



0153 Groundwater Contamination Site

Overview of Remedial Investigation, Human Health
and Ecological Risk Assessment, and Feasibility Study

November 18, 2020



Outline

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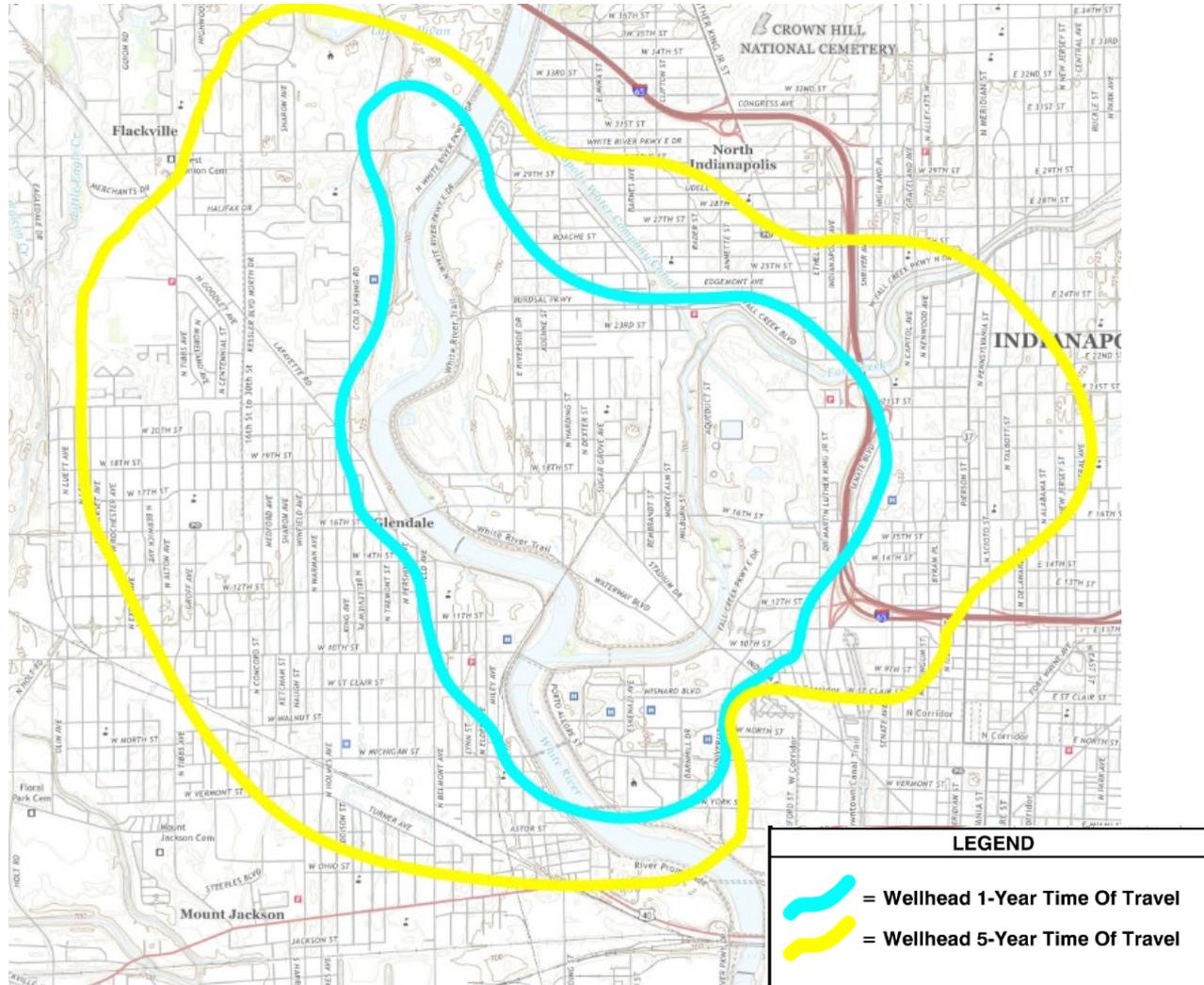


Introduction

- In early 2013, IDEM received notice from Citizens that low levels of **chlorinated volatile organic compounds** (cVOCs) were being detected in the "raw" untreated groundwater located within the Riverside Wellfield.
- The contaminants detected in production wells were **trichloroethene** (TCE), cis-1,2-dichloroethene, vinyl chloride, and 1,1,1-trichloroethane ("**chemicals of concern**"). These chemicals are commonly used and associated with historic manufacturing and dry-cleaning processes.
- The "**finished**" water supplied to customers is and always has been safe, in accordance with the federal **Safe Drinking Water Act (SDWA)**.



Site 0153 Five-Year Time of Travel Map





Introduction (Cont.)

Despite drinking water being safe, "**Site 0153**" was created to:

- determine the sources of contamination,
- further investigate the magnitude of contamination,
- evaluate other potential exposure risks (soil, vapor intrusion, private wells), and
- remediate source areas at individual facilities.



Introduction (Cont.)

- On April 7, 2016, U.S. EPA published a Proposed Rule in the Federal Register, proposing to include Site 0153 on the **National Priorities List** (NPL) based on the high number of potential receptors (Citizens' customers).
- To address public and local government concerns, it was decided to address the Site at the state level in IDEM's **State Cleanup Program** (SCP) rather than via the federal Superfund process.



Introduction (Cont.)

- A **Memorandum of Agreement (MOA)** was executed between the U.S. EPA and IDEM which specifies the expectations and obligations of each agency regarding Site 0153 and memorializes the agreements necessary to ensure that the response actions undertaken at the Site are consistent with the federal **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**.



Requirements of MOA

- ✓ IDEM would identify **Potentially Responsible Parties** (PRPs), responsible for or contributing to impacts identified in the Wellfields.
- ✓ IDEM would **oversee investigations** of the potential sources of impacts and **manage identified sources**.
- ✓ Citizens would remove any production wells above a **Maximum Contaminant Level (MCL)** from service, install aeration equipment to reduce chemicals of concern, and complete confirmatory sampling.
- ✓ Citizens would increase **the frequency of sampling** its production wells for chemicals of concern from semi-annually to quarterly. ([Sampling Results](#))



MOA Schedule of Performance

- A Schedule of Performance was outlined in the MOA requiring the development of a:
 - **Remedial Investigation (RI) Report,**
 - **Human Health and Ecological Risk Assessment (HHERA),**
 - And **Feasibility Study (FS).**
- Acceptance of these documents from the public and U.S. EPA is a necessary step to de-propose Site 0153 from the NPL and allow the U.S. EPA to focus their efforts on sites that are actually posing a threat to human health and the environment.



Remedial Investigation

The purpose of the Remedial Investigation (RI) is to:

- Summarize investigations within the Wellfield;
- Characterize Site conditions;
- Evaluate nature and extent of contaminants;
- Discuss fate and transport of contaminants; and,
- Summarize risks to human health and the environment (further detailed in the HHERA).



Study Area Investigations

- The "**Study Area**" consists of the White River and Riverside Wellfields; therefore, the RI focuses on investigations that have been conducted within the five-year time of travel.
- A definitive source(s) of Wellfield impacts has not been identified. It is likely that multiple sources are contributing to a commingled groundwater plume, which is impacting the Wellfields at higher concentrations than observed at the individual sites.
- IDEM will continue to oversee investigation and remediation of "**individual sites**" separately from Site 0153.



Study Area Investigations (Cont.)

- Beginning in 2017, Citizens began sampling both finished and raw/untreated groundwater in their production wells on a quarterly basis.
([Sampling Results](#))
- The **Marion County Public Health Department** (MCPHD) has identified seven (7) private wells within the Study Area. Of the wells sampled, no chemicals of concern have been detected.
- IDEM is providing oversight for all the individual sites within the Study Area.



Study Area Investigations (Cont.)

IDEM conducted historical research on all commercial properties within the Study Area;

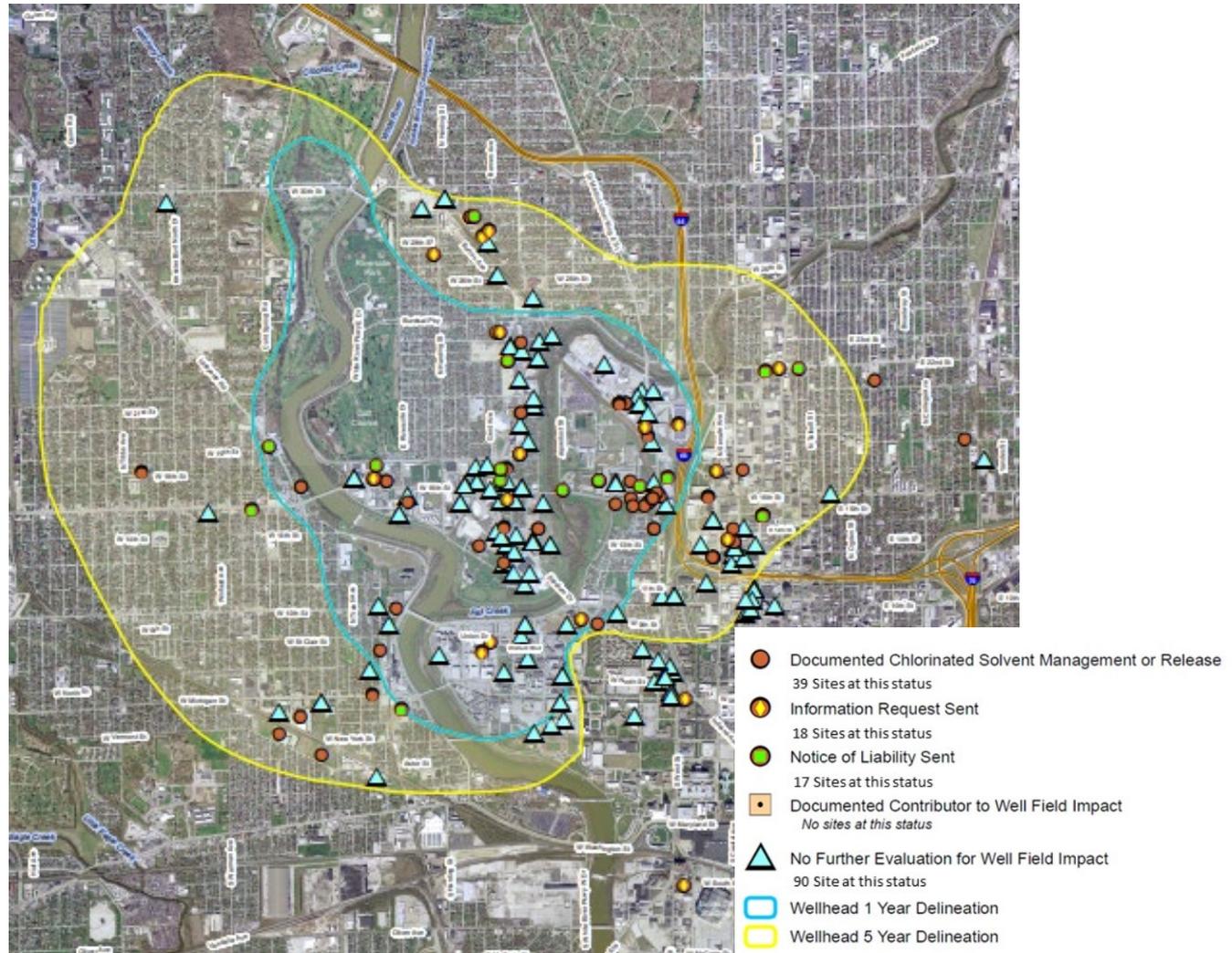
- IDEM issued approximately 140 **Request for Information** (RFI) letters to all parties where additional information was needed; and,
- IDEM issued 25 **Notice of Liability** (NOL) letters to all parties where a release was documented. These parties are required to:
 - determine their contribution to the Wellfield impacts,
 - determine their impacts to other media (soil, vapor, etc.) not related to Site 0153, and
 - conduct remediation as necessary to address any associated risks with the individual sites.



Study Area Investigations (Cont.)

- Of the 25 sites that received NOL letters:
 - 8 sites have received a **No Further Action** (NFA) or similar closure letter from IDEM;
 - 5 sites have completed site investigations and are in the remediation phase; and,
 - 12 sites are continuing to investigate the nature and extent of their releases.

Site 0153 Time of Travel Map





Focused Area of Interest

- A **Focused Area of Interest**, surrounding the impacted production wells, was created for the RI to assign priority levels to the facilities most likely to be contributing to contamination of the Wellfields.
- Facilities in the Focused Area of Interest were assigned as low, medium, or high priority based on degree of contamination and proximity to the Wellfields.

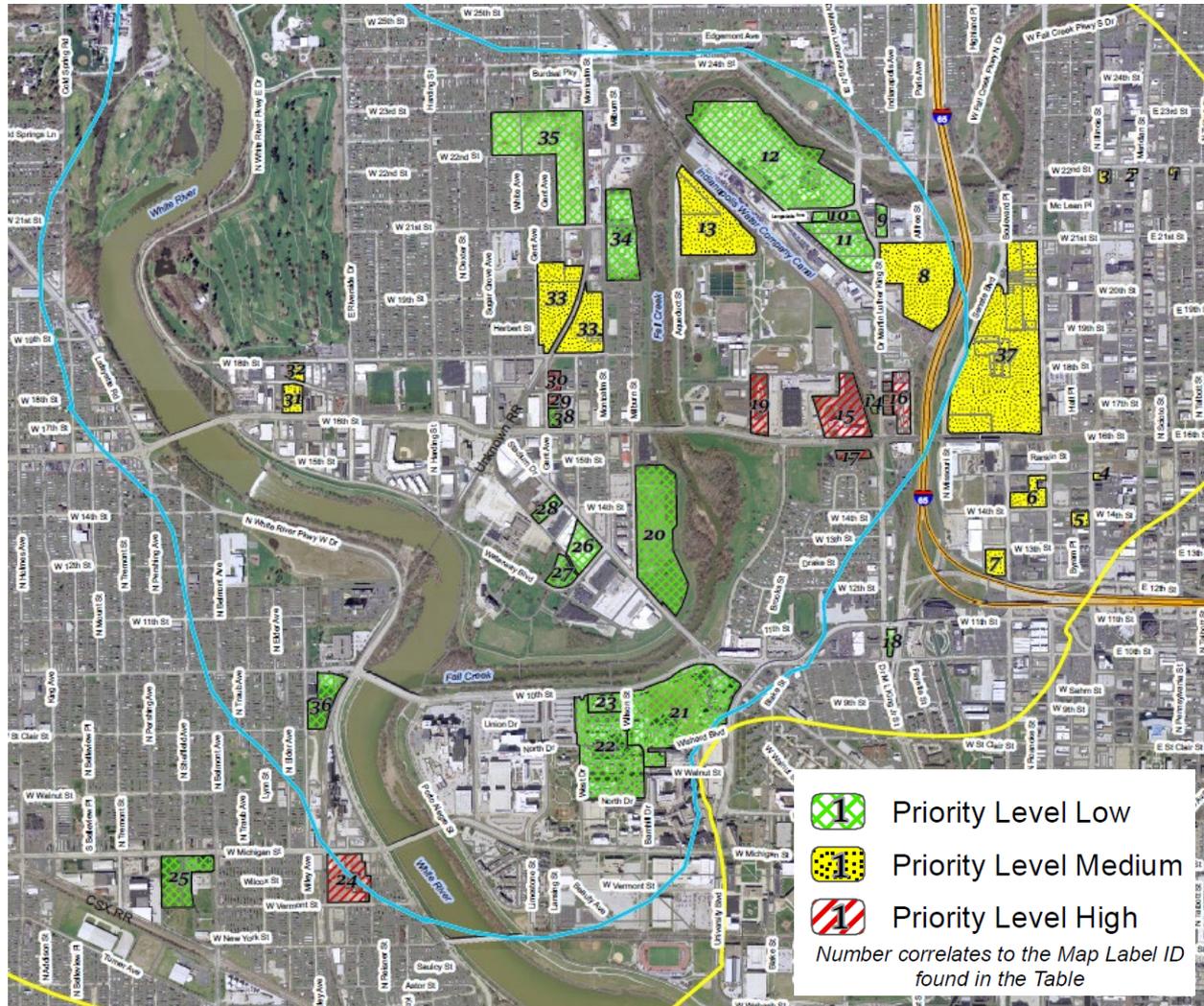


Focused Area of Interest (Cont.)

- Of the 7 sites identified as high priority, one has completed remediation and 6 are continuing to investigate the extent of their releases.
- Of the 13 sites identified as medium priority, 5 have implemented or completed remedial activities and 8 are continuing to investigate their releases.
- Additional details regarding the investigation/remediation status of the sites identified in the focused area of interest are provided on [Table 4](#) and in [Appendix D](#) of the RI.



Site 0153 Focused Area of Interest Sites





Nature and Extent of Contamination

- Untreated groundwater samples collected from production well **RS-29** contained chemicals of concern slightly above their MCL in April 2004 and January 2006, but concentrations have remained below the MCL since.
- An untreated groundwater sample collected from production well **WR-9** contained chemicals of concern slightly above their MCL in January 2008, but concentrations have remained below the MCL since.
- Sampling results of raw groundwater from all production wells from 2005 to 2020 are provided in [Table 1](#) of the RI.



Nature and Extent of Contamination (Cont.)

- Historic untreated groundwater samples collected from production well **WR-3** contained chemicals of concern above the MCL.
 - Well **WR-3** was shut down in June 2016, and an aeration system was installed. The well is now back in service and all raw water generated from WR-3, even before it is aerated, is below MCLs. (Pre- and post-aeration sampling results are provided in [Table 5](#) of the RI.)



Contaminant Fate and Transport

- Contaminant Fate and Transport refers to how a chemical moves from point A to point B, and how it might be altered along the way. To assess fate and transport of the chemicals of concern, the RI utilizes:
 - A **Conceptual Site Model (CSM)** to illustrate potential routes of contaminant migration from sources to human and/or ecological receptors;
 - **Wellhead Protection Area (WHPA)** modeling to predict how contaminants are likely to move through the environment and reach the production wells within a specified period-of-time;
 - **Contaminant persistence**, estimated by the chemical half-life;
 - **Contaminant migration**, estimated by chemical-specific soil mobility and water solubility values.



Remedial Investigation Conclusion

- Although not all investigation and remediation of individual sites are complete, IDEM believes that adequate information is available to rely on for decision making purposes as it pertains to the overall protection of the Wellfields and safety of drinking water supply.
 - Contaminant concentrations are already showing decreasing trends in the Wellfields and finished water continues to be safe.
 - IDEM will continue to pursue individual sites, as necessary and appropriate, to limit future potential contaminant contributions to Wellfields and address any other risks not associated with Site 0153 (e.g., soil, vapor, private wells).
 - In accordance with the MOA, Alternative Plan, Citizens will continue to monitor groundwater, remove production wells above an MCL from service, and install treatment (e.g. aeration or similar), as needed, prior to returning to service.



Human Health and Ecological Risk Assessment (HHERA)

- Water is and always has been safe
 - Always met all Federal Safe Drinking Water Act requirements



Human Health and Ecological Risk Assessment (HHERA)

- What is an HHERA
 - Assessment of the possibility of negative health effects from chemicals in the Wellfield
 - Now and in the future



Human Health and Ecological Risk Assessment (HHERA)

The purpose of the Human Health & Ecological Risk Assessment (HHERA) is to:

- Characterize, assess, and summarize risks to human health and the environment
- The HHERA focuses on the Wellfields and does not focus on individual sites
- Provide a sound basis for current and future risk management decisions.



Exposure Assessment

- An Exposure Assessment to determine:
 - potential exposure pathways,
 - potential future receptors
 - potential exposure routes.
- The HHERA focused on public water supply and calculated risk based on the following:
 - Residential (Adult and Child) receptors, and
 - Potential dermal and ingestion exposure routes.



Site 0153

TABLE 1
SELECTION OF EXPOSURE PATHWAYS

Scenario Timeframe	Environmental Media	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route(s)	Location: (Utility Property; Plume Extent; or Supply Extent)	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current / Future	Groundwater	Outdoor Air	Emissions from aeration treatment of impacted production wells	Commercial / Industrial Worker	Adult	Inhalation	Utility Property	Excluded	The target risk for the Site is groundwater ingestion and municipal wells are screened at depths greater than 50 ft. Impacts to outdoor air through groundwater volatilization for cVOCs observed at depth is highly unlikely. As part of the aeration treatment design, testing, and installation effort Citizens will conduct all necessary air emission calculation and state/federal permitting (if required) to ensure that potential emissions from remedial treatment are protective of human health and the environment.
			Volatilization from groundwater plume to soil gas to outdoor air						
		Indoor Air	Volatilization from groundwater plume to soil gas to indoor air	Commercial / Industrial Worker	Adult	Inhalation	Plume Extent	Excluded	In Attachment A of the 2015 Memorandum of Agreement, under Section 2 of the Alternative Plan, the IDEM has committed to the following plan aspects: -- Determine cVOC concentrations in any private wells within the 5-yr time of travel -- Identify any completed exposure pathways (including ingestion and vapor intrusion) -- Delineate groundwater impacts -- Address sources of contamination as necessary and practical.
				Resident	Adult; Child	Inhalation	Plume Extent	Excluded	
		Groundwater	Tap water (Private Well Supply)	Commercial / Industrial Worker	Adult	Dermal; Ingestion	Plume Extent	Excluded	The IDEM will be addressing the clean-up of source properties through various State-led programs, and each clean-up will require the assessment of risk element. Therefore, individual risks associated with the overall groundwater contamination plume will be assessed on a site-by-site basis by the State.
				Resident	Adult; Child	Dermal; Ingestion	Plume Extent	Excluded	
		Groundwater	Groundwater in a Trench	Construction Worker	Adult	Dermal; Ingestion	Utility Property	Excluded	Excluded
		Trench Air	Trench Air			Inhalation			
		Finished Water	Tap water (Public Supply)	Commercial / Industrial Worker	Adult	Dermal; Ingestion	Supply Extent	Qualitative	Under current and anticipated future conditions, production waters containing cVOC contamination in excess of the MCL will be treated prior to mixing and other processing. The resultant finished water will be verified to contain concentrations less than the federal MCL. As the federal MCL was established to be protective of human health, no additional evaluation of risk for consumers of finished water is necessary.
		Finished Water		Resident	Adult; Child	Dermal; Ingestion	Supply Extent	Qualitative	
		Production Water	Tap water (Public Supply)	Commercial / Industrial Worker	Adult	Dermal; Ingestion	Supply Extent	Quantitative	The quantitative approach would incorporate the current Citizens Water production scenario, i.e., wellfield mixing between the White River and Riverside wellfields and surface water mixing from the White River. Using post-mixing raw water concentrations in the intake assumption will provide a conservative estimate of potential risk.
		Production Water		Resident	Adult; Child	Dermal; Ingestion	Supply Extent	Quantitative	
Indoor Air	Volatilization from groundwater plume to soil gas to indoor air	Commercial / Industrial Worker	Adult	Inhalation	Utility Property	Qualitative	The inhalation exposure route for vapor intrusion associated with raw water from the Wellfields is incomplete due to the low-level of cVOCs observed at depths greater than 50 ft below grade surface.		

Abbreviations & Notes

cVOC = Chlorinated Volatile Organic Compounds

HHRA = Human Health Risk Assessment

IDEM = Indiana Department of Environmental Management

MCL = Maximum Contaminant Limit

Plume Extent = the extent of the contaminated groundwater plume

Supply Extent = the extent of the Citizens Water utility supplying water to homes and businesses

Utility Property = White River and Riverside Wellfield properties owned and operated by Citizens Water

= Pathway excluded from HHRA
 = Pathway addressed in HHRA



Toxicity Assessment

- The Toxicity Assessment (Dose-Response Assessment):
 - Description of the relationship between exposure of a chemical of concern and the possibility of an adverse health effect.
 - Both carcinogenic risk and non-carcinogenic risk were evaluated for Chemicals of Concern in the two Wellfields.
 - The values for each Chemical of Concern are presented on [Table 9](#).



Risk Characterization

- Risk Characterization:
 - Describes the nature and magnitude of the potential for adverse health effects based on the maximum exposure conditions.
 - These results are presented in [Table 10](#) of the report.



Human Health & Ecological Risk Assessment Conclusion

- Current and historic finished drinking water results are, and always have been, safe.
 - Always met all Federal Safe Drinking Water Act requirements
 - Citizens and IDEM will continue to monitor the results.
- Declining concentrations observed in the Wellfields supports that site investigations and remediation efforts conducted are showing a beneficial reduction to contributions to the raw water.



Feasibility Study (FS)

The purpose of the Feasibility Study (FS) is to:

- Identify, screen, and provide analysis of potential remedial alternatives for addressing low-level impacts in the Wellfields.
 - Specifically, the FS focuses on treating the groundwater at production wells that contain chemicals of concern over the screening levels in the raw water.



Development and Application of Remediation Goals

- The **Remedial Action Objective (RAO)**: continue to provide a safe source of drinking water from the production wells
 - Completed by selecting a Treatment Option that:
 - Ensure that all Chemicals of Concern are removed to concentrations that are protective of human health
 - Provide a long-term solution capable of continuing to provide a supply of clean drinking water for the public.



Identification and Screening of Remediation Alternatives

- There are 5 remediation options for treatment of Chemicals of Concern in the Wellfields, the options include:
 - No Action (Baseline)
 - **Aeration Treatment**
 - Carbon Adsorption Treatment
 - Ozonation Treatment
 - Advanced Oxidation
 - Anaerobic Biological Reactor



Table 7 Treatment Alternatives General Response Action Screening Analysis

Remedial Action Objective	General Response Action	Effectiveness	Implementability	Cost	Comment or Further Description	Result of Screening
Treatment of Groundwater to Below MCLs	No Action	○	●	●	Per 40 CFR 300.403(e)(6) of the revised NCP (March 8, 1990), this option must be evaluated as a baseline against other options.	Retain as Baseline
	Aeration	●	●	●	<u>Effectiveness:</u> Proven technology <u>Implementability:</u> Easy to implement <u>Cost:</u> Moderate capital and O&M cost	Retain
	Carbon Adsorption	●	●	●/○	<u>Effectiveness:</u> Proven technology <u>Implementability:</u> Easy to implement <u>Cost:</u> Moderate capital and high O&M cost	Retain
	Ozonation	●	●	●	<u>Effectiveness:</u> Proven technology <u>Implementability:</u> Moderately hard to implement <u>Cost:</u> Moderate capital and O&M cost	Retain
	Advanced Oxidation	●	●	○	<u>Effectiveness:</u> Proven technology <u>Implementability:</u> Moderately hard to implement <u>Cost:</u> High capital and O&M cost	Retain
	Anaerobic Biological Reactor	○	○	○	<u>Effectiveness:</u> Easy to upset <u>Implementability:</u> Large footprint <u>Cost:</u> High capital and O&M cost	Do Not Retain

Notes: CFR = Code of Federal Regulations
NCP= National Contingency Plan

Ratings:

- = Low Effectiveness, Difficult Implementability, High Cost
- = Moderate Effectiveness, Moderate Implementability, Moderate Cost
- = High Effectiveness, Easy Implementability, Low Cost



Table 8 Evaluation Criteria for Production Wells

Criteria Group	Number of Criteria in Group	Criteria Description
Threshold Criteria	2	Protection of human health and the environment
		Compliance with ARARs
Balancing Criteria	5	Long-term effectiveness and permanence
		Reduction in toxicity, mobility, or volume
		Short-term effectiveness
		Implementability
		Cost
Modifying Criteria	2	State acceptance
		Community acceptance



**Table 10
Alternatives Comparative Evaluation**

Criterion	Baseline	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	No Action	Aeration	Carbon Adsorption	Ozonation	Advanced Oxidation
Evaluation Criteria¹ with Assigned Scoring					
Protection of Human Health and Environment	Fail	Pass	Pass	Pass	Pass
Compliance with ARARs/TBCs	Fail	Pass	Pass	Pass	Pass
Long-Term Effectiveness	Low	High - 3 pts	Medium - 2 pts	Medium - 2 pts	High - 3 pts
Reduction in Toxicity, Mobility, or Volume	None	Medium - 2 pts	Medium - 2 pts	High - 3 pts	High - 3 pts
Short-Term Effectiveness	Low	Medium - 2 pts	High - 3 pts	Medium - 2 pts	Low - 1 pt
Implementability	High	High - 3 pts	Medium - 2 pts	Low - 1 pts	Low - 1 pt
Community Acceptance	Low	Medium - 2 pts			
Score Total	NA	12	11	10	10
Estimated Costs²					
Design	\$0	\$50,000	\$50,000	\$75,000	\$85,000
Capital Costs	\$0	\$880,000	\$815,000	\$791,000	\$1,012,000
O&M (30 Years)	\$0	\$964,000	\$3,198,000	1,320,000	\$6,300,000
Total	\$0	\$1,894,000	\$4,063,000	\$2,186,000	\$7,397,000
Cost Rank (Low to High)	1st	2nd	4th	3rd	5th

Notes: ¹ = Refer to Section 4.3 of the Feasibility Study for details of the evaluation.

² = Refer to Table E-1 in Appendix E for costing details.

ARARs = Applicable or Relevant and Appropriate Requirements; TBCs= to be considered.

NA - Not scored since it failed one or more threshold criterion.



Feasibility Study Conclusion

- Based on the results of the Feasibility Study and utilizing all current information, **aeration is the recommended remedial alternative** to treat potential future chemicals of concern impacts in the Wellfields.
- Currently all raw water in the production wells is below screening levels.



Conclusions

- Finished water supplied to customers has always been safe.
- Contaminant concentrations in the production wells are already showing decreasing trends.
- Citizens will continue to monitor for chemicals of concern on a regular basis and will remove or install treatment systems to any wells that exceed MCLs in the future.
- IDEM will continue to oversee individual sites to ensure that risks to Wellfields and other site-specific risks are mitigated.
- IDEM will evaluate all potential exposure pathways (soil, vapor, and groundwater) at each-and-every site to ensure that no unacceptable risks are present.



Next Steps

- Public comment period
 - The RI, HHERA, and FS will be posted for public comment from November 9, 2020 through December 11, 2020.
- Record of Decision (ROD) and Remedial Action Plan (RAP)
 - Following consideration of RI, HHERA, and FS public comments, a ROD and RAP will be issued and posted for a 30-day public comment period.
- Certificate of Completion and Decision Document
- Spring Federal Register to remove Site 0153 from NPL



Questions?



IDEM Office of Land Quality

(800) 451-6027 (toll free within Indiana)

Email: Site0153@idem.IN.gov

Website: www.idem.IN.gov/Site0153

Please send your comments via [email](#) or mail written comments to:

IDEM Office of Land Quality

Attn: Ryan Groves

100 N. Senate Ave. IGCN 1101

Indianapolis, IN 46204