ /Kg)	(see Equation 9 and factors below)
<i>Assumptions for Estimation of Volatilization Factor (VF)</i>		
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm ²)	20,250,000 cm ²
D _{ei}	effective diffusivity (cm ²)	D _i x E ^{0.33}
E	true soil porosity (unitless)	0.35
K _{sa}	soil/air partition coefficient (g soil/cm ³ air)	(H/K _d) x 41, where 41 is a units conversion factor
p _s	true soil density or particulate density (g/cm ³)	2.65 g/cm ³
T	exposure interval (s)	7.90e+08 s
D _i	molecular diffusivity (cm ² /s)	chemical-specific
H	Henry's law constant (atm-m ³ /mol)	chemical-specific
K _d	soil-water partition coefficient (cm ³ /g)	chemical-specific, or K _{oc} x OC
K _{oc}	organic carbon partition coefficient (cm ³ /g)	chemical-specific
OC	organic carbon content of soil (fraction)	site-specific, or 0.02

TABLE 1 Cont.
INTAKE ASSUMPTIONS FOR EXPOSURE TO SURFACE SOILS IN THE NONRESIDENTIAL SCENARIO

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions for Estimation of Particulate Emission Factor (PEF)</i>		
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (m ²)	2,025 m ²
RF	respirable fraction (g/m ² -hr)	0.036 g/m ² -hr
G	fraction of vegetative cover (unitless)	0
U _m	mean annual wind speed (m/s)	4.5 m/s
U _t	equivalent threshold value of windspeed at 10 m (m/s)	12.8 m/s
F(x)	function dependent on U _m /U _t	0.0497

TABLE 2
INTAKE ASSUMPTIONS FOR EXPOSURE TO SUBSURFACE SOILS
IN THE NONRESIDENTIAL AND RESIDENTIAL SCENARIOS

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions For Calculation of Cleanup Goals for Subsurface Soil</i>		
C_s	chemical concentration in soil (mg/Kg)	-
TR	target excess individual lifetime cancer risk (unitless)	10^{-5} (industrial)
THI	target acceptable hazard index (unitless)	1
Sf_o	oral cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
Sf_i	inhalation cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
RfD_o	oral reference dose (mg/Kg/day)	chemical-specific
RfD_i	inhalation reference dose (mg/Kg/day)	chemical-specific
AT	averaging time (yr)	70 yr - carcinogenic 2 yr - noncarcinogenic
EF	exposure frequency (days/yr)	175 5 days/wk, 35 weeks/yr
ED	exposure duration (yr)	2 yr
Ir_{soil}	soil ingestion rate (mg/day)	100 mg/day
Ir_{air}	inhalation rate (m ³ /day)	20 m ³ /day
VF	volatilization factor (m ³ /Kg)	(see Equation 7 and factors below)
PEF	particulate emissions factor (m ³ /Kg)	(see Equation 9 and factors below)
<i>Assumptions for Estimation of Volatilization Factor (VF)</i>		
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (cm ²)	20,250,000 cm ²
D_{ei}	effective diffusivity (cm ²)	$D_i \times E^{0.33}$
E	true soil porosity (unitless)	0.35
K_{sa}	soil/air partition coefficient (g soil/cm ³ air)	(H/ K_d) x 41, where 41 is a units conversion factor
p_s	true soil density or particulate density (g/cm ³)	2.65 g/cm ³
T	exposure interval (s)	7.90e+08 s
D_i	molecular diffusivity (cm ² /s)	chemical-specific
H	Henry's law constant (atm-m ³ /mol)	chemical-specific
K_d	soil-water partition coefficient (cm ³ /g)	chemical-specific, or $K_{oc} \times OC$
K_{oc}	organic carbon partition coefficient (cm ³ /g)	chemical-specific
OC	organic carbon content of soil (fraction)	site-specific, or 0.02

TABLE 2 Cont.
INTAKE ASSUMPTIONS FOR EXPOSURE TO SUBSURFACE SOILS
IN THE NONRESIDENTIAL AND RESIDENTIAL SCENARIOS

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions for Estimation of Particulate Emission Factor (PEF)</i>		
LS	length of side of contaminated area (m)	45 m
V	wind speed in mixing zone (m/s)	2.25 m/s
DH	diffusion height (m)	2 m
A	area of contamination (m ²)	2,025 m ²
RF	respirable fraction (g/m ² -hr)	0.036 g/m ² -hr
G	fraction of vegetative cover (unitless)	0
U _m	mean annual wind speed (m/s)	4.5 m/s
U _t	equivalent threshold value of windspeed at 10 m (m/s)	12.8 m/s
F(x)	function dependent on U _m /U _t	0.0497

TABLE 3
INTAKE ASSUMPTIONS FOR EXPOSURE TO GROUNDWATER
IN THE NONRESIDENTIAL SCENARIO

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions For Calculation of Cleanup Goals for Groundwater</i>		
CW	chemical concentration in water (mg/L)	-
TR	target excess individual lifetime cancer risk (unitless)	10 ⁻⁵ (industrial)
THI	target acceptable hazard index (unitless)	1
Sf _o	oral cancer slope factor ((mg/Kg-day) ⁻¹)	chemical-specific
RfD _o	oral reference dose (mg/Kg/day)	chemical-specific
BW	adult body weight (Kg)	70 Kg
AT	averaging time (yr)	70 yr - carcinogenic 25 yr - noncarcinogenic
EF	exposure frequency (days/yr)	250 days/yr
ED	exposure duration (yr)	25 yr
Ir _w	daily water ingestion rate (L/day)	1 L/day

TABLE 4
INTAKE ASSUMPTIONS FOR EXPOSURE TO SURFACE SOILS
IN THE RESIDENTIAL SCENARIO

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions For Calculation of Cleanup Goals for Surface Soil</i>		
C_s	chemical concentration in soil (mg/Kg)	-
TR	target excess individual lifetime cancer risk (unitless)	10^{-6} (residential)
THI	target acceptable hazard index (unitless)	1
Sf_o	oral cancer slope factor (mg/Kg-day) ⁻¹	chemical-specific
RfD_o	oral reference dose (mg/Kg/day)	chemical-specific
AT	averaging time (yr)	70 yr - carcinogenic 30 yr - noncarcinogenic
EF	exposure frequency (days/yr)	350 days/yr
ED	exposure duration (yr)	30 yr
$If_{soil/adj}$	age-adjusted ingestion factor(mg-yr/Kg-day)	114 mg-yr/Kg-day

Assumptions for Calculation of $IF_{soil/adj}$

$BW_{age\ 1-6}$	average body weight from ages 1-6 (Kg)	15 Kg
$BW_{age\ 7-31}$	average body weight from ages 7-31 (Kg)	70 Kg
$ED_{ages\ 1-6}$	exposure duration during ages 1-6 (yr)	6 yr
$ED_{ages\ 7-31}$	exposure duration during ages 7-31 (yr)	24 yr
$IR_{soil/ages\ 1-6}$	ingestion rate of soil age 1 to 6 (mg/day)	200 mg/day
$IR_{soil/ages\ 7-31}$	ingestion rate of soil all other ages (mg/day)	100 mg/day

TABLE 5
INTAKE ASSUMPTIONS FOR EXPOSURE TO GROUNDWATER
IN THE RESIDENTIAL SCENARIO

<u>Parameters</u>	<u>Definition (units)</u>	<u>Default Value</u>
<i>Assumptions For Calculation of Cleanup Goals for Groundwater</i>		
C_w	chemical concentration in water (mg/L)	-
TR	target excess individual lifetime cancer risk (unitless)	10^{-6} (residential)
THI	target acceptable hazard index (unitless)	1
Sf_o	oral cancer slope factor ((mg/Kg-day) ⁻¹)	chemical-specific
RfD _o	oral reference dose (mg/Kg/day)	chemical-specific
SF_i	inhalation cancer slope factor ((mg/Kg-day) ⁻¹)	chemical-specific
RfD _i	inhalation reference dose (mg/Kg/day)	chemical-specific
BW	adult body weight (Kg)	70 Kg
AT	averaging time (yr)	70 yr - carcinogenic 25 yr - noncarcinogenic
EF	exposure frequency (days/yr)	350 days/yr
ED	exposure duration (yr)	30 yr
IR _a	daily indoor inhalation rate (m ³ /day)	15m ³ /day
Ir _w	daily water ingestion rate (L/day)	2 L/day
K	volatilization factor (unitless)	.0005 x 1000 L/m ³ (Andelman 1990)

TABLE 6
REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS

Chemical Name	Compound Type ^a	Compound is Considered Bioaccumulatable ^b (yes/no)	Maximum Contaminant Level		Maximum Contaminant Level Goal		Practical or Estimated Quantitation Limits ^c	
			Level (MCL) (mg/L)	Level (MCLG) (mg/L)	Value (mg/Kg)	Value (mg/L)	Value (mg/L)	Method
							Groundwater	Method
naphthalene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
acenaphthylene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
acenaphthene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
fluorene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
phenanthrene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
anthracene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
fluoranthene	semivolatile	yes			0.660	SW846 - 8270	0.01000	SW846 - 8270
pyrene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
benzo(a)anthracene*	semivolatile	yes	0.0001	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
chrysene*	semivolatile	yes	0.0002	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
benzo(b)fluoranthene*	semivolatile	yes	0.0002	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
benzo(k)fluoranthene*	semivolatile	yes	0.0002	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
benzo(a)pyrene	semivolatile	yes	0.0002	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
indeno(1,2,3-cd)pyrene*	semivolatile	yes	0.0004	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
dibenzo(a,h)anthracene*	semivolatile	yes	0.0003	0	0.660	SW846 - 8270	0.01000	SW846 - 8270
benzo(g,h,i)perylene	semivolatile	yes			0.660	SW846 - 8270	0.01000	SW846 - 8270
3,3'-dichlorobenzidine	semivolatile	no			1.300	SW846 - 8270	0.02000	SW846 - 8270
n-nitroso-di-n-propylamine	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
bis(2-chloroisopropyl)ether	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
4-chloroaniline	semivolatile	no			1.300	SW846 - 8270	0.02000	SW846 - 8270
2-chloronaphthalene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
2,4-dinitrotoluene	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
hexachlorobutadiene	semivolatile	yes			0.660	SW846 - 8270	0.01000	SW846 - 8270
hexachloroethane	semivolatile	yes			0.660	SW846 - 8270	0.01000	SW846 - 8270
isophorone	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270
benzyl alcohol	semivolatile	no			1.300	SW846 - 8270	0.02000	SW846 - 8270
bis(2-chloroethyl)ether	semivolatile	no			0.660	SW846 - 8270	0.01000	SW846 - 8270

**TABLE 6
REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS**

Chemical Name	Compound Type ^a	Bioaccumulatable ^b (yes/no)	Compound is Considered	Maximum Contaminant Level		Maximum Contaminant Level Goal		Practical or Estimated Quantitation Limits ^c	
				(MCL) (mg/L)	(MCLG) (mg/L)	Low Contaminated Soil	Groundwater		
				Value (mg/L)	Value (mg/Kg)	Value (mg/L)	Value (mg/L)		
nitrobenzene	semivolatitle	no	no	0.6000	0.6000	0.660	0.01000	SW846 - 8270	SW846 - 8270
1,2-dichlorobenzene	semivolatitle	no	no	0.6000	0.6000	0.660	0.01000	SW846 - 8270	SW846 - 8270
1,3-dichlorobenzene	semivolatitle	no	no	0.6000	0.6000	0.660	0.01000	SW846 - 8270	SW846 - 8270
1,4-dichlorobenzene	semivolatitle	no	no	0.0750	0.0750	0.660	0.01000	SW846 - 8270	SW846 - 8270
1,2,4-trichlorobenzene	semivolatitle	no	no	0.0700	0.0700	0.660	0.01000	SW846 - 8270	SW846 - 8270
hexachlorobenzene	semivolatitle	no	no	0.0010	0	0.660	0.01000	SW846 - 8270	SW846 - 8270
hexachlorocyclopentadiene	semivolatitle	no	no	0.0500	0.0500	0.660	0.01000	SW846 - 8270	SW846 - 8270
n-nitrosodiphenylamine	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
benzoic acid	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
2-nitroaniline	semivolatitle	no	no			3.300	0.05000	SW846 - 8270	SW846 - 8270
phenol	semivolatitle	yes	yes			3.300	0.05000	SW846 - 8270	SW846 - 8270
2-methylphenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
3-methylphenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
4-methylphenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
2-chlorophenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
2,4-dichlorophenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
2,4,5-trichlorophenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
2,4,6-trichlorophenol	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
pentachlorophenol	semivolatitle	no	no	0.0010	0	0.660	0.01000	SW846 - 8270	SW846 - 8270
2,4-dinitrophenol	semivolatitle	no	no			3.300	0.05000	SW846 - 8270	SW846 - 8270
bis(2-ethylhexyl)phthalate	semivolatitle	yes	yes	0.0060	0	0.660	0.01000	SW846 - 8270	SW846 - 8270
butylbenzylphthalate	semivolatitle	no	no	0.1000	0	0.660	0.01000	SW846 - 8270	SW846 - 8270
di-n-butylphthalate	semivolatitle	yes	yes			0.660	0.01000	SW846 - 8270	SW846 - 8270
diethylphthalate	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
di methyl phthalate	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
di-n-octyl phthalate	semivolatitle	no	no			0.660	0.01000	SW846 - 8270	SW846 - 8270
benzene	volatitle	no	no	0.0050	0	0.005	0.00500	SW846 - 8240	SW846 - 8240

**TABLE 6
REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS**

Chemical Name	Compound Type ^a	Bioaccumulatable ^b (yes/no)	Compound is Considered	Maximum Contaminant Level		Practical or Estimated Quantitation Limits ^c		
				Level (MCL) (mg/L)	Maximum Level Goal (MCLG) (mg/L)	Low Contaminated Soil Value (mg/Kg)	Groundwater Value (mg/L)	
				Method	Method	Method	Method	
toluene	volatile	no	no	1.0000	1.0000	0.005	0.00500	SW846 - 8240
ethylbenzene	volatile	no	no	0.7000	0.7000	0.005	0.00500	SW846 - 8240
xylenes	volatile	no	no	10.0000	10.0000	0.005	0.00500	SW846 - 8240
vinyl chloride	volatile	no	no	0.0020	0	0.010	0.01000	SW846 - 8240
chloroethane	volatile	no	no	0.0070	0.0070	0.010	0.01000	SW846 - 8240
1,1-dichloroethene	volatile	no	no	0.0070	0.0070	0.005	0.00500	SW846 - 8240
1,1-dichloroethane	volatile	no	no	0.0700	0.0700	0.005	0.00500	SW846 - 8240
1,2-dichloroethene (cis)	volatile	no	no	0.0050	0	0.005	0.00500	SW846 - 8240
1,2-dichloroethane	volatile	no	no	0.0050	0	0.005	0.00500	SW846 - 8240
trichloroethene	volatile	no	no	0.2000	0.2000	0.005	0.00500	SW846 - 8240
1,1,1-trichloroethane	volatile	no	no	0.0050	0.0030	0.005	0.00500	SW846 - 8240
1,1,2-trichloroethane	volatile	no	no	0.0050	0	0.005	0.00500	SW846 - 8240
tetrachloroethene	volatile	no	no	0.1000	0	0.005	0.00500	SW846 - 8240
1,1,1,2-tetrachloroethane	volatile	no	no	0.1000	0	0.005	0.00500	SW846 - 8240
1,1,1,2,2-tetrachloroethane	volatile	no	no	0.1000	0	0.005	0.00500	SW846 - 8240
chloroform	volatile	no	no	0.1000	0	0.005	0.00500	SW846 - 8240
acetone	volatile	no	no	0.1000	0	0.100	0.10000	SW846 - 8240
4-methyl-2-pentanone	volatile	no	no	0.0500	0.0500	0.050	0.05000	SW846 - 8240
methyl ethyl ketone	volatile	no	no	0.1000	0.1000	0.100	0.10000	SW846 - 8240
Aldrin	pest/herb/PCB	yes	yes	0.0002	0.0002	0.003	0.00004	SW846 - 8080
gamma-BHC (Lindane)	pest/herb/PCB	yes	yes	0.0002	0.0002	0.006	0.00009	SW846 - 8080
chlordane	pest/herb/PCB	yes	yes	0.0020	0	0.009	0.00014	SW846 - 8080
DDD	pest/herb/PCB	yes	yes	0.0020	0.0020	0.007	0.00011	SW846 - 8080
DDE	pest/herb/PCB	yes	yes	0.0020	0.0020	0.003	0.00004	SW846 - 8080
DDT	pest/herb/PCB	yes	yes	0.0020	0.0020	0.008	0.00012	SW846 - 8080
dieldrin	pest/herb/PCB	yes	yes	0.0020	0.0020	0.001	0.00002	SW846 - 8080
endosulfan sulfate	pest/herb/PCB	no	no	0.0020	0.0020	0.044	0.00066	SW846 - 8080

**TABLE 6
REPRESENTATIVE COMPOUNDS AND CHARACTERISTICS**

Chemical Name	Compound Type ^a	Bioaccumulatable ^b	Compound is Considered (yes/no)	Maximum Contaminant Level			Practical or Estimated Quantitation Limits ^c	
				Level (MCL) (mg/L)	Level Goal (MCLG) (mg/L)	Value (mg/Kg)	Value (mg/L)	Method
							Groundwater	
endrin	pest/herb/PCB		yes	0.0020	0.0020	0.004	0.00006	SW846 - 8080
heptachlor	pest/herb/PCB		yes	0.0004	0	0.002	0.00003	SW846 - 8080
heptachlor epoxide	pest/herb/PCB		no	0.0002	0	0.056	0.00083	SW846 - 8080
PCBs	pest/herb/PCB		yes	0.0005	0	0.044	0.00065	SW846 - 8080
lead	inorganic		no	0.0150	0	0.500	0.00300	SW846-200.7
cadmium	inorganic		no	0.0050	0.0050	0.500	0.00500	SW846-200.7
silver	inorganic		no			1.000	0.01000	SW846-200.7
mercury	inorganic		yes	0.0020	0.0020	0.100	0.00020	SW846-245.1
chromium vi	inorganic		no	0.1000	0.1000	1.000	0.01000	SW846-7196
chromium iii	inorganic		no	0.1000	0.1000	1.000	0.01000	SW846-200.7
barium	inorganic		no	2.0000	2.0000	20.000	0.20000	SW846-200.7
arsenic	inorganic		no	0.0500		1.000	0.01000	SW846-206.2
antimony	inorganic		no	0.0060	0.0060	6.000	0.06000	SW846-204.2
beryllium	inorganic		no	0.0040	0.0040	0.500	0.00500	SW846-200.7
cyanide	inorganic		no	0.2000	0.2000	0.125	0.01000	SW846-335.3
nickel	inorganic		no	0.1000	0.1000	4.000	0.04000	SW846-200.7
selenium	inorganic		no	0.0500	0.0500	0.500	0.00500	SW846-270.2
vanadium	inorganic		no			5.000	0.05000	SW846-200.7
zinc	inorganic		no			2.000	0.02000	SW846-200.7

NOTES: a - Determined according to analytical methods summarized in *Test Methods for Evaluating Solid Waste*, EPA SW-846.

b - Determined according to *Water Quality Criteria for Specific Substances*, Ind. Reg. Vol 17, No. 7, April 1, 1993.

c - Practical quantitation limits based on *Test Methods for Evaluating Solid Waste*, EPA SW-846, 1986 for GC/MS methods. However, PQLs will change according to the specific analytical method used.

TABLE 7
SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

Chemical Name	Molecular Weight [MW] (g/g-mol)	Org Car Part-Koc [KOC] (L/Kg)	Oct Wat Part-Kow [KOW] (mg/L)(mg/L)	Aqueous Solubility [SOL] (mg/L)	Henry Law [H] (atm/mol)	Vapor Phase Diffus Coeff. [Dij] (cm ² /s)	Reference Doses		Cancer Slope Factors	
							Oral mg/kg/day	Inhalation mg/kg/day	Oral mg/kg/day	Inhalation mg/kg/day (mg/kg/day)-1
naphthalene	128.20	1.28E+03	2.70E+03	31.7000	1.18E-03	5.90E-02	0.04000			
acenaphthylene	152.21	4.79E+03	1.17E+04	3.9300	1.14E-04	6.60E-02				
acenaphthene	154.21	1.78E+01	1.33E+04	3.4200	7.71E-03	6.50E-02	0.06000			
fluorene	166.00	5.01E+03	1.69E+04	1.6900	1.17E-04	6.20E-02	0.04000			
phenanthrene	178.22	1.67E+04	2.68E+04	1.0000	6.05E-03	5.90E-02				
anthracene	178.23	2.17E+04	2.78E+04	0.0450	8.60E-05	5.90E-02	0.30000			
fluoranthene	202.00	4.17E+04	1.66E+05	0.2600	6.73E-02	5.60E-02	0.04000			
pyrene	202.30	6.90E+04	1.31E+05	0.1320	7.00E-09	5.50E-02	0.03000			
benzo(a)anthracene*	228.30	1.38E+06	6.41E+05	0.0140	1.38E-09	4.30E-02			0.7300	
chrysene*	228.20	2.45E+05	5.09E+05	0.0020	1.18E-09	5.10E-02			0.0073	
benzo(b)fluoranthene*	252.32	5.50E+05	3.72E+06	0.0015	1.19E-05	5.00E-02			0.7300	
benzo(k)fluoranthene*	252.32	4.37E+06	7.08E+06	0.0008	3.94E-05	4.70E-02			0.0730	
benzo(a)pyrene	252.30	8.81E+05	1.16E+06	0.0038	1.38E-09	4.30E-02			7.3000	6.1000
indeno(1,2,3-cd)pyrene*	276.34	3.09E+07	6.84E+06	0.0005	6.86E-08	4.60E-02			0.7300	
dibenzo(a,h)anthracene*	278.35	1.84E+06	3.20E+06	0.0005	7.33E-08	4.50E-02			7.3000	
benzo(g,h,i)perylene	276.34	7.76E+06	1.40E+07	0.0003	5.34E-08	4.80E-02				
3,3'-dichlorobenzidine	253.13	2.00E+03	3.24E+03	4.0000	8.33E-07	NA			0.4500	
n-nitroso-di-n-propylamine	130.19	1.02E+01	2.04E+01	9900.0000	NA	NA			7.0000	
bis(2-chloroisopropyl)ether	171.10	6.17E+01	3.80E+02	1700.0000	1.13E-04	6.02E-02	0.04000		0.0700	0.0350
4-chloroaniline	127.47	3.23E+02	2.02E+02	3.9000	1.07E-05	7.50E-02	0.00400			
2-chloronaphthalene	162.62	8.51E+03	1.17E+04	6.7400	1.82E-02	6.60E-02	0.08000			
2,4-dinitrotoluene	182.10	6.17E+01	9.55E+01	270.0000	4.07E-06	2.03E-01	0.00200			
hexachlorobutadiene	260.80	4.68E+03	6.03E+04	2.0000	4.57E+00	5.61E-02	0.00200		0.0780	
hexachloroethane	237.00	2.19E+03	1.10E+04	50.0000	2.49E-06	6.50E-02	0.00100		0.0142	
isophorone	138.21	3.09E+01	4.84E+01	12000.0000	5.76E-06	6.23E-02	0.20000		0.0010	
benzyl alcohol	108.15	9.55E+01	1.26E+01	35000.0000	6.10E-07	7.90E-02	0.30000			
bis(2-chloroethyl)ether	143.00	1.41E+01	2.24E+01	10200.0000	1.30E-05	6.92E-02			1.1000	1.1000
nitrobenzene	123.10	9.72E+01	6.89E+01	1900.0000	1.31E-05	7.60E-02	0.00050			

TABLE 7
SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

Chemical Name	CHEMICAL PROPERTIES										DOSE-RESPONSE DATA			
	Molecular Weight [MW] (g/g-mol)	Org Car Part-Koc [KOC] (L/Kg)	Oct Wat Part-Kow [KOW] (mg/L)(mg/L)	Aqueous Solubility [SOL] (mg/L)	Henry Law [H] (atm/mol)	Vapor Phase Diffus Coeff. [D] (cm ² /s)	Oral mg/kg/day	Inhalation mg/kg/day	Oral mg/kg/day	Inhalation mg/kg/day	Cancer Slope Factors			
1,2-dichlorobenzene	147.00	3.66E+02	2.78E+03	145.0000	1.94E-03	6.90E-02	0.09000							
1,3-dichlorobenzene	147.01	4.40E+02	3.00E+03	123.0000	3.61E-03	6.98E-02								
1,4-dichlorobenzene	147.00	2.09E+02	2.87E+03	79.0000	1.60E-03	6.90E-02		0.19999		0.0240				
1,2,4-trichlorobenzene	181.50	9.39E+02	1.20E+04	30.0000	1.42E-03	6.80E-02	0.01000							
hexachlorocyclopentadiene	284.80	4.55E+03	3.91E+05	0.0060	6.80E-04	5.42E-02	0.00080							
hexachlorocyclopentadiene	272.77	4.27E+03	7.08E+04	1.8000	1.37E-02	5.61E-02	0.00700	0.00002		1.6000				
n-nitrosodiphenylamine	198.23	5.75E+02	1.35E+03	34.7000	NA	9.70E-02				0.0049				
benzoic acid	122.13	1.40E+02	7.90E+01	2700.0000	1.82E-08	7.40E-02	4.00000							
2-nitroaniline	138.14	2.66E+01	4.86E+01	1280.0000	5.00E-07	7.30E-02	0.00006		0.00006					
phenol	94.10	2.19E+01	2.95E+01	93000.0000	4.54E-07	8.20E-02	0.60000							
2-methylphenol	108.10	2.19E+01	9.05E+01	24660.0000	2.60E-06	7.40E-02	0.05000							
3-methylphenol	108.10	3.50E+01	9.33E+01	21928.0000	4.43E-07	7.40E-02								
4-methylphenol	108.10	1.57E+02	1.36E+02	19543.0000	4.43E-07	7.90E-02	0.05000							
2-chlorophenol	128.60	3.63E+02	1.47E+02	28500.0000	1.78E-05	7.90E-02	0.00500							
2,4-dichlorophenol	163.01	7.00E+02	1.35E+03	4500.0000	4.80E-06	7.10E-02	0.00300							
2,4,5-trichlorophenol	197.45	1.74E+03	8.13E+03	1202.0000	2.18E-04	6.50E-02	0.10000							
2,4,6-trichlorophenol	197.46	7.19E+02	1.77E+03	800.0000	1.77E-05	6.60E-02				0.0110				
pentachlorophenol	266.40	2.63E+03	1.70E+05	14.0000	2.80E-06	5.60E-02	0.03000			0.1200				
2,4-dinitrophenol	184.00	1.78E+01	3.65E+01	5600.0000	1.53E-07	2.73E-02	0.00200							
bis(2-ethylhexyl)phthalate	391.07	1.00E+05	4.52E+04	0.4000	3.00E-07	3.51E-02	0.02000							
butylbenzylphthalate	312.39	1.53E+02	4.24E+04	2.9000	1.08E-02	4.30E-02	0.20000			0.0140				
di-n-butylphthalate	278.30	1.38E+03	3.60E+04	13.0000	2.80E-07	4.38E-02	0.10000							
diethylphthalate	222.00	6.92E+01	1.96E+02	896.0000	1.11E-02	5.30E-02	0.80000							
di methyl phthalate	194.20	1.91E+02	4.70E+01	4320.0000	2.15E-06	5.68E-02	10.00000							
di-n-octyl phthalate	390.58	9.77E+08	1.58E+09	3.0000	1.37E-01	3.60E-02	0.02000							
benzene	78.10	7.91E+01	1.01E+02	1750.0000	5.50E-03	8.80E-02				0.0290				
toluene	92.40	1.62E+02	3.70E+02	535.0000	6.68E-03	8.70E-02	0.20000		0.11428					
ethylbenzene	106.20	1.81E+02	1.29E+03	152.0000	6.44E-03	7.50E-02	0.10000		0.28571					

TABLE 7
SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

Chemical Name	CHEMICAL PROPERTIES										DOSE-RESPONSE DATA			
	Molecular Weight [MW] (g/g-mol)	Org Car Part-Koc [KOC] (L/Kg)	Oct Wat Part-Kow [KOW] (mg/L/mg/L)	Aqueous Solubility [SOL] (mg/L)	Henry Law [H] (atm/mol)	Vapor Phase Diffus Coeff. [D] (cm ² /s)	Oral mg/kg/day	Inhalation mg/kg/day	Oral mg/kg/day	Inhalation mg/kg/day	Cancer Slope Factors			
xlenes	106.20	3.32E+02	1.26E+03	198.0000	7.04E-03	7.47E-02	2.00000							
vinyl chloride	62.50	2.45E+00	3.98E+00	2670.0000	8.60E-02	1.06E-01				1.9000	0.3000			
chloroethane	64.52	3.24E+00	2.69E+01	5740.0000	1.11E-02	2.71E-01		2.85700						
1,1-dichloroethylene	97.00	6.46E+01	6.38E+01	2250.0000	2.61E-02	1.00E-01	0.00900		0.10000	0.6000	1.2000			
1,1-dichloroethane	98.96	3.02E+01	6.10E+01	5500.0000	5.62E-03	9.60E-02	0.01000							
1,2-dichloroethylene (cis)	96.95	4.90E+01	1.00E+00	3500.0000	4.08E-03	7.36E-02	0.30000			0.0910	0.0910			
1,2-dichloroethane	99.00	1.64E+01	2.92E+01	8520.0000	9.78E-04	1.04E-01	0.00600			0.0110	0.0170			
trichloroethylene	131.40	9.63E+01	5.28E+02	1100.0000	9.58E-03	7.90E-02	0.09000	0.30000						
1,1,1-trichloroethane	133.40	1.42E+02	2.28E+02	1500.0000	1.72E-02	7.80E-02	0.00400			0.0570	0.0570			
1,1,2-trichloroethane	133.40	6.87E+01	1.51E+02	4500.0000	7.42E-04	7.80E-02	0.01000			0.0510	0.0018			
tetrachloroethylene	165.83	6.69E+01	3.37E+02	150.0000	2.87E-02	7.20E-02	0.03000			0.0260	0.0260			
1,1,1,2-tetrachloroethane	168.00	3.99E+02	1.07E+03	1099.0000	2.00E-03	7.10E-02				0.2000	0.0200			
1,1,1,2-tetrachloroethane	168.00	7.55E+01	2.99E+02	2900.0000	3.80E-04	7.10E-02	0.01000			0.0061	0.0805			
chloroform	119.40	4.42E+01	8.71E+01	8200.0000	3.39E-03	1.04E-01	0.10000							
acetone	58.00	3.72E-01	5.75E-01	100000.0000	2.50E-05	1.24E-01	0.05000							
4-methyl-2-pentanone	100.16	6.17E+00	1.23E+01	21300.0000	4.95E-05	7.50E-02	0.05000							
methyl ethyl ketone	72.10	1.23E+00	1.88E+00	137190.0000	4.35E-05	8.08E-02	0.05000	0.28570						
Aldrin	364.93	4.07E+02	2.82E+05	0.1800	4.96E-04	5.00E-02	0.00003			17.0000	17.1000			
gamma-BHC (Lindane)	290.83	1.32E+03	4.09E+03	7.8000	4.93E-07	5.30E-02	0.00030			1.3000	1.3000			
chlordane	410.00	2.29E+05	1.00E+06	0.0560	3.67E-05	4.80E-02	0.00006			1.3000	1.2900			
DDD	320.05	4.37E+04	4.90E+05	0.0900	3.89E-05	5.00E-02				0.2400				
DDE	318.03	4.93E+05	5.78E+05	0.0140	3.89E-05	4.90E-02				0.3400				
DDT	354.49	3.13E+05	9.64E+05	0.0050	3.89E-05	4.70E-02	0.00050			0.3400	0.3400			
dieldrin	380.93	2.07E+04	4.05E+04	0.1950	5.84E-05	NA	0.00005			16.0000	16.1000			
endosulfan sulfate	422.90	2.34E+03	4.57E+03	0.1170	NA	NA	0.00005							
endrin	380.93	8.32E+03	3.69E+04	0.2600	NA	4.70E-02	0.00030							
heptachlor	373.35	2.19E+04	8.32E+04	0.1800	8.19E-04	5.10E-02	0.00050			4.5000	4.5500			
heptachlor epoxide	389.20	2.09E+04	3.35E+04	0.3500	3.50E-01	NA	0.00001			9.1000	9.1000			

TABLE 7
SUMMARY OF CHEMICAL PROPERTIES AND DOSE-RESPONSE

Chemical Name	CHEMICAL PROPERTIES										DOSE-RESPONSE DATA			
	Molecular Weight [MW] (g/g-mol)	Org Car Part-Koc [KOC] (L/Kg)	Oct Wat Part-Kow [KOW] (mg/L)mg/L)	Aqueous Solubility [SOL] (mg/L)	Henry Law [H] (atm/mol)	Vapor Phase Diffus Coeff. [D] (cm ² /s)	Reference Doses Oral mg/kg/day	Reference Doses Inhalation mg/kg/day	Cancer Slope Factors Oral mg/kg/day	Cancer Slope Factors Inhalation (mg/kg/day)-1				
PCBs	328.00	5.30E+05	1.10E+06	0.0031	1.07E-03	4.80E-02			7.7000					
lead	207.19	NA	NA	NA	NA	5.50E-02								
cadmium	112.00	NA	NA	NA	NA	5.50E-02	0.00050			6.1000				
silver	107.90	NA	NA	NA	NA	NA	0.00500							
mercury	200.59	NA	1.00	NA	1.14E-02	2.76E-02	0.00030	0.00009						
chromium vi	52.00	NA	NA	NA	NA	NA	0.00500			41.0000				
chromium iii	52.00	NA	NA	NA	NA	NA	1.00000							
barium	137.00	NA	NA	NA	NA	NA	0.07000							
arsenic	74.92	NA	NA	NA	NA	5.50E-02	0.00030			50.0000				
antimony	121.80	NA	NA	NA	NA	NA	0.00040							
beryllium	9.01	NA	NA	0.2000	NA	NA	0.00500		4.3000	8.4000				
cyanide	27.00	1.00E+00	5.00E-01	1000000.0000	2.70E-06	NA	0.02000							
nickel	58.70	NA	NA	NA	NA	NA	0.02000			0.8400				
selenium	78.96	NA	NA	NA	NA	NA	0.00500							
vanadium	51.00	NA	NA	NA	NA	NA	0.00700							
zinc	65.00	NA	NA	NA	NA	5.50E-02	0.30000							

NOTES: * - Assumes TEF approach.

NA - Data not available or not applicable.

**TABLE 8
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER**

NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit ^b (mg/L)	Groundwater		
				Carcinogenic Effects @10-5 (mg/L)	Noncarcinogenic Effects (mg/L)	Groundwater Criteria (mg/L)
naphthalene	no		0.01000	NA	4.0880	4.0880
acenaphthylene	no		0.01000	NA	NA	NA
acenaphthene	no		0.01000	NA	6.1320	6.1320
fluorene	no		0.01000	NA	4.0880	4.0880
phenanthrene	no		0.01000	NA	NA	NA
anthracene	no		0.01000	NA	30.6600	30.6600
fluoranthene	yes		0.01000	NA	0.8176	0.8176
pyrene	no		0.01000	NA	3.0660	3.0660
benzo(a)anthracene*	yes	0.0001	0.01000	0.0039	NA	0.0100
chrysene*	yes	0.0002	0.01000	0.3918	NA	0.3918
benzo(b)fluoranthene*	yes	0.0002	0.01000	0.0039	NA	0.0100
benzo(k)fluoranthene*	yes	0.0002	0.01000	0.0392	NA	0.0392
benzo(a)pyrene	yes	0.0002	0.01000	0.0004	NA	0.0100
indeno(1,2,3-cd)pyrene*	yes	0.0004	0.01000	0.0039	NA	0.0100
dibenzo(a,h)anthracene*	yes	0.0003	0.01000	0.0004	NA	0.0100
benzo(g,h,i)perylene	yes		0.01000	NA	NA	NA
3,3'-dichlorobenzidine	no		0.02000	0.0064	NA	0.0200
n-nitroso-di-n-propylamine	no		0.01000	0.0004	NA	0.0100
bis(2-chloroisopropyl)ether	no		0.01000	0.0409	4.0880	0.0409
4-chloroaniline	no		0.02000	NA	0.4088	0.4088
2-chloronaphthalene	no		0.01000	NA	8.1760	8.1760
2,4-dinitrotoluene	no		0.01000	NA	0.2044	0.2044
hexachlorobutadiene	yes		0.01000	0.0367	0.0409	0.0367
hexachloroethane	yes		0.01000	0.2014	0.0204	0.0204
isophorone	no		0.01000	3.0105	20.4400	3.0105
benzyl alcohol	no		0.02000	NA	30.6600	30.6600
bis(2-chloroethyl)ether	no		0.01000	0.0026	NA	0.0100

**TABLE 8
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER**

NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit ^b (mg/L)	Groundwater		
				Carcinogenic Effects @10-5 (mg/L)	Noncarcinogenic Effects (mg/L)	Groundwater Criteria (mg/L)
nitrobenzene	no		0.01000	NA	0.0511	0.0511
1,2-dichlorobenzene	no	0.6000	0.01000	NA	9.1980	9.1980
1,3-dichlorobenzene	no	0.6000	0.01000	NA	NA	NA
1,4-dichlorobenzene	no	0.0750	0.01000	0.1192	NA	0.1192
1,2,4-trichlorobenzene	no	0.0700	0.01000	NA	1.0220	1.0220
hexachlorocyclopentadiene	no	0.0010	0.01000	0.0018	0.0818	0.0100
n-nitrosodiphenylamine	no	0.0500	0.01000	NA	0.7154	0.7154
benzoic acid	no		0.01000	0.5837	NA	0.5837
2-nitroaniline	no		0.05000	NA	408.8000	408.8000
phenol	no		0.05000	NA	0.0061	0.0500
2-methylphenol	yes		0.01000	NA	12.2640	12.2640
3-methylphenol	no		0.01000	NA	5.1100	5.1100
4-methylphenol	no		0.01000	NA	NA	NA
2-chlorophenol	no		0.01000	NA	5.1100	5.1100
2,4-dichlorophenol	no		0.01000	NA	0.5110	0.5110
2,4,5-trichlorophenol	no		0.01000	NA	0.3066	0.3066
2,4,6-trichlorophenol	no		0.01000	NA	10.2200	10.2200
pentachlorophenol	no		0.01000	0.2600	NA	0.2600
2,4-dinitrophenol	no	0.0010	0.05000	0.0238	3.0660	0.0500
bis(2-ethylhexyl)phthalate	no		0.05000	NA	0.2044	0.2044
butylbenzylphthalate	yes	0.0060	0.01000	0.2043	0.4088	0.2043
di-n-butylphthalate	no	0.1000	0.01000	NA	20.4400	20.4400
diethylphthalate	yes		0.01000	NA	2.0440	2.0440
di methyl phthalate	no		0.01000	NA	81.7600	81.7600
di-n-octyl phthalate	no		0.01000	NA	1022.0000	1022.0000
benzene	no	0.0050	0.00500	0.0986	2.0440	2.0440
	no				NA	0.0986

TABLE 8
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER
 NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit ^b (mg/L)	Groundwater		
				Carcinogenic Effects @10-5 (mg/L)	Noncarcinogenic Effects (mg/L)	
					Groundwater Criteria (mg/L)	
toluene	no	1.0000	0.00500	NA	20.4400	20.4400
ethylbenzene	no	0.7000	0.00500	NA	10.2200	10.2200
xylenes	no	10.0000	0.00500	NA	204.4000	204.4000
vinyl chloride	no	0.0020	0.01000	0.0015	NA	0.0100
chloroethane	no		0.01000	NA	NA	NA
1,1-dichloroethylene	no	0.0070	0.00500	0.0048	0.9198	0.0070
1,1-dichloroethane	no		0.00500	NA	10.2200	10.2200
1,2-dichloroethylene (cis)	no	0.0700	0.00500	NA	1.0220	1.0220
1,2-dichloroethane	no	0.0050	0.00500	0.0314	30.6600	0.0314
trichloroethylene	no	0.0050	0.00500	0.2600	0.6132	0.2600
1,1,1-trichloroethane	no	0.2000	0.00500	NA	9.1980	9.1980
1,1,2-trichloroethane	no	0.0050	0.00500	0.0502	0.4088	0.0502
tetrachloroethylene	no	0.0050	0.00500	0.0561	1.0220	0.0561
1,1,1,2-tetrachloroethane	no		0.00500	0.1100	3.0660	0.1100
1,1,2,2-tetrachloroethane	no		0.00500	0.0143	NA	0.0143
chloroform	no	0.1000	0.00500	0.4689	1.0220	0.4689
acetone	no		0.10000	NA	10.2200	10.2200
4-methyl-2-pentanone	no		0.05000	NA	5.1100	5.1100
methyl ethyl ketone	no		0.10000	NA	5.1100	5.1100
Aldrin	yes		0.00004	0.0002	0.0006	0.0002
gamma-BHC (Lindane)	yes	0.0002	0.00009	0.0022	0.0061	0.0022
chlordane	yes	0.0020	0.00014	0.0022	0.0012	0.0020
DDD	yes		0.00011	0.0119	NA	0.0119
DDE	yes		0.00004	0.0084	NA	0.0084
DDT	yes		0.00012	0.0084	0.0102	0.0084
dieldrin	yes		0.00002	0.0002	0.0010	0.0002
endosulfan sulfate	no		0.00066	NA	0.0051	0.0051

**TABLE 8
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER**

NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit ^b (mg/L)	Groundwater		
				Carcinogenic Effects @10-5 (mg/L)	Noncarcinogenic Effects (mg/L)	Groundwater Criteria (mg/L)
endrin	yes	0.0020	0.00006	NA	0.0061	0.0061
heptachlor	yes	0.0004	0.00003	0.0006	0.0102	0.0006
heptachlor epoxide	no	0.0002	0.00083	0.0003	0.0013	0.0008
PCBs	yes	0.0005	0.00065	0.0004	NA	0.0007
lead	no	0.0150	0.00300	NA	NA	NA
cadmium	no	0.0050	0.00500	NA	0.0511	0.0511
silver	no		0.01000	NA	0.5110	0.5110
mercury	yes	0.0020	0.00020	NA	0.0061	0.0061
chromium vi	no	0.1000	0.01000	NA	0.5110	0.5110
chromium iii	no	0.1000	0.01000	NA	102.2000	102.2000
barium	no	2.0000	0.20000	NA	7.1540	7.1540
arsenic	no	0.0500	0.01000	NA	0.0307	0.0500
antimony	no	0.0060	0.06000	NA	0.0409	0.0600
beryllium	no	0.0040	0.00500	0.0007	0.5110	0.0050
cyanide	no	0.2000	0.01000	NA	2.0440	2.0440
nickel	no	0.1000	0.04000	NA	2.0440	2.0440
selenium	no	0.0500	0.00500	NA	0.5110	0.5110
vanadium	no		0.05000	NA	0.7154	0.7154
zinc	no		0.02000	NA	30.6600	30.6600

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

TABLE 9
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Surface Soils			Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)		
naphthalene	no	0.660	NA	81,600.00	10,000.00	
acenaphthylene	no	0.660	NA	NA	NA	
acenaphthene	no	0.660	NA	122,400.00	10,000.00	
fluorene	no	0.660	NA	81,600.00	10,000.00	
phenanthrene	no	0.660	NA	NA	NA	
anthracene	no	0.660	NA	612,000.00	10,000.00	
fluoranthene	yes	0.660	NA	16,320.00	10,000.00	
pyrene	no	0.660	NA	61,200.00	10,000.00	
benzo(a)anthracene*	yes	0.660	79.45	NA	79.45	
chrysene*	yes	0.660	7,945.21	NA	7,945.21	
benzo(b)fluoranthene*	yes	0.660	79.45	NA	79.45	
benzo(k)fluoranthene*	yes	0.660	794.52	NA	794.52	
benzo(a)pyrene	yes	0.660	7.94	NA	7.94	
indeno(1,2,3-cd)pyrene*	yes	0.660	79.45	NA	79.45	
dibenzo(a,h)anthracene*	yes	0.660	7.95	NA	7.95	
benzo(g,h,i)perylene	yes	0.660	NA	NA	NA	
3,3'-dichlorobenzidine	no	1.300	128.89	NA	128.89	
n-nitroso-di-n-propylamine	no	0.660	8.29	NA	8.29	
bis(2-chloroisopropyl)ether	no	0.660	93.12	81,600.00	93.12	
4-chloroaniline	no	1.300	NA	8,160.00	8,160.00	
2-chloronaphthalene	no	0.660	NA	163,200.00	10,000.00	
2,4-dinitrotoluene	no	0.660	NA	4,080.00	4,080.00	
hexachlorobutadiene	yes	0.660	1.78	816.00	1.78	
hexachloroethane	yes	0.660	2,898.99	408.00	408.00	
isophorone	no	0.660	61,052.63	408,000.00	10,000.00	
benzyl alcohol	no	1.300	NA	612,000.00	10,000.00	
bis(2-chloroethyl)ether	no	0.660	4.06	NA	4.06	

**TABLE 9
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS**

NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Surface Soils			Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)		
nitrobenzene	no	0.660	NA	1,020.00	1,020.00	
1,2-dichlorobenzene	no	0.660	NA	183,600.00	10,000.00	
1,3-dichlorobenzene	no	0.660	NA	NA	NA	
1,4-dichlorobenzene	no	0.660	2,416.67	11,788.20	2,416.67	
1,2,4-trichlorobenzene	no	0.660	NA	20,400.00	10,000.00	
hexachlorobenzene	no	0.660	6.87	1,632.00	6.87	
hexachlorocyclopentadiene	no	0.660	NA	2.02	2.02	
n-nitrosodiphenylamine	no	0.660	11,836.73	NA	10,000.00	
benzoic acid	no	3.300	NA	8,160,000.00	10,000.00	
2-nitroaniline	no	3.300	NA	42.90	42.90	
phenol	yes	0.660	NA	244,800.00	10,000.00	
2-methylphenol	no	0.660	NA	102,000.00	10,000.00	
3-methylphenol	no	0.660	NA	NA	NA	
4-methylphenol	no	0.660	NA	102,000.00	10,000.00	
2-chlorophenol	no	0.660	NA	10,200.00	10,000.00	
2,4-dichlorophenol	no	0.660	NA	6,120.00	6,120.00	
2,4,5-trichlorophenol	no	0.660	NA	204,000.00	10,000.00	
2,4,6-trichlorophenol	no	0.660	1,922.89	NA	1,922.89	
pentachlorophenol	no	3.300	483.33	61,200.00	483.33	
2,4-dinitrophenol	no	3.300	NA	4,080.00	4,080.00	
bis(2-ethylhexyl)phthalate	yes	0.660	4,142.86	8,160.00	4,142.86	
butylbenzylphthalate	no	0.660	NA	408,000.00	10,000.00	
di-n-butylphthalate	yes	0.660	NA	40,800.00	10,000.00	
diethylphthalate	no	0.660	NA	1,632,000.00	10,000.00	
di methyl phthalate	no	0.660	NA	20,400,000.00	10,000.00	
di-n-octyl phthalate	no	0.660	NA	40,800.00	10,000.00	
benzene	no	0.005	16.63	NA	16.63	

TABLE 9
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Surface Soils			Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)		
toluene	no	0.005	NA	2,552.81	1,000.00	
ethylbenzene	no	0.005	NA	7,180.32	1,000.00	
xylenes	no	0.005	NA	4,080,000.00	1,000.00	
vinyl chloride	no	0.010	0.02	NA	0.02	
chloroethane	no	0.010	NA	2,580.36	1,000.00	
1,1-dichloroethylene	no	0.005	0.15	18,360.00	0.15	
1,1-dichloroethane	no	0.005	NA	973.47	973.47	
1,2-dichloroethylene (cis)	no	0.005	NA	20,400.00	1,000.00	
1,2-dichloroethane	no	0.005	5.27	612,000.00	5.27	
trichloroethylene	no	0.005	24.97	12,240.00	24.97	
1,1,1-trichloroethane	no	0.005	NA	3,998.01	1,000.00	
1,1,2-trichloroethane	no	0.005	22.74	8,160.00	22.74	
tetrachloroethylene	no	0.005	101.23	20,400.00	101.23	
1,1,1,2-tetrachloroethane	no	0.005	75.91	61,200.00	75.91	
1,1,2,2-tetrachloroethane	no	0.005	75.41	NA	75.41	
chloroform	no	0.005	5.28	20,400.00	5.28	
acetone	no	0.100	NA	204,000.00	1,000.00	
4-methyl-2-pentanone	no	0.050	NA	102,000.00	1,000.00	
methyl ethyl ketone	no	0.100	NA	6,726.27	1,000.00	
Aldrin	yes	0.003	0.27	12.24	0.27	
gamma-BHC (Lindane)	yes	0.006	44.62	122.40	44.62	
chlordane	yes	0.009	39.45	24.48	24.48	
DDD	yes	0.007	241.67	NA	241.67	
DDE	yes	0.003	170.59	NA	170.59	
DDT	yes	0.008	153.01	204.00	153.01	
dieldrin	yes	0.001	3.63	20.40	3.63	
endosulfan sulfate	no	0.044	NA	102.00	102.00	

**TABLE 9
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS**

NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable ^a (yes/no)	Practical Quantitation Limit ^b (mg/Kg)	Surface Soils		Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	
endrin	yes	0.004	NA	122.40	122.40
heptachlor	yes	0.002	4.16	204.00	4.16
heptachlor epoxide	no	0.056	6.37	26.52	6.37
PCBs	yes	0.044	7.53	NA	7.53
lead	no	0.500	NA	NA	NA
cadmium	no	0.500	NA	1,020.00	1,020.00
silver	no	1.000	NA	10,200.00	10,000.00
mercury	yes	0.100	NA	122.40	122.40
chromium vi	no	1.000	NA	10,200.00	10,000.00
chromium iii	no	1.000	NA	2,040,000.00	10,000.00
barium	no	20.000	NA	142,800.00	10,000.00
arsenic	no	1.000	NA	612.00	612.00
antimony	no	6.000	NA	816.00	816.00
beryllium	no	0.500	13.49	10,200.00	13.49
cyanide	no	0.125	NA	40,800.00	1,000.00
nickel	no	4.000	NA	40,800.00	10,000.00
selenium	no	0.500	NA	10,200.00	10,000.00
vanadium	no	5.000	NA	14,280.00	10,000.00
zinc	no	2.000	NA	612,000.00	10,000.00

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

TABLE 10
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
 NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable* (yes/no)	Practical Quantitation Limit ^b (mg/Kg)	Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)	
naphthalene	no	0.660	NA	58,400.00	4.0880	10,534.54	10,000.00
acenaphthylene	no	0.660	NA	NA	NA	NA	NA
acenaphthene	no	0.660	NA	87,600.00	6.1320	65,215.08	10,000.00
fluorene	no	0.660	NA	58,400.00	4.0880	52,850.39	10,000.00
phenanthrene	no	0.660	NA	NA	NA	NA	NA
anthracene	no	0.660	NA	438,000.00	30.6600	7,585,812.53	10,000.00
fluoranthene	yes	0.660	NA	11,680.00	0.8176	13,782.92	10,000.00
pyrene	no	0.660	NA	43,800.00	3.0660	140,591.20	10,000.00
benzo(a)anthracene*	yes	0.660	698.63	NA	0.0100	103.88	103.88
chrysene*	yes	0.660	69,863.01	NA	0.3918	67,777.62	10,000.00
benzo(b)fluoranthene*	yes	0.660	698.63	NA	0.0100	354.98	354.98
benzo(k)fluoranthene*	yes	0.660	6,986.30	NA	0.0392	3,759.12	3,759.12
benzo(a)pyrene	yes	0.660	69.85	NA	0.0100	212.87	69.85
indeno(1,2,3-cd)pyrene*	yes	0.660	698.63	NA	0.0100	629.17	629.17
dibenzo(a,h)anthracene*	yes	0.660	69.86	NA	0.0100	649.66	69.86
benzo(g,h,i)perylene	yes	0.660	NA	NA	NA	NA	NA
3,3'-dichlorobenzidine	no	1.300	1,133.33	NA	0.0200	12.86	12.86
n-nitroso-di-n-propylamine	no	0.660	72.86	NA	0.0100	0.06	0.66
bis(2-chloroisopropyl)ether	no	0.660	1,472.23	58,400.00	0.0409	1.32	1.32
4-chloroaniline	no	1.300	NA	5,840.00	0.4088	1,117.69	1,117.69
2-chloronaphthalene	no	0.660	NA	116,800.00	8.1760	68,632.75	10,000.00
2,4-dinitrotoluene	no	0.660	NA	2,920.00	0.2044	39.07	39.07
hexachlorobutadiene	yes	0.660	31.18	584.00	0.0367	46.06	31.18
hexachloroethane	yes	0.660	29,818.48	292.00	0.0204	3.31	3.31
isophorone	no	0.660	536,842.11	292,000.00	3.0105	256.03	256.03
benzyl alcohol	no	1.300	NA	438,000.00	30.6600	4,356.75	4,356.75
bis(2-chloroethyl)ether	no	0.660	66.24	NA	0.0100	0.06	0.66

TABLE 10
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
 NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)	
nitrobenzene	no	0.660	NA	730.00	0.0511	1.73	1.73
1,2-dichlorobenzene	no	0.660	NA	131,400.00	9.1980	15,093.56	10,000.00
1,3-dichlorobenzene	no	0.660	NA	NA	NA	NA	NA
1,4-dichlorobenzene	no	0.660	21,250.00	16,873.31	0.1192	34.67	34.67
1,2,4-trichlorobenzene	no	0.660	NA	14,600.00	1.0220	1,405.37	1,405.37
hexachlorobenzene	no	0.660	101.56	1,168.00	0.0100	165.57	101.56
hexachlorocyclopentadiene	no	0.660	NA	2.89	0.7154	3,904.08	2.89
n-nitrosodiphenylamine	no	0.660	104,081.63	NA	0.5837	567.80	567.80
benzoic acid	no	3.300	NA	5,840,000.00	408.8000	813,796.56	10,000.00
2-nitroaniline	no	3.300	NA	45.47	0.0500	2.08	3.30
phenol	yes	0.660	NA	175,200.00	12.2640	658.78	658.78
2-methylphenol	no	0.660	NA	73,000.00	5.1100	375.93	375.93
3-methylphenol	no	0.660	NA	NA	NA	NA	NA
4-methylphenol	no	0.660	NA	73,000.00	5.1100	427.24	427.24
2-chlorophenol	no	0.660	NA	73,000.00	5.1100	11.63	11.63
2,4-dichlorophenol	no	0.660	NA	7,300.00	0.3066	15.12	15.12
2,4,5-trichlorophenol	no	0.660	NA	4,380.00	0.3066	15.12	15.12
2,4,6-trichlorophenol	no	0.660	NA	146,000.00	10.2200	5,507.44	5,507.44
pentachlorophenol	no	0.660	24,779.61	NA	0.2600	30.65	30.65
2,4-dinitrophenol	no	3.300	4,250.00	43,800.00	0.0500	24.95	24.95
bis(2-ethylhexyl)phthalate	no	3.300	NA	2,920.00	0.2044	7.37	7.37
butylbenzylphthalate	yes	0.660	36,428.57	5,840.00	0.2043	1,406.25	1,406.25
di-n-butylphthalate	no	0.660	NA	292,000.00	20.4400	421,659.24	10,000.00
diethylphthalate	yes	0.660	NA	29,200.00	2.0440	6,188.56	6,188.56
di methyl phthalate	no	0.660	NA	1,168,000.00	81.7600	139,039.43	10,000.00
di-n-octyl phthalate	no	0.660	NA	14,600,000.00	1022.0000	2,427,459.10	10,000.00
benzene	no	0.660	NA	29,200.00	2.0440	13,865.50	10,000.00
	no	0.005	289.96	NA	0.0986	4.77	4.77

**TABLE 10
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS**

NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)	
toluene	no	0.005	NA	3,631.30	20.4400	23,897.46	1,000.00
ethylbenzene	no	0.005	NA	9,928.27	10.2200	17,179.71	1,000.00
xylenes	no	0.005	NA	2,920,000.00	204.4000	1,232,453.05	1,000.00
vinyl chloride	no	0.010	0.30	NA	0.0100	0.13	0.13
chloroethane	no	0.010	NA	3,693.46	NA	NA	1,000.00
1,1-dichloroethylene	no	0.005	2.59	13,140.00	0.0070	0.08	0.08
1,1-dichloroethane	no	0.005	NA	1,386.78	10.2200	2,385.62	1,000.00
1,2-dichloroethylene (cis)	no	0.005	NA	14,600.00	1.0220	102.49	102.49
1,2-dichloroethane	no	0.005	91.96	438,000.00	0.0314	0.37	0.37
trichloroethylene	no	0.005	437.11	8,760.00	0.2600	25.73	25.73
1,1,1-trichloroethane	no	0.005	NA	5,600.68	9.1980	4,173.92	1,000.00
1,1,2-trichloroethane	no	0.005	391.20	5,840.00	0.0502	1.05	1.05
tetrachloroethylene	no	0.005	1,634.72	14,600.00	0.0561	8.01	8.01
1,1,1,2-tetrachloroethane	no	0.005	1,291.02	43,800.00	0.1100	7.24	7.24
1,1,2,2-tetrachloroethane	no	0.005	1,052.52	NA	0.0143	0.21	0.21
chloroform	no	0.005	92.76	14,600.00	0.4689	20.33	20.33
acetone	no	0.100	NA	146,000.00	10.2200	136.29	136.29
4-methyl-2-pentanone	no	0.050	NA	73,000.00	5.1100	407.48	407.48
methyl ethyl ketone	no	0.100	NA	9,032.18	5.1100	146.24	146.24
Aldrin	yes	0.003	4.35	8.76	0.0002	0.06	0.06
gamma-BHC (Lindane)	yes	0.006	392.31	87.60	0.0022	0.34	0.34
chlordane	yes	0.009	368.21	17.52	0.0020	4.51	4.51
DDD	yes	0.007	2,125.00	NA	0.0119	48.34	48.34
DDE	yes	0.003	1,500.00	NA	0.0084	80.49	80.49
DDT	yes	0.008	1,418.50	146.00	0.0084	141.83	141.83
dieldrin	yes	0.001	31.88	14.60	0.0002	0.06	0.06
endosulfan sulfate	no	0.044	NA	73.00	0.0051	12.00	12.00

TABLE 10
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
NONRESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-5 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)	
endrin	yes	0.004	NA	87.60	0.0061	10.12	10.12
heptachlor	yes	0.002	55.28	146.00	0.0006	0.44	0.44
heptachlor epoxide	no	0.056	56.04	18.98	0.0008	0.45	0.45
PCBs	yes	0.044	66.23	NA	0.0007	4.23	4.23
lead	no	0.500	NA	NA	NA	NA	NA
cadmium	no	0.500	NA	730.00	0.0511	NA	730.00
silver	no	1.000	NA	7,300.00	0.5110	NA	7,300.00
mercury	yes	0.100	NA	87.60	0.0061	NA	87.60
chromium vi	no	1.000	NA	7,300.00	0.5110	NA	7,300.00
chromium iii	no	1.000	NA	1,460,000.00	102.2000	NA	10,000.00
barium	no	20.000	NA	102,200.00	7.1540	NA	10,000.00
arsenic	no	1.000	NA	438.00	0.0500	NA	438.00
antimony	no	6.000	NA	584.00	0.0600	NA	584.00
beryllium	no	0.500	118.60	7,300.00	0.0050	NA	118.60
cyanide	no	0.125	NA	29,200.00	2.0440	NA	10,000.00
nickel	no	4.000	NA	29,200.00	2.0440	NA	10,000.00
selenium	no	0.500	NA	7,300.00	0.5110	NA	7,300.00
vanadium	no	5.000	NA	10,220.00	0.7154	NA	10,000.00
zinc	no	2.000	NA	438,000.00	30.6600	NA	10,000.00

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of

0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER
RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit (mg/L)	Groundwater		Groundwater Criteria (mg/L)
				Carcinogenic Effects @10-6 (mg/L)	Noncarcinogenic Effects (mg/L)	
naphthalene	no		0.01000	NA	1.21600	1.21600
acenaphthylene	no		0.01000	NA	NA	NA
acenaphthene	no		0.01000	NA	1.82400	1.82400
fluorene	no		0.01000	NA	1.21600	1.21600
phenanthrene	no		0.01000	NA	NA	NA
anthracene	no		0.01000	NA	9.12000	9.12000
fluoranthene	yes		0.01000	NA	0.24320	0.24320
pyrene	no		0.01000	NA	0.91200	0.91200
benzo(a)anthracene*	yes	0.00010	0.01000	0.00012	NA	0.00010
chrysene*	yes	0.00020	0.01000	0.01164	NA	0.00020
benzo(b)fluoranthene*	yes	0.00020	0.01000	0.00012	NA	0.00020
benzo(k)fluoranthene*	yes	0.00020	0.01000	0.00116	NA	0.00020
benzo(a)pyrene	yes	0.00020	0.01000	0.00001	NA	0.00020
indeno(1,2,3-cd)pyrene*	yes	0.00040	0.01000	0.00012	NA	0.00040
dibenzo(a,h)anthracene*	yes	0.00030	0.01000	0.00001	NA	0.00030
benzo(g,h,i)perylene	yes		0.01000	NA	NA	NA
3,3'-dichlorobenzidine	no		0.02000	0.00019	NA	0.02000
n-nitroso-di-n-propylamine	no		0.01000	0.00001	NA	0.01000
bis(2-chloroisopropyl)ether	no		0.01000	0.00042	1.21600	0.01000
4-chloroaniline	no		0.02000	NA	0.12160	0.12160
2-chloronaphthalene	no		0.01000	NA	2.43200	2.43200
2,4-dinitrotoluene	no		0.01000	NA	0.06080	0.06080
hexachlorobutadiene	yes		0.01000	0.00109	0.01216	0.01000
hexachloroethane	yes		0.01000	0.00599	0.00608	0.01000
isophorone	no		0.01000	0.08947	6.08000	0.08947
benzyl alcohol	no		0.02000	NA	9.12000	9.12000
bis(2-chloroethyl)ether	no		0.01000	0.00002	NA	0.01000
nitrobenzene	no		0.01000	NA	0.01520	0.01520

**TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER**

RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit (mg/L)	Groundwater		Groundwater Criteria (mg/L)
				Carcinogenic Effects @10-6 (mg/L)	Noncarcinogenic Effects (mg/L)	
1,2-dichlorobenzene	no	0.60000	0.01000	NA	2.73600	0.60000
1,3-dichlorobenzene	no	0.60000	0.01000	NA	NA	0.60000
1,4-dichlorobenzene	no	0.07500	0.01000	0.00354	1.62125	0.07500
1,2,4-trichlorobenzene	no	0.07000	0.01000	NA	0.30400	0.07000
hexachlorobenzene	no	0.00100	0.01000	0.00005	0.02432	0.00100
hexachlorocyclopentadiene	no	0.05000	0.01000	NA	0.21280	0.05000
n-nitrosodiphenylamine	no		0.01000	0.01735	NA	0.01735
benzoic acid	no		0.05000	NA	121.60000	121.60000
2-nitroaniline	no		0.05000	NA	0.00182	0.05000
phenol	yes		0.01000	NA	3.64800	3.64800
2-methylphenol	no		0.01000	NA	1.52000	1.52000
3-methylphenol	no		0.01000	NA	NA	NA
4-methylphenol	no		0.01000	NA	1.52000	1.52000
2-chlorophenol	no		0.01000	NA	1.52000	1.52000
2,4-dichlorophenol	no		0.01000	NA	0.15200	0.15200
2,4,5-trichlorophenol	no		0.01000	NA	0.09120	0.09120
2,4,6-trichlorophenol	no		0.01000	NA	3.04000	3.04000
pentachlorophenol	no	0.00100	0.01000	0.00175	NA	0.01000
2,4-dinitrophenol	no		0.05000	0.00071	0.91200	0.00100
bis(2-ethylhexyl)phthalate	yes	0.00600	0.05000	NA	0.06080	0.06080
butylbenzylphthalate	no	0.10000	0.01000	0.00607	0.12160	0.00600
di-n-butylphthalate	yes		0.01000	NA	6.08000	0.10000
diethylphthalate	no		0.01000	NA	0.60800	0.60800
di methyl phthalate	no		0.01000	NA	24.32000	24.32000
di-n-octyl phthalate	no		0.01000	NA	304.00000	304.00000
benzene	no	0.00500	0.01000	NA	0.60800	0.60800
toluene	no	1.00000	0.00500	0.00062	NA	0.00500
ethylbenzene	no	0.70000	0.00500	NA	0.80393	1.00000
					1.31459	0.70000

**TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER
RESIDENTIAL LAND USE SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit (mg/L)	Groundwater		Groundwater Criteria (mg/L)
				Carcinogenic Effects @10-6 (mg/L)	Noncarcinogenic Effects (mg/L)	
xylene	no	10.00000	0.00500	NA	60.80000	10.00000
vinyl chloride	no	0.00200	0.01000	0.00003	NA	0.00200
chloroethane	no		0.01000	NA	23.16075	23.16075
1,1-dichloroethylene	no	0.00700	0.00500	0.00002	0.27360	0.00700
1,1-dichloroethane	no		0.00500	NA	0.64000	0.64000
1,2-dichloroethylene (cis)	no	0.07000	0.00500	NA	0.30400	0.07000
1,2-dichloroethane	no	0.00500	0.00500	0.00020	9.12000	0.00500
trichloroethylene	no	0.00500	0.00500	0.00114	0.18240	0.00500
1,1,1-trichloroethane	no	0.20000	0.00500	NA	1.28753	0.20000
1,1,2-trichloroethane	no	0.00500	0.00500	0.00031	0.12160	0.00500
tetrachloroethylene	no	0.00500	0.00500	0.00147	0.30400	0.00500
1,1,1,2-tetrachloroethane	no		0.00500	0.00069	0.91200	0.00500
1,1,2,2-tetrachloroethane	no		0.00500	0.00031	NA	0.00500
chloroform	no	0.10000	0.00500	0.00028	0.30400	0.10000
acetone	no		0.10000	NA	3.04000	3.04000
4-methyl-2-pentanone	no		0.05000	NA	1.52000	1.52000
methyl ethyl ketone	no		0.10000	NA	0.91772	0.91772
Aldrin	yes		0.00004	0.00001	0.00018	0.00004
gamma-BHC (Lindane)	yes	0.00020	0.00009	0.00007	0.00182	0.00020
chlordane	yes	0.00200	0.00014	0.00007	0.00036	0.00200
DDD	yes		0.00011	0.00035	NA	0.00035
DDE	yes		0.00004	0.00025	NA	0.00025
DDT	yes		0.00012	0.00025	0.00304	0.00025
dieldrin	yes		0.00002	0.00001	0.00030	0.00002
endosulfan sulfate	no		0.00066	NA	0.00152	0.00152
endrin	yes	0.00200	0.00006	NA	0.00182	0.00200
heptachlor	yes	0.00040	0.00003	0.00002	0.00304	0.00040
heptachlor epoxide	no	0.00020	0.00083	0.00001	0.00040	0.00020

TABLE 11
SUMMARY OF HEALTH-BASED
CRITERIA FOR GROUNDWATER

RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	MCL or Nonzero MCLG (mg/L)	Practical Quantitation Limit ^b (mg/L)	Groundwater		Groundwater Criteria (mg/L)
				Carcinogenic Effects @10-6 (mg/L)	Noncarcinogenic Effects (mg/L)	
PCBs	yes	0.00050	0.00065	0.00001	NA	0.00050
lead	no	0.01500	0.00300	NA	NA	NA
cadmium	no	0.00500	0.00500	NA	0.01520	0.00500
silver	no		0.01000	NA	0.15200	0.15200
mercury	yes	0.00200	0.00020	NA	0.00182	0.00200
chromium vi	no	0.10000	0.01000	NA	0.15200	0.10000
chromium iii	no	0.10000	0.01000	NA	30.40000	0.10000
barium	no	2.00000	0.20000	NA	2.12800	2.00000
arsenic	no	0.05000	0.01000	NA	0.00912	0.05000
antimony	no	0.00600	0.06000	NA	0.01216	0.00600
beryllium	no	0.00400	0.00500	0.00002	0.15200	0.00400
cyanide	no	0.20000	0.01000	NA	0.60800	0.20000
nickel	no	0.10000	0.04000	NA	0.60800	0.10000
selenium	no	0.05000	0.00500	NA	0.15200	0.05000
vanadium	no		0.05000	NA	0.21280	0.21280
zinc	no		0.02000	NA	9.12000	9.12000

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16.7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

**TABLE 12
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS**

RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable ^a (yes/no)	Practical Quantitation Limit ^b (mg/Kg)	Surface Soils		Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	
naphthalene	no	0.660	NA	10,800.00	10,000.00
acenaphthylene	no	0.660	NA	NA	NA
acenaphthene	no	0.660	NA	16,200.00	10,000.00
fluorene	no	0.660	NA	10,800.00	10,000.00
phenanthrene	no	0.660	NA	NA	NA
anthracene	no	0.660	NA	81,000.00	10,000.00
fluoranthene	yes	0.660	NA	2,160.00	2,160.00
pyrene	no	0.660	NA	8,100.00	8,100.00
benzo(a)anthracene*	yes	0.660	0.88	NA	0.88
chrysene*	yes	0.660	87.67	NA	87.67
benzo(b)fluoranthene*	yes	0.660	0.88	NA	0.88
benzo(k)fluoranthene*	yes	0.660	8.77	NA	8.77
benzo(a)pyrene	yes	0.660	0.09	NA	0.66
indeno(1,2,3-cd)pyrene*	yes	0.660	0.88	NA	0.88
dibenzo(a,h)anthracene*	yes	0.660	0.09	NA	0.66
benzo(g,h,i)perylene	yes	0.660	NA	NA	NA
3,3'-dichlorobenzidine	no	1.300	1.42	NA	1.42
n-nitroso-di-n-propylamine	no	0.660	0.09	NA	0.66
bis(2-chloroisopropyl)ether	no	0.660	9.14	10,800.00	9.14
4-chloroaniline	no	1.300	NA	1,080.00	1,080.00
2-chloronaphthalene	no	0.660	NA	21,600.00	10,000.00
2,4-dinitrotoluene	no	0.660	NA	540.00	540.00
hexachlorobutadiene	yes	0.660	8.21	108.00	8.21
hexachloroethane	yes	0.660	45.07	54.00	45.07
isophorone	no	0.660	673.68	54,000.00	673.68
benzyl alcohol	no	1.300	NA	81,000.00	10,000.00
bis(2-chloroethyl)ether	no	0.660	0.58	NA	0.66

TABLE 12
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Surface Soils		Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	
nitrobenzene	no	0.660	NA	135.00	135.00
1,2-dichlorobenzene	no	0.660	NA	24,300.00	10,000.00
1,3-dichlorobenzene	no	0.660	NA	NA	NA
1,4-dichlorobenzene	no	0.660	26.67	NA	26.67
1,2,4-trichlorobenzene	no	0.660	NA	2,700.00	2,700.00
hexachlorobenzene	no	0.660	0.40	216.00	0.66
hexachlorocyclopentadiene	no	0.660	NA	1,890.00	1,890.00
n-nitrosodiphenylamine	no	0.660	130.61	NA	130.61
benzoic acid	no	3.300	NA	1,080,000.00	10,000.00
2-nitroaniline	no	3.300	NA	16.20	16.20
phenol	yes	0.660	NA	32,400.00	10,000.00
2-methylphenol	no	0.660	NA	13,500.00	10,000.00
3-methylphenol	no	0.660	NA	NA	NA
4-methylphenol	no	0.660	NA	13,500.00	10,000.00
2-chlorophenol	no	0.660	NA	13,500.00	10,000.00
2,4-dichlorophenol	no	0.660	NA	1,350.00	1,350.00
2,4,5-trichlorophenol	no	0.660	NA	810.00	810.00
2,4,6-trichlorophenol	no	0.660	NA	27,000.00	10,000.00
pentachlorophenol	no	0.660	58.18	NA	58.18
2,4-dinitrophenol	no	3.300	5.33	8,100.00	5.33
bis(2-ethylhexyl)phthalate	yes	0.660	45.71	1,080.00	45.71
butylbenzylphthalate	no	0.660	NA	54,000.00	10,000.00
di-n-butylphthalate	yes	0.660	NA	5,400.00	5,400.00
diethylphthalate	no	0.660	NA	216,000.00	10,000.00
di methyl phthalate	no	0.660	NA	2,700,000.00	10,000.00
di-n-octyl phthalate	no	0.660	NA	5,400.00	5,400.00
benzene	no	0.005	22.07	NA	22.07

TABLE 12
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS
 RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Surface Soils			Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)		
toluene	no	0.005	NA	54,000.00	1,000.00	
ethylbenzene	no	0.005	NA	27,000.00	1,000.00	
xylenes	no	0.005	NA	540,000.00	1,000.00	
vinyl chloride	no	0.010	0.34	NA	0.34	
chloroethane	no	0.010	NA	NA	NA	
1,1-dichloroethylene	no	0.005	1.07	2,430.00	1.07	
1,1-dichloroethane	no	0.005	NA	27,000.00	1,000.00	
1,2-dichloroethylene (cis)	no	0.005	NA	2,700.00	1,000.00	
1,2-dichloroethane	no	0.005	7.03	81,000.00	7.03	
trichloroethylene	no	0.005	58.18	1,620.00	58.18	
1,1,1-trichloroethane	no	0.005	NA	24,300.00	1,000.00	
1,1,2-trichloroethane	no	0.005	11.23	1,080.00	11.23	
tetrachloroethylene	no	0.005	12.55	2,700.00	12.55	
1,1,1,2-tetrachloroethane	no	0.005	24.62	8,100.00	24.62	
1,1,2,2-tetrachloroethane	no	0.005	3.20	NA	3.20	
chloroform	no	0.005	104.92	2,700.00	104.92	
acetone	no	0.100	NA	27,000.00	1,000.00	
4-methyl-2-pentanone	no	0.050	NA	13,500.00	1,000.00	
methyl ethyl ketone	no	0.100	NA	13,500.00	1,000.00	
Aldrin	yes	0.003	0.04	1.62	0.04	
gamma-BHC (Lindane)	yes	0.006	0.49	16.20	0.49	
chlordane	yes	0.009	0.49	3.24	0.49	
DDD	yes	0.007	2.67	NA	2.67	
DDE	yes	0.003	1.88	NA	1.88	
DDT	yes	0.008	1.88	27.00	1.88	
dieldrin	yes	0.001	0.04	2.70	0.04	
endosulfan sulfate	no	0.044	NA	13.50	13.50	

TABLE 12
SUMMARY OF HEALTH-BASED
CRITERIA FOR SURFACE SOILS

RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable ^a (yes/no)	Practical Quantitation Limit ^b (mg/Kg)	Surface Soils		Surface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	
endrin	yes	0.004	NA	16.20	16.20
heptachlor	yes	0.002	0.14	27.00	0.14
heptachlor epoxide	no	0.056	0.07	3.51	0.07
PCBs	yes	0.044	0.08	NA	0.08
lead	no	0.500	NA	NA	NA
cadmium	no	0.500	NA	135.00	135.00
silver	no	1.000	NA	1,350.00	1,350.00
mercury	yes	0.100	NA	16.20	16.20
chromium vi	no	1.000	NA	1,350.00	1,350.00
chromium iii	no	1.000	NA	270,000.00	10,000.00
barium	no	20.000	NA	18,900.00	10,000.00
arsenic	no	1.000	NA	81.00	81.00
antimony	no	6.000	NA	108.00	108.00
beryllium	no	0.500	0.15	1,350.00	0.50
cyanide	no	0.125	NA	5,400.00	1,000.00
nickel	no	4.000	NA	5,400.00	5,400.00
selenium	no	0.500	NA	1,350.00	1,350.00
vanadium	no	5.000	NA	1,890.00	1,890.00
zinc	no	2.000	NA	81,000.00	10,000.00

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

TABLE 13
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)	Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Soil Criteria (mg/Kg)		
naphthalene	no	0.660	NA	58,400.00	1.21600	1,761.785	1,761.785	1,761.785
acenaphthylene	no	0.660	NA	NA	NA	NA	NA	NA
acenaphthene	no	0.660	NA	87,600.00	1.82400	10,906.498	10,906.498	10,000.000
fluorene	no	0.660	NA	58,400.00	1.21600	8,838.641	8,838.641	8,838.641
phenanthrene	no	0.660	NA	NA	NA	NA	NA	NA
anthracene	no	0.660	NA	438,000.00	9.12000	1,268,642.929	1,268,642.929	10,000.000
fluoranthene	yes	0.660	NA	11,680.00	0.24320	2,305.040	2,305.040	2,305.040
pyrene	no	0.660	NA	43,800.00	0.91200	23,512.317	23,512.317	10,000.000
benzo(a)anthracene*	yes	0.660	698.63	NA	0.01000	103.881	103.881	103.881
chrysene*	yes	0.660	69,863.01	NA	0.01164	379.273	379.273	379.273
benzo(b)fluoranthene*	yes	0.660	698.63	NA	0.01000	354.977	354.977	354.977
benzo(k)fluoranthene*	yes	0.660	6,986.30	NA	0.01000	501.638	501.638	501.638
benzo(a)pyrene	yes	0.660	69.85	NA	0.01000	212.868	212.868	69.849
indeno(1,2,3-cd)pyrene*	yes	0.660	698.63	NA	0.01000	629.166	629.166	629.166
di benzo(a,h)anthracene*	yes	0.660	69.86	NA	0.01000	649.661	649.661	69.863
benzo(g,h,i)perylene	yes	0.660	NA	NA	NA	NA	NA	NA
3,3'-dichlorobenzidine	no	1.300	1,133.33	NA	0.02000	12.865	12.865	12.865
n-nitroso-di-n-propylamine	no	0.660	72.86	NA	0.01000	0.063	0.063	0.660
bis(2-chloroisopropyl)ether	no	0.660	1,472.23	58,400.00	0.01000	0.166	0.166	0.660
4-chloroaniline	no	1.300	NA	5,840.00	0.12160	186.921	186.921	186.921
2-chloronaphthalene	no	0.660	NA	116,800.00	2.43200	11,478.065	11,478.065	10,000.000
2,4-dinitrotoluene	no	0.660	NA	2,920.00	0.06080	6.535	6.535	6.535
hexachlorobutadiene	yes	0.660	31.18	584.00	0.01000	6.777	6.777	6.777
hexachloroethane	yes	0.660	29,818.48	292.00	0.01000	1.153	1.153	1.153
isophorone	no	0.660	536,842.11	292,000.00	0.08947	1.433	1.433	1.433
benzyl alcohol	no	1.300	NA	438,000.00	9.12000	728.618	728.618	728.618
bis(2-chloroethyl)ether	no	0.660	66.24	NA	0.01000	0.062	0.062	0.660
nitrobenzene	no	0.660	NA	730.00	0.01520	0.289	0.289	0.660

TABLE 13
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS

RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)	Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)		
1,2-dichlorobenzene	no	0.660	NA	131,400.00	2.73600	2,524.230	2,524.230	2,524.230
1,3-dichlorobenzene	no	0.660	NA	NA	NA	NA	NA	NA
1,4-dichlorobenzene	no	0.660	21,250.00	16,873.31	0.01000	0.897	0.897	0.897
1,2,4-trichlorobenzene	no	0.660	NA	14,600.00	0.30400	235.033	235.033	235.033
hexachlorobenzene	no	0.660	101.56	1,168.00	0.01000	165.569	165.569	101.564
hexachlorocyclopentadiene	no	0.660	NA	2.89	0.21280	652.914	652.914	2.891
n-nitrosodiphenylamine	no	0.660	104,081.63	NA	0.01735	3.177	3.177	3.177
benzoic acid	no	3.300	NA	5,840,000.00	121.60000	136,098.441	136,098.441	10,000.000
2-nitroaniline	no	3.300	NA	45.47	0.05000	2.080	2.080	3.300
phenol	yes	0.660	NA	175,200.00	3.64800	110.173	110.173	110.173
2-methylphenol	no	0.660	NA	73,000.00	1.52000	62.871	62.871	62.871
3-methylphenol	no	0.660	NA	NA	NA	NA	NA	NA
4-methylphenol	no	0.660	NA	73,000.00	1.52000	71.452	71.452	71.452
2-chlorophenol	no	0.660	NA	7,300.00	0.15200	1.945	1.945	1.945
2,4-dichlorophenol	no	0.660	NA	4,380.00	0.09120	2.528	2.528	2.528
2,4,5-trichlorophenol	no	0.660	NA	146,000.00	3.04000	921.059	921.059	921.059
2,4,6-trichlorophenol	no	0.660	24,779.61	NA	0.01000	0.251	0.251	0.660
pentachlorophenol	no	3.300	4,250.00	43,800.00	0.05000	24.947	24.947	24.947
2,4-dinitrophenol	no	3.300	NA	2,920.00	0.06080	1.232	1.232	3.300
bis(2-ethylhexyl)phthalate	yes	0.660	36,428.57	5,840.00	0.01000	16.427	16.427	16.427
butylbenzylphthalate	no	0.660	NA	292,000.00	6.08000	70,517.828	70,517.828	10,000.000
di-n-butylphthalate	yes	0.660	NA	29,200.00	0.60800	1,034.967	1,034.967	1,034.967
diethylphthalate	no	0.660	NA	1,168,000.00	24.32000	23,252.800	23,252.800	10,000.000
di methyl phthalate	no	0.660	NA	14,600,000.00	304.00000	405,965.586	405,965.586	10,000.000
di-n-octyl phthalate	no	0.660	NA	29,200.00	0.60800	2,318.850	2,318.850	2,318.850
benzene	no	0.005	289.96	NA	0.00500	0.059	0.059	0.059
toluene	no	0.005	NA	3,631.30	1.00000	278.926	278.926	278.926
ethylbenzene	no	0.005	NA	9,928.27	1.31459	834.372	834.372	834.372

TABLE 13
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
 RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)	Subsurface Soils		Leaching to Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)	Subsurface Soil Criteria (mg/Kg)
			Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)			
xylenes	no	0.005	NA	2,920,000.00	60.80000	206,114.090	1000.000
vinyl chloride	no	0.010	0.30	NA	0.01000	0.129	0.129
chloroethane	no	0.010	NA	3,693.46	23.16075	7,788.243	1000.000
1,1-dichloroethylene	no	0.005	2.59	13,140.00	0.00700	0.084	0.084
1,1-dichloroethane	no	0.005	NA	1,386.78	0.64000	40.074	40.074
1,2-dichloroethylene (cis)	no	0.005	NA	14,600.00	0.30400	17.140	17.140
1,2-dichloroethane	no	0.005	91.96	438,000.00	0.00500	0.025	0.025
trichloroethylene	no	0.005	437.11	8,760.00	0.00500	0.076	0.076
1,1,1-trichloroethane	no	0.005	NA	5,600.68	1.28753	229.642	229.642
1,1,2-trichloroethane	no	0.005	391.20	5,840.00	0.00500	0.035	0.035
tetrachloroethylene	no	0.005	1,634.72	14,600.00	0.00500	0.227	0.227
1,1,1,2-tetrachloroethane	no	0.005	1,291.02	43,800.00	0.00500	0.076	0.076
1,1,2,2-tetrachloroethane	no	0.005	1,052.52	NA	0.00500	0.044	0.044
chloroform	no	0.005	92.76	14,600.00	0.10000	2.082	2.082
acetone	no	0.100	NA	146,000.00	3.04000	22.793	22.793
4-methyl-2-pentanone	no	0.050	NA	73,000.00	1.52000	68.147	68.147
methyl ethyl ketone	no	0.100	NA	9,032.18	0.91772	11.620	11.620
Aldrin	yes	0.003	4.35	8.76	0.00004	0.007	0.007
gamma-BHC (Lindane)	yes	0.006	392.31	87.60	0.00020	0.010	0.010
chlordane	yes	0.009	368.21	17.52	0.00200	4.512	4.512
DDD	yes	0.007	2,125.00	NA	0.00035	0.270	0.270
DDE	yes	0.003	1,500.00	NA	0.00025	0.450	0.450
DDT	yes	0.008	1,418.50	146.00	0.00025	0.794	0.794
dieldrin	yes	0.001	31.88	14.60	0.00002	0.003	0.003
endosulfan sulfate	no	0.044	NA	73.00	0.00152	2.007	2.007
endrin	yes	0.004	NA	87.60	0.00200	1.939	1.939
heptachlor	yes	0.002	55.28	146.00	0.00040	0.221	0.221
heptachlor epoxide	no	0.056	56.04	18.98	0.00083	0.450	0.450

TABLE 13
SUMMARY OF HEALTH-BASED
CRITERIA FOR SUBSURFACE SOILS
 RESIDENTIAL LAND USE SCENARIO

Chemical Name	Compound is Bioaccumulatable (yes/no)	Practical Quantitation Limit (mg/Kg)		Subsurface Soils		Leaching to Groundwater		Subsurface Soil Criteria (mg/Kg)
		Quantitation Limit (mg/Kg)	Carcinogenic Effects @10-6 (mg/Kg)	Noncarcinogenic Effects (mg/Kg)	Groundwater Criteria (mg/L)	Subsurface Soil Criteria (mg/Kg)		
PCBs	yes	0.044	66.23	NA	0.00065	4.226	4.226	4.226
lead	no	0.500	NA	NA	NA	NA	NA	NA
cadmium	no	0.500	NA	730.00	0.01520	NA	NA	730.000
silver	no	1.000	NA	7,300.00	0.15200	NA	NA	7,300.000
mercury	yes	0.100	NA	87.60	0.00182	NA	NA	87.600
chromium vi	no	1.000	NA	7,300.00	0.15200	NA	NA	7,300.000
chromium iii	no	1.000	NA	1,460,000.00	30.40000	NA	NA	10,000.000
barium	no	20.000	NA	102,200.00	2.12800	NA	NA	10,000.000
arsenic	no	1.000	NA	438.00	0.01000	NA	NA	438.000
antimony	no	6.000	NA	584.00	0.06000	NA	NA	584.000
beryllium	no	0.500	118.60	7,300.00	0.00500	NA	NA	118.605
cyanide	no	0.125	NA	29,200.00	0.60800	NA	NA	10,000.000
nickel	no	4.000	NA	29,200.00	0.60800	NA	NA	10,000.000
selenium	no	0.500	NA	7,300.00	0.15200	NA	NA	7,300.000
vanadium	no	5.000	NA	10,220.00	0.21280	NA	NA	10,000.000
zinc	no	2.000	NA	438,000.00	9.12000	NA	NA	10,000.000

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

TABLE 14
SUMMARY OF TIER II CLEANUP GOALS
FOR THE NONRESIDENTIAL SCENARIO

Chemical Name	Compound is Bioaccumulatable* (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
naphthalene	no	10,000.00	10,000.00	4.0880
acenaphthylene	no	NA	NA	NA
acenaphthene	no	10,000.00	10,000.00	6.1320
fluorene	no	10,000.00	10,000.00	4.0880
phenanthrene	no	NA	NA	NA
anthracene	no	10,000.00	10,000.00	30.6600
fluoranthene	yes	10,000.00	10,000.00	0.8176
pyrene	no	10,000.00	10,000.00	3.0660
benzo(a)anthracene*	yes	79.45	103.88	0.0100
chrysene*	yes	7,945.21	10,000.00	0.3918
benzo(b)fluoranthene*	yes	79.45	354.98	0.0100
benzo(k)fluoranthene*	yes	794.52	3,759.12	0.0392
benzo(a)pyrene	yes	7.94	69.85	0.0100
indeno(1,2,3-cd)pyrene*	yes	79.45	629.17	0.0100
dibenzo(a,h)anthracene*	yes	7.95	69.86	0.0100
benzo(g,h,i)perylene	yes	NA	NA	NA
3,3'-dichlorobenzidine	no	128.89	12.86	0.0200
n-nitroso-di-n-propylamine	no	8.29	0.66	0.0100
bis(2-chloroisopropyl)ether	no	93.12	1.32	0.0409
4-chloroaniline	no	8,160.00	1,117.69	0.4088
2-chloronaphthalene	no	10,000.00	10,000.00	8.1760
2,4-dinitrotoluene	no	4,080.00	39.07	0.2044
hexachlorobutadiene	yes	1.78	31.18	0.0367
hexachloroethane	yes	408.00	3.31	0.0204
isophorone	no	10,000.00	256.03	3.0105
benzyl alcohol	no	10,000.00	4,356.75	30.6600
bis(2-chloroethyl)ether	no	4.06	0.66	0.0100

**TABLE 14
SUMMARY OF TIER II CLEANUP GOALS
FOR THE NONRESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
nitrobenzene	no	1,020.00	1.73	0.0511
1,2-dichlorobenzene	no	10,000.00	10,000.00	9.1980
1,3-dichlorobenzene	no	NA	NA	NA
1,4-dichlorobenzene	no	2,416.67	34.67	0.1192
1,2,4-trichlorobenzene	no	10,000.00	1,405.37	1.0220
hexachlorobenzene	no	6.87	101.56	0.0100
hexachlorocyclopentadiene	no	2.02	2.89	0.7154
n-nitrosodiphenylamine	no	10,000.00	567.80	0.5837
benzoic acid	no	10,000.00	10,000.00	408.8000
2-nitroaniline	no	42.90	3.30	0.0500
phenol	yes	10,000.00	658.78	12.2640
2-methylphenol	no	10,000.00	375.93	5.1100
3-methylphenol	no	NA	NA	NA
4-methylphenol	no	10,000.00	427.24	5.1100
2-chlorophenol	no	10,000.00	11.63	0.5110
2,4-dichlorophenol	no	6,120.00	15.12	0.3066
2,4,5-trichlorophenol	no	10,000.00	5,507.44	10.2200
2,4,6-trichlorophenol	no	1,922.89	30.65	0.2600
pentachlorophenol	no	483.33	24.95	0.0500
2,4-dinitrophenol	no	4,080.00	7.37	0.2044
bis(2-ethylhexyl)phthalate	yes	4,142.86	1,406.25	0.2043
butylbenzylphthalate	no	10,000.00	10,000.00	20.4400
di-n-butylphthalate	yes	10,000.00	6,188.56	2.0440
diethylphthalate	no	10,000.00	10,000.00	81.7600
di methyl phthalate	no	10,000.00	10,000.00	1,022.0000
di-n-octyl phthalate	no	10,000.00	10,000.00	2.0440
benzene	no	16.63	4.77	0.0986

**TABLE 14
SUMMARY OF TIER II CLEANUP GOALS
FOR THE NONRESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
toluene	no	1,000.00	1,000.00	20.4400
ethylbenzene	no	1,000.00	1,000.00	10.2200
xylenes	no	1,000.00	1,000.00	204.4000
vinyl chloride	no	0.02	0.13	0.0100
chloroethane	no	1,000.00	1,000.00	NA
1,1-dichloroethylene	no	0.15	0.08	0.0070
1,1-dichloroethane	no	973.47	1,000.00	10.2200
1,2-dichloroethylene (cis)	no	1,000.00	102.49	1.0220
1,2-dichloroethane	no	5.27	0.37	0.0314
trichloroethylene	no	24.97	25.73	0.2600
1,1,1-trichloroethane	no	1,000.00	1,000.00	9.1980
1,1,2-trichloroethane	no	22.74	1.05	0.0502
tetrachloroethylene	no	101.23	8.01	0.0561
1,1,1,2-tetrachloroethane	no	75.91	7.24	0.1100
1,1,2,2-tetrachloroethane	no	75.41	0.21	0.0143
chloroform	no	5.28	20.33	0.4689
acetone	no	1,000.00	136.29	10.2200
4-methyl-2-pentanone	no	1,000.00	407.48	5.1100
methyl ethyl ketone	no	1,000.00	146.24	5.1100
Aldrin	yes	0.27	0.06	0.0002
gamma-BHC (Lindane)	yes	44.62	0.34	0.0022
chlordane	yes	24.48	4.51	0.0020
DDD	yes	241.67	48.34	0.0119
DDE	yes	170.59	80.49	0.0084
DDT	yes	153.01	141.83	0.0084
dieldrin	yes	3.63	0.06	0.0002
endosulfan sulfate	no	102.00	12.00	0.0051

**TABLE 14
SUMMARY OF TIER II CLEANUP GOALS
FOR THE NONRESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable * (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
endrin	yes	122.40	10.12	0.0061
heptachlor	yes	4.16	0.44	0.0006
heptachlor epoxide	no	6.37	0.45	0.0008
PCBs	yes	7.53	4.23	0.0007
lead	no	NA	NA	NA
cadmium	no	1,020.00	730.00	0.0511
silver	no	10,000.00	7,300.00	0.5110
mercury	yes	122.40	87.60	0.0061
chromium vi	no	10,000.00	7,300.00	0.5110
chromium iii	no	10,000.00	10,000.00	102.2000
barium	no	10,000.00	10,000.00	7.1540
arsenic	no	612.00	438.00	0.0500
antimony	no	816.00	584.00	0.0600
beryllium	no	13.49	118.60	0.0050
cyanide	no	1,000.00	10,000.00	2.0440
nickel	no	10,000.00	10,000.00	2.0440
selenium	no	10,000.00	7,300.00	0.5110
vanadium	no	10,000.00	10,000.00	0.7154
zinc	no	10,000.00	10,000.00	30.6600

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

**TABLE 15
SUMMARY OF TIER II CLEANUP GOALS
FOR THE RESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
naphthalene	no	10,000.00	1,761.785	1.21600
acenaphthylene	no	NA	NA	NA
acenaphthene	no	10,000.00	10,000.000	1.82400
fluorene	no	10,000.00	8,838.641	1.21600
phenanthrene	no	NA	NA	NA
anthracene	no	10,000.00	10,000.000	9.12000
fluoranthene	yes	2,160.00	2,305.040	0.24320
pyrene	no	8,100.00	10,000.000	0.91200
benzo(a)anthracene*	yes	0.88	103.881	0.00010
chrysene*	yes	87.67	379.273	0.00020
benzo(b)fluoranthene*	yes	0.88	354.977	0.00020
benzo(k)fluoranthene*	yes	8.77	501.638	0.00020
benzo(a)pyrene	yes	0.66	69.849	0.00020
indeno(1,2,3-cd)pyrene*	yes	0.88	629.166	0.00040
dibenzo(a,h)anthracene*	yes	0.66	69.863	0.00030
benzo(g,h,i)perylene	yes	NA	NA	NA
3,3'-dichlorobenzidine	no	1.42	12.865	0.02000
n-nitroso-di-n-propylamine	no	0.66	0.660	0.01000
bis(2-chloroisopropyl)ether	no	9.14	0.660	0.01000
4-chloroaniline	no	1,080.00	186.921	0.12160
2-chloronaphthalene	no	10,000.00	10,000.000	2.43200
2,4-dinitrotoluene	no	540.00	6.535	0.06080
hexachlorobutadiene	yes	8.21	6.777	0.01000
hexachloroethane	yes	45.07	1.153	0.01000
isophorone	no	673.68	1.433	0.08947
benzyl alcohol	no	10,000.00	728.618	9.12000
bis(2-chloroethyl)ether	no	0.66	0.660	0.01000

**TABLE 15
SUMMARY OF TIER II CLEANUP GOALS
FOR THE RESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
nitrobenzene	no	135.00	0.660	0.01520
1,2-dichlorobenzene	no	10,000.00	2,524.230	0.60000
1,3-dichlorobenzene	no	NA	NA	0.60000
1,4-dichlorobenzene	no	26.67	0.897	0.07500
1,2,4-trichlorobenzene	no	2,700.00	235.033	0.07000
hexachlorobenzene	no	0.66	101.564	0.00100
hexachlorocyclopentadiene	no	1,890.00	2.891	0.05000
n-nitrosodiphenylamine	no	130.61	3.177	0.01735
benzoic acid	no	10,000.00	10,000.000	121.60000
2-nitroaniline	no	16.20	3.300	0.05000
phenol	yes	10,000.00	110.173	3.64800
2-methylphenol	no	10,000.00	62.871	1.52000
3-methylphenol	no	NA	NA	NA
4-methylphenol	no	10,000.00	71.452	1.52000
2-chlorophenol	no	1,350.00	1.945	0.15200
2,4-dichlorophenol	no	810.00	2.528	0.09120
2,4,5-trichlorophenol	no	10,000.00	921.059	3.04000
2,4,6-trichlorophenol	no	58.18	0.660	0.01000
pentachlorophenol	no	5.33	24.947	0.00100
2,4-dinitrophenol	no	540.00	3.300	0.06080
bis(2-ethylhexyl)phthalate	yes	45.71	16.427	0.00600
butylbenzylphthalate	no	10,000.00	10,000.000	0.10000
di-n-butylphthalate	yes	5,400.00	1,034.967	0.60800
diethylphthalate	no	10,000.00	10,000.000	24.32000
di methyl phthalate	no	10,000.00	10,000.000	304.00000
di-n-octyl phthalate	no	5,400.00	2,318.850	0.60800
benzene	no	22.07	0.059	0.00500

**TABLE 15
SUMMARY OF TIER II CLEANUP GOALS
FOR THE RESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
toluene	no	1,000.00	278.926	1.00000
ethylbenzene	no	1,000.00	834.372	0.70000
xylenes	no	1,000.00	1,000.000	10.00000
vinyl chloride	no	0.34	0.129	0.00200
chloroethane	no	NA	1,000.000	23.16075
1,1-dichloroethylene	no	1.07	0.084	0.00700
1,1-dichloroethane	no	1,000.00	40.074	0.64000
1,2-dichloroethylene (cis)	no	1,000.00	17.140	0.07000
1,2-dichloroethane	no	7.03	0.025	0.00500
trichloroethylene	no	58.18	0.076	0.00500
1,1,1-trichloroethane	no	1,000.00	229.642	0.20000
1,1,2-trichloroethane	no	11.23	0.035	0.00500
tetrachloroethylene	no	12.55	0.227	0.00500
1,1,1,2-tetrachloroethane	no	24.62	0.076	0.00500
1,1,2,2-tetrachloroethane	no	3.20	0.044	0.00500
chloroform	no	104.92	2.082	0.10000
acetone	no	1,000.00	22.793	3.04000
4-methyl-2-pentanone	no	1,000.00	68.147	1.52000
methyl ethyl ketone	no	1,000.00	11.620	0.91772
Aldrin	yes	0.04	0.007	0.00004
gamma-BHC (Lindane)	yes	0.49	0.010	0.00020
chlordane	yes	0.49	4.512	0.00200
DDD	yes	2.67	0.270	0.00035
DDE	yes	1.88	0.450	0.00025
DDT	yes	1.88	0.794	0.00025
dieldrin	yes	0.04	0.003	0.00002
endosulfan sulfate	no	13.50	2.007	0.00152

**TABLE 15
SUMMARY OF TIER II CLEANUP GOALS
FOR THE RESIDENTIAL SCENARIO**

Chemical Name	Compound is Bioaccumulatable (yes/no)	Surface Soils (mg/Kg)	Subsurface Soils (mg/Kg)	Groundwater (mg/L)
endrin	yes	16.20	1.939	0.00200
heptachlor	yes	0.14	0.221	0.00040
heptachlor epoxide	no	0.07	0.450	0.00020
PCBs	yes	0.08	4.226	0.00050
lead	no	NA	NA	NA
cadmium	no	135.00	730.000	0.00500
silver	no	1,350.00	7,300.000	0.15200
mercury	yes	16.20	87.600	0.00200
chromium vi	no	1,350.00	7,300.000	0.10000
chromium iii	no	10,000.00	10,000.000	0.10000
barium	no	10,000.00	10,000.000	2.00000
arsenic	no	81.00	438.000	0.05000
antimony	no	108.00	584.000	0.00600
beryllium	no	0.50	118.605	0.00400
cyanide	no	1,000.00	10,000.000	0.20000
nickel	no	5,400.00	10,000.000	0.10000
selenium	no	1,350.00	7,300.000	0.05000
vanadium	no	1,890.00	10,000.000	0.21280
zinc	no	10,000.00	10,000.000	9.12000

NOTES: a - Compounds that are assumed to be bioaccumulative have an acceptable hazard index of 0.2 versus 1, as determined based on Indiana Register, 16:7, April 1, 1993.

b - Practical quantitation limits based EPA SW-846, 1986 for GC/MS. PQLs will change according to the specific analytical method used.

* - Assumes TEF approach.

NA - Data not available or not applicable.

**APPENDIX G: INDIANA CODE CHAPTER 13 - ARTICLE 11. CHAPTER 2 -
DEFINITIONS**

Section.

- 13-11-2-67...."Enforcement Action" defined.
- 13-11-2-98...."Hazardous substance" defined.
- 13-11-2-160...."Petroleum" defined.
- 13-11-2-184(e)...."Release" defined.
- 13-11-2-186...."Remediation" defined.
- 13-11-2-203(a)...."Site" defined.

13-11-2-67. Enforcement action. - "Enforcement action", for purposes of IC 13-25-5, means:

- (1) a written notice of violation issued under IC 13-30-3-3, IC 13-30-3-4, or IC 13-7-11-2 (before its repeal) that requires or involves the removal or remediation of petroleum or a hazardous substance;
- (2) another written notice that requires the removal or remediation of petroleum or a hazardous substance and that is:
 - (A) issued under:
 - (i) IC 4-21.5-3-6;
 - (ii) IC 4-21.5-3-8; or
 - (iii) IC 4-21.5-4; or
 - (B) substantially equivalent to a special notice letter issued under 42 U.S.C. 9622(e); or
- (3) a similar notice issued by the federal government.

13-11-2-98. Hazardous substance. - "Hazardous substance", for purposes of IC 13-25-4 and IC 13-25-5, has the meaning set forth in Section 101 of CERCLA (42 U.S.C. 9601). The term includes any substance that the solid waste management board determines to be hazardous under environmental management laws.

13-11-2-160. Petroleum. - "Petroleum", for purposes of:

- (1) IC 13-23;
- (2) IC 13-24-1; and
- (3) IC 13-25-5;

includes petroleum and crude oil or any part of petroleum or crude oil that is liquid at standard conditions of temperature and pressure (sixty (60) degrees Fahrenheit) and fourteen and seven-tenths (14.7) pounds per square inch absolute.

13-11-2-184. Release. - (e) "Release", for purposes of IC 13-25-5, means any:

- (1) spilling;
- (2) leaking;
- (3) pumping;
- (4) pouring;
- (5) emitting;
- (6) emptying;
- (7) discharging;

- (8) injecting;
- (9) escaping;
- (10) leaching;
- (11) dumping; or
- (12) disposing;

into the environment. The term includes the abandonment or discarding of barrels, containers, or other closed receptacles containing any hazardous substance or petroleum.

13-11-2-186. Remediation. - “Remediation”, for purposes of IC 13-25-5, means any of the following:

- (1) Actions necessary to:
 - (A) prevent;
 - (B) minimize; or
 - (C) mitigate;

damages to the public health or welfare or to the environment that may otherwise result from a release or threat of a release.

- (2) Actions consistent with a permanent remedy taken instead of or in addition to removal actions if a release or threatened release of a hazardous substance or petroleum into the environment occurs to eliminate the release of hazardous substances or petroleum so that the hazardous substances or petroleum do not migrate to cause substantial danger to present or future public health or welfare or the environment.

- (3) The cleanup or removal of released hazardous substances or petroleum from the environment.

13-11-2-203. Site. - (a) “Site”, for purposes of IC 13-25-5, means a parcel of real property for which an application has been submitted under IC 13-25-5-2.

**INDIANA CODE CHAPTER 13 - ARTICLE 25. CHAPTER 5 -
VOLUNTARY REMEDIATION OF HAZARDOUS SUBSTANCES AND PETROLEUM**

Section.

- 13-25-5-1....Purpose - Liability of participant.
- 13-25-5-2....Application and fee - Confidentiality.
- 13-25-5-3....Environmental assessment.
- 13-25-5-4....Eligibility determination.
- 13-25-5-5....Rejection of application - Reasons - Incomplete application - Notice to applicant.
- 13-25-5-6....Rejection of application - Appeal - Completion of application - Refund.
- 13-25-5-7....Proposed voluntary remediation work plan - Requirements.
- 13-25-5-8....Voluntary remediation agreement - Failure to reach agreement.
- 13-25-5-9....Review and evaluation by department - Recommendation - Request for information.
- 13-25-5-10....Approval, modification, or rejection of work plan.
- 13-25-5-11....Notification of local government units and public - Comment period - Public hearing.
- 13-25-5-12....Rejection of work plan - Notice to applicant - Appeal.
- 13-25-5-13....Notice of approval, or modification and approval of work plan.
- 13-25-5-14....Notice of intent to implement work plan.
- 13-25-5-15....Oversight and review of implementation by department - Reports to commissioner.
- 13-25-5-16....Certificate of completion.
- 13-25-5-17....Notice applicant has not successfully completed work plan.
- 13-25-5-18....Covenant not to sue - Actions prohibited during implementation.
- 13-25-5-19....Withdrawal of approval of work plan.
- 13-25-5-20....Claims against third parties - Liability for matters addressed in work plan or certificate of completion.
- 13-25-5-21....Voluntary remediation fund.
- 13-25-5-22....Transfer from environmental management special fund - Reimbursement {expires August 1, 1998}.
- 13-25-5-23....Adoption of rules.

13-25-5-1. Voluntary Remediation: Purpose - Liability of participant. -

- (a) This chapter is intended to provide an alternative procedure to assure compliance with the law. A person who performs an action under an approved remediation work plan is performing the action to comply with existing legal obligations to protect human health and the environment.
- (b) This section does not affect a person's legal obligations set forth in 42 U.S.C. 6901 et seq. regardless of a person's participation in this chapter.

13-25-5-2. Voluntary Remediation: Application and fee - Confidentiality. -

- (a) A person who desires to participate in the voluntary remediation program under this chapter must submit an application and a fee to the department as described under subsection (c).
- (b) Except as provided under section 5 of this chapter, any information submitted to the division of the department responsible for reviewing and making determinations on applications under this chapter is confidential between the applicant and the department.
- (c) An application submitted under this section must meet the following conditions:
 - (1) Be on a form provided by the department.

- (2) Contain the following:
 - (A) General information concerning:
 - (i) the person;
 - (ii) the site; and
 - (iii) other background information;as requested by the department.
 - (B) An environmental assessment of the actual or threatened release of the hazardous substance or petroleum at the site.
- (3) Be accompanied by an application fee of one thousand dollars (\$1,000).
- (d) A fee collected under this section shall be deposited in the voluntary remediation fund established by section 21 of this chapter.

13-25-5-3. Voluntary Remediation: Environmental assessment. -

An environmental assessment described under section 2(c)(2)(B) of this chapter must include the following:

- (1) A legal description of the site.
- (2) The physical characteristics of the site.
- (3) The operational history of the site to the extent the history is known by the applicant.
- (4) Information that the applicant is aware of concerning:
 - (A) the nature and extent of any relevant contamination ; and
 - (B) relevant releases;at the site and immediately contiguous to the site.
- (5) Relevant information the applicant is aware of concerning the potential for human exposure to contamination at the site.

13-25-5-4. Voluntary Remediation: Eligibility determination. -

Not more than thirty (30) days after receiving:

- (1) an application; and
- (2) an application fee;

under section 2 of this chapter, the department shall determine if the applicant is eligible to participate in the voluntary remediation program under this chapter.

13-25-5-5. Voluntary Remediation: Rejection of application - Reasons - Incomplete application - Notice to applicant. -

- (a) The department may reject an application submitted under section 2 of this chapter only for one (1) or more of the following reasons:
 - (1) A state or federal enforcement action that concerns the remediation of the hazardous substance or petroleum described in the application is pending.
 - (2) A federal grant requires an enforcement action at the site.
 - (3) The condition of the hazardous substance or petroleum described in the application constitutes an imminent and substantial threat to human health or the environment.
 - (4) The application is not complete.
- (b) If the application is rejected under subsection (a)(4), the department, not more than forty-five (45)

days after the department received the application, shall provide the applicant with a list of all information needed to make the application complete. If the department fails to comply with this subsection, the application shall be considered completed for the purposes of this chapter.

- (c) If the department rejects an application, the department shall do the following:
- (1) As described under IC 4-21.5-3-4(b) and IC 4-21.5-3-4(c), notify the applicant that the department rejected the application.
 - (2) Explain the reason the department rejected the application.

13-25-5-6. Voluntary Remediation: Rejection of application - Appeal - Completion of application - Refund. -

- (a) If an applicant's application is rejected under section 5 of this chapter, the applicant may do the following:
- (1) Appeal the department's decision under IC 4-21.5.
 - (2) If the application is rejected because the application is not complete, submit a completed application without submitting an additional application fee.
- (b) If an applicant's application is rejected and the applicant:
- (1) does not appeal the rejection; or
 - (2) loses an appeal concerning the rejection;
- the department shall refund any unexpended portion or the applicant's application fee.

13-25-5-7. Voluntary Remediation: Proposed voluntary remediation work plan - Requirements. -

- (a) If the department determines an application is eligible under section 4 of this chapter, the applicant may submit a proposed voluntary remediation work plan to the department.
- (b) A proposed voluntary remediation work plan must include the following:
- (1) Detailed documentation of the investigation conducted by the applicant in preparing the proposed voluntary remediation work plan and a description of the work to be performed by the applicant to determine the nature and extent of the actual or threatened release.
 - (2) A proposed statement of work to accomplish the remediation in accordance with guidelines established by the department.
 - (3) Plans concerning the following:
 - (A) Quality assurance for the implementation of the proposed remediation project.
 - (B) Descriptions of sampling and analysis.
 - (C) Health and safety considerations.
 - (D) Community relations.
 - (E) Data management and record keeping.
 - (F) A proposed schedule concerning the implementation of all tasks set forth in the proposed statement of work.

13-25-5-8. Voluntary Remediation: Voluntary remediation agreement - Failure to reach agreement. -

- (a) Before the department evaluates a proposed voluntary remediation work plan, the applicant who submitted the work plan and the commissioner must enter into a voluntary remediation agreement that sets forth the terms and conditions of the evaluation and the implementation of the work plan. A voluntary remediation agreement must include the following:
- (1) Provisions for the following:

- (A) A requirement that the department provide the applicant with an itemized list of estimated costs the department may incur under this chapter.
 - (B) The recovery of all reasonable costs that:
 - (i) are incurred by the department in the review and oversight of the work plan;
 - (ii) are attributable to the voluntary remediation agreement; and
 - (iii) exceed the fee submitted by the applicant under section 2 of this chapter.
 - (C) A schedule of payments to be made by the applicant to the department to recover the costs to the department.
- (2) A mechanism to resolve disputes arising from the evaluation, analysis, and oversight of the implementation of the work plan, including any of the following:
 - (A) Arbitration.
 - (B) Adjudication under IC 4-21.5.
 - (C) A dispute resolution procedure provided under the Indiana Rules of Court.
 - (3) A provision concerning the indemnification of the Parties.
 - (4) A provision concerning the retention of records.
 - (5) A timetable for the department to do the following:
 - (A) Reasonably review and evaluate the adequacy of the work plan.
 - (B) Make a determination concerning the approval or rejection of the work plan.
 - (6) A provision concerning applicable interagency coordination.
 - (7) Any other conditions considered necessary by the commissioner or the applicant concerning the effective and efficient implementation of this chapter.
- (b) If any agreement is not reached between an applicant and the commissioner within a reasonable time after good faith negotiations have begun between the applicant and the commissioner:
- (1) the applicant or the commissioner may withdraw from the negotiations; and
 - (2) the department shall refund any unexpended portion of the applicant's application fee.

13-25-5-9. Voluntary Remediation: Review and evaluation by department - Recommendation - Request for information. -

- (a) After the commissioner and an applicant have signed a voluntary remediation agreement described under section 8 of this chapter, the department or a person under contract with the department shall do the following:
- (1) Review and evaluate the site and the affected area surrounding the site.
 - (2) Review and evaluate the documentation of the investigation and feasibility study conducted by the applicant or the applicant's representative for accuracy and thoroughness.
 - (3) Review and evaluate the proposed voluntary remediation work plan for quality, efficiency, and safety based on guidelines established by the department.
 - (4) Make a recommendation to the commissioner concerning whether the commissioner should
 - (A) approve;
 - (B) modify and approve; or
 - (C) reject;the proposed voluntary remediation work plan.
- (b) At any time during the evaluation of a proposed voluntary remediation work plan, the commissioner or the department may request that an applicant submit additional or corrected information to the

department. An applicant may:

- (1) comply with the request; or
- (2) withdraw the applicant's proposed voluntary remediation work plan from consideration.

13-25-5-10. Voluntary Remediation: Approval, modification, or rejection of work plan. -

Subject to section 11 of this chapter, after receiving a recommendation under section 9 of this chapter, the commissioner shall:

- (1) approve;
- (2) modify and approve; or
- (3) reject;

the proposed voluntary remediation work plan.

13-25-5-11. Voluntary Remediation: Notification of local government units and public - Comment period - Public hearing. -

(a) Before the commissioner approves or rejects a proposed voluntary remediation work plan under section 10 of this chapter, the commissioner must:

- (1) notify local government units located in a county affected by the proposed voluntary remediation work plan of the work plan;
- (2) provide that a copy of the proposed voluntary remediation work plan be placed in at least one (1) public library in a county affected by the work plan; and
- (3) publish a notice requesting comments concerning the proposed voluntary remediation work plan.

(b) A comment period of at least thirty (30) days must follow publication of a notice under this section. During a comment period, interested persons may do the following:

- (1) Submit written comments to the commissioner concerning the proposed voluntary remediation work plan.
- (2) Request a public hearing concerning the proposed voluntary remediation work plan.

(c) If the commissioner receives at least one (1) written request, the commissioner may hold a public hearing in the geographical area affected by the proposed voluntary remediation work plan on the question of whether to approve or reject the work plan. The commissioner shall consider all written comments and public testimony.

13-25-5-12. Voluntary Remediation: Rejection of work plan - Notice to applicant - Appeal. -

If the commissioner rejects a proposed voluntary remediation work plan under this section 10 of this chapter:

- (1) the commissioner shall, under applicable provisions set forth in IC 4-21.5-3-5(b) and IC 4-21.5-3-5(c), notify the applicant and specify the reasons for rejecting the work plan; and
- (2) the applicant may appeal the commissioner's decision under IC 4-21.5.

13-25-5-13. Voluntary Remediation: Notice of approval, or modification and approval of work plan.-

If the commissioner approves or modifies and approves a proposed voluntary remediation work plan under this chapter, the commissioner shall notify the applicant in writing, under the applicable provisions set forth in IC 4-21.5-3-5(b) and IC 4-21.5-3-5(c), of the following:

- (1) That the voluntary remediation work plan has been approved or modified and approved.
- (2) The date:
 - (A) the applicant may begin implementing the work plan; and
 - (B) by which the work plan must be completed.
- (3) The applicant's right to appeal the commissioner's decision under IC 4-21.5.

13-25-5-14. Voluntary Remediation: Notice of intent to implement work plan. -

If an applicant who submitted an approved voluntary remediation work plan desires to proceed with the implementation of the work plan, the applicant must notify the commissioner in writing not more than sixty (60) days after the work plan is approved that the applicant:

- (1) intends to proceed with the implementation of the work plan; and
- (2) agrees to the starting and completion dates set forth by the commissioner under subsection 13(2) of this chapter.

13-25-5-15. Voluntary Remediation: Oversight and review of implementation by department - Reports to commissioner. -

If the applicant who submitted an approved voluntary remediation work plan proceeds with the work plan, the department or a person under contract with the department shall do the following:

- (1) Oversee and review the implementation of the voluntary remediation work plan.
- (2) Make regular reports to the commissioner concerning the remediation.

13-25-5-16. Voluntary Remediation: Certificate of completion. -

(a) If the commissioner determines that an applicant has successfully completed a voluntary remediation work plan approved under this chapter, the commissioner shall certify that the work plan has been completed by issuing the applicant a certificate of completion.

(b) The issuance of a certificate of completion under this section is a final agency action for purposes of IC 4-21.5.

(c) A person who receives a certificate under this section shall attach a copy of the certificate to the recorded deed that concerns the property on which the remediation took place.

13-25-5-17. Voluntary Remediation: Notice applicant has not successfully completed work plan. -

If the commissioner determines that the applicant has not successfully completed a voluntary remediation work plan approved under this chapter, the commissioner shall notify the applicant of this determination un IC 4-21.5

13-25-5-18. Voluntary Remediation: Covenant not to sue - Actions prohibited during implementation. -

(a) If the commissioner issues a certificate to a person under section 16 of this chapter, the governor shall also provide the person with a covenant not to sue for:

- (1) any liability, including future liability; or
- (2) a claim;

resulting from or based upon the release or threatened release of a hazardous substance or petroleum that is the subject of the approved voluntary remediation work plan successfully conducted under this chapter.

(b) A covenant not to sue issued under this section shall bar suit against:

- (1) any person who received the certificate of completion under section 16 of this chapter; or

- (2) any other person who receives the certificate of completion;
 - (A) through a legal transfer of the certificate of completion; or
 - (B) by acquiring property to which the certificate of completion applies;from all public or private claims arising under this title or rules adopted under this title in connection with the release or threatened release of a hazardous substance or petroleum that was the subject of the approved voluntary remediation work plan, except as provided in subsection (c).
- (c) A covenant not to sue issued under this section may not apply to future liability for a condition or the extent of a condition that:
 - (1) was present on property that was involved in an approved and completed voluntary remediation work plan; and
 - (2) was not known to the commissioner at the time the commissioner issued the certificate of completion under section 16 of this chapter.
- (d) Except as:
 - (1) provided under federal law; or
 - (2) agreed to by a federal governmental entity;a covenant not to sue issued under this section may not release a person from liability to the federal government for claims based on federal law.
- (e) During the implementation of an approved voluntary remediation work plan, a person may not bring an action, including an administrative action, against a person implementing the voluntary work plan for any cause of action:
 - (1) arising under this title or rules adopted under the title; and
 - (2) relating to the release or threatened release of a hazardous substance or petroleum that is the subject of the voluntary remediation work plan.

13-25-5-19. Voluntary Remediation: Withdrawal of approval of work plan. -

This chapter does not prohibit or limit the commissioner from withdrawing the commissioner's approval of a voluntary remediation work plan at any time during the implementation of the work plan if:

- (1) the person implementing the work plan fails substantially to comply with the terms and conditions of:
 - (A) the voluntary remediation work plan; or
 - (B) a voluntary remediation agreement; or
- (2) a hazardous substance or petroleum becomes an imminent and substantial threat to human health or the environment. [P.L.87-1992, § 3.]

13-25-5-20. Voluntary Remediation: Claims against third parties - Liability for matters addressed in work plan or certificate of completion. -

- (a) This chapter does not affect an action or a claim, including a claim for contribution, that a person who implements or completes an approved voluntary remediation work plan has or may have against a third party.
- (b) A person who implements or completes an approved voluntary remediation work plan under this chapter may not be held liable for claims for contribution concerning matters addressed in:
 - (1) the work plan; or
 - (2) a certificate of completion issued to the person under section 16 of this chapter.

13-25-5-21. Voluntary Remediation: Voluntary remediation fund. -

- (a) The voluntary remediation fund is established to provide a source of funds for the department to implement this chapter.
- (b) The expenses of administering the fund shall be paid from the 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. Interest that accrues from these investments shall be deposited in the fund.
- (d) Money in the fund at the end of a state fiscal year does not revert to that state general fund.
- (e) The sources of money for the fund are as follows:
 - (1) Fees paid under section 2 of this chapter.
 - (2) Appropriations made by the general assembly.
 - (3) Gifts and donations intended for deposit in the fund.
 - (4) Transfers under section 22 of this chapter from the environmental management special fund established under IC 13-14-12-1.

13-25-5-22. Voluntary Remediation: Transfer from environmental management special fund - Reimbursement [expires August 1, 1998]. -

- (a) Two hundred fifty thousand dollars (\$250,000) shall be transferred from the environmental management special fund established by IC 13-14-12-1 to the voluntary remediation fund on July 1, 1992, to be used to implement this chapter.
- (b) Beginning July 1, 1994, the money transferred under subsection (a) shall be reimbursed to the environmental management special fund with money in the voluntary remediation fund. Sixty-two thousand five hundred dollars (\$62,500) shall be transferred per year. Money transferred under this subsection must come from the balances remaining in the voluntary remediation fund at the end of each state fiscal year.
- (c) This section expires August 1, 1998.

13-25-5-23. Voluntary Remediation: Adoption of rules. -

The board may adopt rules under IC 4-22-2 and IC 13-14-8 to implement this chapter. The rules may include interim or final remediation standards or provisions limiting the liability of lenders associated with persons involved in voluntary remediation projects under this chapter.

**APPENDIX H: ADDENDUM SUPERFUND MEMORANDUM OF AGREEMENT -
BROWNFIELDS AND VOLUNTARY REMEDIATION PROGRAM**

For Immediate Release:

December 4, 1995

IDEM Commissioner Kathy Prosser today signed a Memorandum of Agreement with the U.S. Environmental Protection Agency that establishes federal approval of environmental cleanups under Indiana's Voluntary Remediation Program.

"This agreement removes the last major stumbling block for our voluntary cleanup efforts," said Commissioner Prosser. "Some property owners have been concerned that EPA would not accept cleanups done under our program. The MOA I am signing today erases that fear, and should help Indiana return many industrial and commercial properties to productive use."

In 1993, IDEM established one of the nation's first voluntary remediation programs. Through the program companies receive state approval for cleanups done voluntarily. Currently, 52 sites are being cleaned up in Indiana under the program.

Although IDEM's Voluntary Remediation Program is viewed in a positive light, some businesses and lenders have expressed concern about liability under the federal Superfund law.

Under the agreement, Region V agrees that when an Indiana site has been investigated or remediated under Indiana's program and IDEM has issued a Certificate of Completion for the site, EPA will not plan or anticipate any federal action under the Superfund law. In exceptional circumstances, EPA reserves the right to intervene if the site poses an imminent and substantial threat to human health or the environment.

The agreement does not apply to sites on the Superfund National Priority list or site currently subject to orders or enforcement under Superfund law.

Indiana is the fourth state in the nation to establish such an agreement, joining the states of Illinois, Minnesota and Wisconsin.

Introduction

IDEM and U.S. EPA, Region V, recognize that the revitalization of contaminated or potentially contaminated properties (Brownfields) will provide a significant benefit to both the environment and the economy of the local communities. To the extent possible, Region V and IDEM seek to facilitate the productive use of industrial and commercial properties by addressing regulatory impediments to the financing, transfer, and appropriate reuse of these properties. Both agencies recognize that a key factor to meet this goal is to exercise their authorities and use their resources in ways that are mutually complementary and are not duplicative. In particular, IDEM and Region V seek to protect human health and the environment by encouraging the voluntary investigation and cleanup of properties in Indiana by implementing the following strategic goals:

1. Promoting appropriate investigations and cleanups by parties participating in the Voluntary Remediation Program (VRP).

2. Developing partnerships between Region V, IDEM, other federal, state, local governmental agencies, and key external stakeholders in Indiana, including representatives from citizen/community groups and the private sector.
3. Providing necessary information to the key stakeholders in Indiana to allow for informed decision-making by property owners, prospective purchasers, lenders, public and private developers, citizens, municipalities, counties and elected officials.
4. Promoting the adequate remediation and revitalization of contaminated or potentially contaminated properties in Indiana for an appropriate use as determined by the key stakeholders.

In order to accomplish these goals, Region V intends to assist IDEM in further expanding the use of the VRP. Region V recognizes that the VRP has been developing and implementing successful strategies to help promote the voluntary investigation and cleanup of under-utilized properties. Similarly, IDEM intends to assist and support efforts to promote and implement Region V's Brownfields activities. IDEM recognizes Region V as a key partner in the ongoing success of state voluntary cleanup programs, including the VRP, and the role of Region V in addressing the uncertainty of financing, transferring and developing Brownfields sites by clarifying the risk of federal liability.

Principles

When a site in Indiana has been investigated or remediated in accordance with the practices and procedures of the VRP and IDEM has issued a Certificate of Completion for the site, Region V will not plan or anticipate any federal action under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA/Superfund) unless, in exceptional circumstance, the site poses an imminent and substantial threat to human health or the environment. In all cases, the Region V decision will be based strictly on the information available at the time of IDEM determination. The foregoing principle does not apply to sites listed on the NPL or sites currently subject to orders or enforcement actions under Superfund law.

Region V will continue to work with IDEM to remove any concerns associated with federal activity under Superfund so as to encourage the financing, transfer and appropriate redevelopment and use of industrial and commercial property. In addition, Region V will continue to provide technical assistance and, in its discretion, financial support to local and state governmental agencies in order to facilitate the revitalization of contaminated or potentially contaminated properties in Indiana.

Reporting

On an annual basis, IDEM will report to Region V on the following:

1. Number of sites in the VRP.
2. Sites entering the VRP in the previous year.
3. Sites having received Certificates of Completion in the previous year.

Several operational factors are important and will complement the mutual objectives of both IDEM and Region V:

1. IDEM has successfully operated a Voluntary Remediation Program (VRP) since 1993.
2. Region V and IDEM find the VRP provides for response actions that are protective of human health and the environment.
3. Region V and IDEM find the VRP provides adequate opportunities for public involvement and technical assistance.
4. At sites successfully completing a remediation under the VRP, Region V does not plan or anticipate any federal action under the Superfund law (CERCLA) unless, in exceptional circumstances, the site poses an imminent threat to human health and the environment.
5. The State of Indiana and IDEM have made a substantial commitment to the VRP and the revitalization of contaminated property (Brownfield's redevelopment) by, among other things, passage of House Resolution 40 establishing an Interim Study Committee for Brownfields issues and the establishment of a Brownfields Coordinator position at IDEM.
6. Region V will continue to work with IDEM to remove any concerns associated with federal activity under Superfund so as to encourage the financing, transfer, and appropriate redevelopment and use of industrial and commercial property.
7. Region V will continue to provide technical assistance and, at its discretion, financial support to local and state Governmental agencies in order to facilitate the revitalization of contaminated or potentially contaminated properties in Indiana.