

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

**RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control**

Facility Name: AdvanSix Resins and Chemicals
Facility Address: Margaret & Bermuda Streets Philadelphia, PA 19137
Facility EPA ID #: PAD002312791

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?
- If yes - check here and continue with #2 below.
- If no - re-evaluate existing data, or
- if data are not available, skip to #8 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

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2. Is **groundwater** known or reasonably suspected to be “**contaminated**”¹ above appropriately protective “levels” (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

- If yes - continue after identifying key contaminants, citing appropriate “levels,” and referencing supporting documentation.
- If no - skip to #8 and enter “YE” status code, after citing appropriate “levels,” and referencing supporting documentation to demonstrate that groundwater is not “contaminated.”
- If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

As documented in the Phase I and Phase II RCRA Facility (RFI) Reports, both light non-aqueous phase liquid (LNAPL), dense non-aqueous phase liquid (DNAPL) and dissolved phase chemicals were identified in groundwater. Analytical samples of groundwater collected from the site contained Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs) and metals.

The following chemical compounds were detected during the Phase I and Phase II WI investigation:

VOCs	SVOCs	Metals
1,1,1-Trichloroethane	Acenaphthene	Aluminum
Acetone	Acenaphthylene	Arsenic
Benzene	Anthracene	Barium
Benzoic Acid	Carbazole	Cadmium
2-Butanone	Dibenzofuran	Calcium
Chlorobenzene	2,3-Dimethylphenol	Chromium
Chloroethane	Bis-(2-Ethylhexyl)	Iron
Bis(2-chloroethyl)ether	Phthalate	Lead
Chloroform	Fluoranthene	Magnesium
Cumene	Fluorene	Manganese
Total 1,2-DCE	2-Methylphenol	Mercury
Ethylbenzene	4-Methylphenol	Nickel
Hexachloroethane	Naphthalene	Potassium
2-Hexanone	Phenanthrene	Selenium
Methylene Chloride	Pyrene	Sodium
2-Methylnaphthalene		Vanadium
4-Methyl-2-Pentanone		Zinc
Methyl Styrene		
Phenol		
Pyridine		
Styrene		
Toluene		
Xylene		

References:

"Phase I RCRA facility Investigation Report" submitted by Halliburton NUS prepared for Allied-Signal, Inc to EPA in May 1992.

Footnotes:

¹“Contamination” and “contaminated” describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”² as defined by the monitoring locations designated at the time of this determination)?

- If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the “existing area of groundwater contamination”².
- If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”²) – skip to #8 and enter “NO” status code, after providing an explanation.
- If unknown - skip to #8 and enter “IN” status code.

Rationale:

Northwest Benzene Area

At the northwest section of the Facility, benzene and other contaminants in groundwater have been migrating close to the property line. As discussed in the document entitled, Phase III RCRA Facility Investigation Report, the northwest area of the Facility has shown historical fluctuations in concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene in monitoring wells MW-110 and MW-118. A soil gas investigation was conducted in the northwest portion of the Facility to evaluate the BTEX source area and offsite along Lefevre Street. Based on the results of the soil gas survey, three monitoring wells (MW-129, MW-130, and MW-131) were installed to delineate and monitor contaminants of concern (COCs) in groundwater. Monitoring well MW-130 is located at the northwest corner of the Facility property while monitoring wells MW-129 and MW-131 are located off-site beyond the northwestern property boundary.

Benzene was detected above the USEPA MCL of 5 micrograms per liter (µg/L) during the February 2016 sample event in MW-129 with a concentration of 56 µg/L. Cumene was detected above the USEPA RSL of 45 µg/L during the February 2016 sample event in MW-129 with a concentration of 110 µg/L. Naphthalene was detected above the USEPA RSL of 0.17 µg/L during the February and September 2016 sample events in MW-129 and MW-131 with concentrations ranging from 0.4 µg/L to 8 µg/L. These initial detections for COCs were not present or were estimated values in the following sampling events conducted in September and December 2016. Analytical results suggest that the benzene plume near the northwest property boundary and does not appear to be migrating off-site and is delineated to the north, northwest and west of monitoring well MW-130.

Northeast LNAPL Area

In 2013, LNAPL was observed in temporary monitoring well TWP-09 near the northeastern property boundary. One temporary well point (TWP-12) was installed northeast of the property and one monitoring well (MW-125) was installed further northeast in order to delineate the existing LNAPL plume. No COCs were detected as a result of December 2016 and February 2017 sampling events. The existing LNAPL plume does not appear to be migrating off-site towards the northeast.

Eastern Boundary Along Bridge Street

A Frankford Arsenal technical memorandum (EA, 2013) suggested that there is evidence of dissolved-phase plume migration between MW-105 and MW-106 onto the Frankford Arsenal property. While the Arsenal report suggested that site-related compounds (acetone, cumene, phenol) were migrating from the Facility across the eastern boundary, historic data from MW-105 and MW-106 show much lower concentrations of these compounds at the Facility than at the Arsenal. However, review of boring logs indicated that MW-104 and MW-105 are screened in shallower silt and clay deposits that may function as a semi-confining layer, and groundwater samples were not being collected in the preferential pathway of the sand and gravel aquifer.

To further investigate the eastern Facility boundary along Bridge Street, MW-126 was installed between MW-105 and MW-106. To address the possibility that MW-104 and MW-105 were not screened in the sand and gravel aquifer, two additional wells were installed. MW-127 was installed adjacent to MW-105, and MW-128 was installed between MW-105

and MW-104. The following outlines the groundwater sample results conducted over four sampling events (February 2016, June 2016, September 2016, December 2016 and June 2017):

Acetone was detected above the USEPA Regional Screening Level (RSL) of 1,400ug/L during the February 2016 sample event in MW-126 with a concentration of 2,600 ug/L. Acetone concentrations in MW-126 were below the RSL in each of the four subsequent sample events.

Benzene was detected above the USEPA MCL of 5 µg/L during multiple sample events in MW-106, MW-126, MW-127, and MW-128 with concentrations ranging from 6 µg/L to 140 µg/L

Naphthalene was detected above the USEPA RSL of 0.17 µg/L during multiple sample events in MW-104, MW-105, MW-106, MW-126, MW-127, and MW-128 with concentrations ranging from 0.3 J µg/L to 340 µg/L

Cumene was detected above the USEPA RSL of 45 µg/L through all four sample events in MW-106, MW-126, MW-127, and MW-128 with concentrations ranging from 330 µg/L to 200,000 µg/L

Phenol concentrations were less than or equal to 10 µg/L for all samples and sampling dates except MW-106 in June 2017, with a phenol concentration of 2,400 µg/L. This contrasts to the phenol concentrations on the Frankford Arsenal, where phenol reached 200,000 µg/L in the well closest to the Facility, and phenol concentrations at other locations at the arsenal have exceeded 1,000 µg/L.

*MW-105 was not sampled in June 2017

Based on the groundwater sample results from the four sample events and the Frankford Arsenal data, COCs with concentrations exceeding the MCLs or tapwater RSLs may have migrated from the eastern portion of the Facility to the Frankford Arsenal property through a preferential pathway in the former Milnor Street right-of-way. Based on the contaminant profiles on the Frankford Arsenal, migration from the Facility is unlikely to be the only source of COC contamination at the arsenal. The Frankford Arsenal data show delineation of COCs to the east on the Frankford Arsenal property.

Deep Overburden Groundwater

In 2011, a DNAPL investigation was initiated to delineate product material observed at monitoring well MW-302. Twenty nine soil borings were advanced at depths ranging from approximately 38 to 54 feet below ground surface (bgs) to screen and characterize the DNAPL plume across the southeast boundary of the Facility. A DNAPL layer was observed from approximately 39 feet to 42 feet bgs oriented in an east to west direction south of the RCRA waste storage pad area and along the southern border of the Facility. A slightly shallower DNAPL layer was observed from approximately 35 feet to 37 feet bgs oriented in an east to west direction along the RCRA pad area.

Additionally, four deep unconsolidated groundwater/DNAPL monitoring wells (MW-310D through MW-313D), were installed to monitor the DNAPL thickness and characterize the dissolved-phase contaminants. The well screened intervals were placed in the deep overburden at depths of 37 to 42 feet bgs. The wells were gauged in using an oil/water interface probe to collect DNAPL measurements. DNAPL was not detected at wells MW-310D through MW-313D during any of three 2012 gauging events. The lack of DNAPL in the wells indicate that DNAPL materials do not appear to be migrating.

However, the additional wells indicated dissolved-phase impacts above USEPA MCLs and/or RSLs. To delineate dissolved-phase exceedances to the south, MW-314 was installed offsite to the south of monitoring well MW-302. Monitoring well MW-314 was sampled over four events in February, June, September, and December 2016. Benzene had one low-level detection above USEPA MCL of 5 µg/L in February 2016 event with a concentration of 7 µg/L and was not detected during the subsequent sampling events. Naphthalene had two low-level detections above the USEPA RSL of 0.17 µg/L in the September and December 2016 events with concentrations of 5 J µg/L and 0.4 J µg/L, respectively. These concentrations are qualified as “estimated” (J) due to the result value being below the reporting limit but higher than the method detection limit.

Based on additional review of the subsurface lithology and the presence of clay lenses in the shallow zone, USEPA requested that a shallow well be installed adjacent to MW-314. In December 2017, shallow monitoring well MW-132 was installed

adjacent to MW-314. MW-132 was sampled in December 2017; results indicate that concentrations of all COCs were below detection limits characterize the dissolved-phase contaminants.

Reference(s):

Brown & Root Environmental, February 1994, *Phase II RCRA Facility Investigation Report. Prepared for AlliedSignal Fibers Division, Margaret and Bermuda Streets, Philadelphia, Pennsylvania.*

EA Engineering, Science, and Technology, Inc. February 2013. *Technical Memorandum Regarding Potentially Responsible Party File Review and Findings for the Former Frankford Arsenal Area II.*

Amec Environment and Infrastructure, Inc. April 2014. *RCRA Remedial Investigation and Interim Remedial Measures Summary*

Amec Environment and Infrastructure, Inc. April 2018. *Phase II RCRA Facility Investigation Report, Prepared for AdvanSix Resins and Chemicals LLC*

² “existing area of contaminated groundwater” is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of “contamination” that can and will be sampled/tested in the future to physically verify that all “contaminated” groundwater remains within this area, and that the further migration of “contaminated” groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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4. Does “contaminated” groundwater **discharge** into **surface water** bodies?
- If yes - continue after identifying potentially affected surface water bodies.
 - If no - skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies.
 - If unknown - skip to #8 and enter “IN” status code.

Rationale:

A focused study was conducted to assess the influence of tidal fluctuations in Frankford Creek as it relates to the shallow water table aquifer in wells adjacent to the tributary. The results of this investigation indicated the water elevation fluctuates by 1.29 feet and 3.59 feet within well MW-109 and in the Frankford Creek surface water respectively.

Based on results of the tidal studies of the Frankford Inlet and its interaction with site groundwater, mean hydraulic gradients towards the inlet have been calculated. Tidal studies indicate that there is little, if any, discharge of shallow groundwater to surface water as evidenced by lack of tidal effects in MW-107 and MW-104. Tidal studies confirmed that deep groundwater may contribute to surface water near Frankford Inlet as evidenced by tidal response in MW-301 and MW-306.

Reference:

Amec Environment and Infrastructure, Inc. April 2014. *RCRA Remedial Investigation and Interim Remedial Measures Summary*

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5. Is the **discharge** of “contaminated” groundwater into surface water likely to be “**insignificant**” (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times their appropriate groundwater “level,” and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration³ of key contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

If unknown - enter “IN” status code in #8.

Rationale:

The maximum deep groundwater concentrations near surface water do not exceed the PA Used Aquifer, residential MSCs by more than ten times. Therefore, concentrations of any dissolved constituents discharging to surface water will also be less than ten times the applicable groundwater criteria.

Modeled shallow groundwater contributions at the Frankford Inlet indicate that all constituents are below:

1. Delaware River Basin Commission (DRBC) stream quality objectives applied for human health in zones 2 and 3, for carcinogens, and for systemic toxicants for the Delaware River Estuary (Administrative Manual Part III, Water Quality Regulations, updated October 23, 1996, Tables 3, 5, 6 in Article 3).
2. Pennsylvania Code, Chapter 16 Water Quality Toxics Management Strategy - Statement of Policy, Table 1, Water Quality Criteria for Toxic Substances, Lower Value of Either “fish and Aquatic Life Criteria” or “Human Health Criteria” (November 18, 2000).

Modeling was performed using the highest dissolved groundwater concentrations observed near surface water (MW-107).

Reference:

MWH Americas, Inc., January 3, 2002, *Groundwater and Surface Water Interaction Data and Graphs, Documentation of Environmental Indicator Determination, Sunoco Frankford Plant Philadelphia, PA September 2004.*

³ As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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6. Can the **discharge** of “contaminated” groundwater into surface water be shown to be “**currently acceptable**” (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?
- If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site’s surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment⁵, appropriate to the potential for impact that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment “levels,” as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.
 - If no - (the discharge of “contaminated” groundwater can not be shown to be “**currently acceptable**”) - skip to #8 and enter “NO” status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.
 - If unknown - skip to 8 and enter “IN” status code.

Rationale and Reference(s):

⁴Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

⁵The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the “existing area of contaminated groundwater?”
- If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the “existing area of groundwater contamination.”
- If no - enter “NO” status code in #8.
- If unknown - enter “IN” status code in #8.

Rationale and Reference(s):

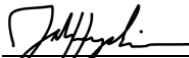
A long-term monitoring workplan is currently being established. In general, it is planned to monitor as follows:


1. Annual monitoring of seventeen existing boundary wells and three select interior wells.
2. Additional semi-annual monitoring of wells MW-110, MW-112, MW-118, MW-121 and MW-122.

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8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

- YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Crompton Corporation Petrolia facility, EPA ID # PAD004388500, located at Route 269, Petrolia, Pennsylvania 16050. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.
- NO - Unacceptable migration of contaminated groundwater is observed or expected.
- IN - More information is needed to make a determination.

Completed by  Date 09/29/2020
John Hopkins
Remedial Project Manager

Supervisor (signature)  Date 9/29/2020
(print) Paul
(title)
(EPA Region or State)

Locations where References may be found:

US EPA Region III
Land, Chemicals, and Redevelopment Division
1650 Arch Street
Philadelphia, PA 19103

Contact telephone and e-mail numbers

John Hopkins
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Additional References:

- A. Phase I RCRA Facility Investigation Report
- B. Phase II RCRA Facility Investigation Report
- C. June 1996 Groundwater Sampling Results Letter Report
- D. August 2000 Groundwater Sampling Results Letter Report
- E. January 2002 Groundwater Sampling Results Letter Report
- F. January - June 2004 Semi-Annual Report: LNAPL Recovery Systems Oversight Activities
- G. Final Report: Conceptual Design Study for Free-Phase Product Recover