

US EPA ARCHIVE DOCUMENT

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

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

Facility Name: AK Steel – Mansfield Works
Facility Address: Mansfield, OH
Facility EPA ID #: OHD 004 157 418

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
☐ If data are not available skip to #6 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 **Acontaminated@**¹ above appropriately protective Alevels@ (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 Alevels,@ and referencing supporting documentation.
- ☐ If no - skip to #8 and enter AYE@ status code, after citing appropriate Alevels,@ and referencing supporting documentation to demonstrate that groundwater is not Acontaminated.@
- ☐ If unknown - skip to #8 and enter AIN@ status code.

Rationale and Reference(s):

General Background

The facility was divided into several different areas for the investigative work ordered under the Resource and Recovery Act (RCRA) 3013 Administrative Order. Those areas are the Slag Processing Area (SPA), Old Slag Storage Area (OSSA), Water Recirculation Reservoirs (WWR)/Skimmed Oil Tanks (SOT), Melt Shop Area, Former Spent Acid Holding Tank Area (SAHTA), Former Electric Arc Furnace Dust Landfill (EAF LF), Spent Pickle Liquor Acid Tank & Recovery Area (SPLAR), and the Old Coke Pile Area. The results of the groundwater investigation are below. During the initial site investigation, six quarters of groundwater monitoring were performed during 2000 and 2002. There were several constituents above either the Federal Drinking Water Standards (MCLs) or if a chemical did not have an established MCL, the EPA Region 9 Preliminary Remediation Goals (R9 PRGs) for tap water. These were used as a preliminary conservative screening level in this report. Tables 1-6b on the following page list the maximum concentration of contaminants exceeding the screening levels found during the 2007 sampling events in groundwater.

Hydrogeology

There are two different aquifers in the area: the Till Unit and the Mohican Buried Valley. The Till Unit has layers of discontinuous sand and gravel with a thickness of 20-30 ft. The groundwater in this area provides the base flow for Rocky Fork Creek. The next water bearing unit is the MBV Aquifer and forms the primary regional aquifer for the area. It consists of coarse sand and gravel outwash beneath the Till Unit. The MBV aquifer is confined by the overlying till and has a strong upward hydraulic gradient. The flow direction is generally to the south and east along the Rocky Fork buried valley (AK Steel-Mansfield Works Phase I/II Report, September 14, 2007).

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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Slag Processing Area (SPA)

Table 1-Data from the Phase I/II Report, September, 2007 for the Till Unit in the SPA

*Contaminant	MCL/PRG Tap (mg/L)	Max. Concentration (mg/L)	Well
Arsenic	0.01	0.056	SPA-MW-6
Chromium	0.1	0.2	SPA-MW-6
Lead	0.015	0.086	SPA-MW-6
Vanadium	0.036	0.15	SPA-MW-6

*Using unfiltered metals data

Water Recirculation Reservoirs/Skimmed Oil Tanks (SOT)

Table 2- Data from the Phase I/II Report, September, 2007 for the Till Unit in the WRR/SOT

*Contaminant	MCL/PRG Tap (mg/L)	Max. Concentration (mg/L)	Well
Arsenic	0.01	0.079	SOT-MW-4
Cadmium	0.005	0.0082	SOT-MW-2
Chromium	0.1	0.13	SOT-MW-4
Lead	0.015	1.2	SOT-MW-2
Thallium	0.002	0.0045	SOT-MW-4
Vanadium	0.036	0.11	SOT-MW-4

* Using unfiltered metals data

Spent Acid Holding Tank Area (SAHTA)

Table 3-Data from Phase I/II Report, September, 2007 for the Till Unit in the SAHTA

*Contaminant	MCL/PRG Tap (mg/L)	Max. Concentration (mg/L)	Well
Arsenic	0.01	0.035	SAHTA-MW-6

* Using unfiltered metals data

Spent Pickle Liquor Acid Tank and Recovery Area (SPLAR)

Table 4- Data from Phase I/II Report, September, 2007 for the Till Unit in the SPLAR

*Contaminant	MCL/PRG Tap (mg/L)	Max. Concentration (mg/L)	Well
Chromium	0.1	0.21	SPLAR-MW3
Lead	0.015	0.13	SPLAR-MW1

* Using unfiltered metals data

Old Slag Storage Area (OSSA)

Table 5-Data from Phase I/II Report, September, 2007 for the Till Unit in the OSSA

*Contaminant	MCL/PRG Tap (mg/L)	Max. Concentration (mg/L)	Well
Arsenic	0.01	0.13	OSSA-MW-2
Lead	0.015	0.11	OSSA-MW-5

* Using unfiltered metals data

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Electric Arc Furnace (EAF) Dust Landfill

Table 6a -Data from the Phase I/II Report, September 2007 for the Till Unit in the EAF Dust LF

*Contaminant	MCL/PRG Tap Water (mg/L)	Max. Concentration (mg/L)	Well
Arsenic	0.01	0.063	LF-5A
Cadmium	0.005	0.0057	LF-5A
Chromium	0.1	0.13	LF-5A
Lead	0.015	0.30	LF-5A
Thallium	0.002	0.0048	LF-2A
Vanadium	0.036	0.11	LF-2A
Tetrachloroethene	0.005	0.0088	LF-6A
Trichloroethene	0.005	0.008	LF-6A
1,2,4,5-Tetrachlorobenzene	0.01095	1.1	LF-6A
1,2,4-Trichlorobenzene	0.07	8.8	LF-6A
1,3-Dichlorobenzene	0.1825	1.6	LF-6A
1,4-Dichlorobenzene	5.0x10 ⁻⁴	9.8	LF-6A
Chrysene	0.00921	0.64	LF-6A
Napthalene	0.0062	0.19	LF-6A
Pentachlorobenzene	0.0292	1.2	LF-6A
Aroclor 1242	5.0x10 ⁻⁴	0.014	LF-6A

* Using unfiltered metals data

Table 6b-Data from the Phase I/II Report, September 2007 for the MBV Aquifer in the EAF Dust LF

*Contaminant	MCL/PRG Tap Water (mg/L)	Max. Concentration (mg/L)	Well
Arsenic	0.01	0.049	LF-2B
Lead	0.015	0.11	LF-5B

*Using unfiltered metals data

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3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within Aexisting area of contaminated groundwater² 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 Aexisting area of groundwater contamination²).
- ☐ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the existing area of groundwater contamination²) - skip to #8 and enter a 'No' status code, after providing an explanation.
- ☐ If unknown - skip to #8 and enter IN status code.

Rationale and Reference(s): *Final Report for Site Investigative Work for the AK Steel Mansfield Plant, August 8, 2002.*

Phase I/II Report for the AK Steel-Mansfield Site, September 14, 2007

The contaminants that were found to be above the screening level in the Till Unit were arsenic, cadmium, chromium, lead, thallium, vanadium, VOCs, SVOCs, and PCBs. In the MBV aquifer, lead and arsenic were the only contaminants found above their respective MCLs. For discussion purposes and to be conservative, only unfiltered groundwater samples, without consideration for background, were used in this report.

Organic Contaminants

Monitoring well LF-6A was the only monitoring well contained concentrations of organic contaminants. Since no other wells had organic contaminants including those downgradient of LF-6A, above MCLs or Region 9 PRG for tap water, it appears the contamination is stabilized. Even though, for the purposes of this EI determination, sediment was not considered, it should be noted that PCB concentrations in the sediment/soil in the ravine area were between 180mg/kg and 240 mg/kg.

Inorganic Contaminants

Arsenic: Arsenic was found in most wells above the MCL of 0.01 mg/L. The maximum concentration of 0.13 mg/L was found in well OSSA-MW-2. Data from 2002 shows generally the same concentrations in the monitoring wells. Therefore, since the concentrations of arsenic have not changed significantly in five years, arsenic contamination has stabilized.

Cadmium: Cadmium was found in five wells with a maximum concentration of 0.0082 mg/L compared to the MCL of 0.003 mg/L. In general, the concentration of cadmium found in 2002 was about 10 to 100 times the MCL. Therefore, it appears that the cadmium concentration in the groundwater has decreased in the last five years and the concentration is stabilizing.

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 Acontamination@ 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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Chromium: Chromium was found in five wells with a maximum concentration of 0.2 mg/L compared to the MCL of 0.10 mg/L. In general, the groundwater monitoring results from 2002 were the same as those results from 2007. Therefore, the concentration of chromium in the groundwater has stabilized.

Lead: Lead was found in seven monitoring wells. The maximum concentration was 1.2 mg/L compared to the MCL of 0.015 mg/L. When the 2002 data is compared to the 2007 data, concentrations of lead are generally the same. Therefore, the concentration of lead in the groundwater has stabilized.

Thallium: Thallium was found in one well above the MCL of 0.002 mg/L at a concentration of 0.0048 mg/L. Since this contaminant was only found in one well, thallium is stabilized in the groundwater at the site.

Vanadium: Vanadium was only found in two wells above the MCL of 0.036 mg/L at a concentration of 0.115 mg/L and 0.11 mg/L. Since no downgradient wells had any vanadium results above the MCL, vanadium concentration in groundwater has stabilized.

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4. Does Acontaminated@ groundwater **discharge** into **surface water** bodies?

- ☒ If yes - continue after identifying potentially affected surface water bodies.
- ☐ If no - skip to #7 (and enter a AYE@ status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater Acontamination@ does not enter surface water bodies.
- ☐ If unknown - skip to #8 and enter AIN@ status code.

Rationale and Reference(s):

Rocky Fork Creek

The groundwater on site flows towards Rocky Fork Creek, which is a gaining stream, with its base flow coming from the groundwater in the Till Unit. The creek divides the facility in half with the majority of the processes occurring on the southwest side of the creek. The part of the creek that borders AK Steel-Mansfield Works is designated as aquatic use warm water habitat. The creek is not designated as a drinking water source, but is designated as agricultural and industrial water supply (Ohio Revised Code 3745.30).

Ravine Area by the EAF Landfill and the Slag Processing Area

The wells in the landfill area are located in a topographically elevated area that was formed by the buildup of slag over time. Slag is a porous material that has essentially formed an artificial groundwater system that is perched above the original land surface. The slag pile is dissected by a ravine that intermittently contains surface water throughout the year (Phase I/II Report for the AK Steel-Mansfield Site, September 14, 2007).

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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 Alevel,@ 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 judgment/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 and Reference(s):

Ohio EPA Ohio River Basin Aquatic Life Criteria 'Outside the Mixing Zone' average levels or Federal Water Quality Standards were used for the surface water quality standards if an Ohio standard was not available. Table 9 shows the contaminants that were found to be ten times above the water quality standard.

Of the two wells shown below that had concentrations of a contaminant ten times above the water quality standard, only SOT-MW2 was considered a groundwater/surface water interaction (GSI) well. Well LF-5A is located approximately 1,000 feet from the Rocky Fork Creek and no downgradient wells closer to Rocky Fork Creek had lead above the water quality standard. Well SOT-MW2 is approximately 250 feet away from Rocky Fork Creek and is screened in the water bearing Till Unit that discharges to Rocky Fork Creek (Phase I/II Report for AK Steel-Mansfield, September 14, 2007).

Table 9-Exceedances of Ten Times the Water Quality Criteria in the Till Groundwater Unit

Contaminant	Water Quality Standard (mg/L)	Ten Times WQ Std. (mg/L)	Concentration (mg/L)	Well
*Lead	0.022	0.22	0.3	LF-5A
			1.2	SOT-MW2

*Unfiltered results were used for lead

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 **Acurrently acceptable**⁴ (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-assessment,⁵ 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 Alevels,@ 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 cannot 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):

To determine whether the maximum concentration of lead from the previous question was impacting the Rocky Fork Creek, it was necessary to use the equations below. The first equation finds the groundwater flow rate entering the creek. This is needed in order to determine what the concentration of lead from the groundwater will be once it meets the surface water and becomes diluted. This concentration is found from Equation #2.

⁴ Note, 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.

⁵ The 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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Equation #1

$$Q_{GW} = KiA$$

Q_{GW} = Groundwater flow rate

K = Hydraulic conductivity (14.2 ft./day)

i = Gradient (0.0062 ft. /ft.)

A = Area of the plume venting to surface water (7000 ft²)

$$Q_{GW} = 616.28 \text{ ft}^3/\text{day}$$

Equation #2

$$C_{SW} = \frac{C_{GW}Q_{GW}}{Q_{GW} + 0.1Q_{SW}}$$

C_{GW} = Current contaminant concentration in the groundwater (Maximum concentration of lead = 1.2 mg/L)

Q_{GW} = Groundwater flow rate (from Equation #1, 606.28 ft³/day)

Q_{SW} = Surface water flow rate in the Rocky Fork Creek, approximately 5.2 ft³/s (This value was determined from adding the known flow rate from the outfalls on site to the known flow rate from a staff gauge downstream.)

C_{SW} = Concentration of contaminant in the surface water from groundwater (value we are trying to find)

0.1 is the dilution factor of 10 from the groundwater into the surface water

$$C_{SW} = 0.016 \text{ mg/L}$$

The concentration of lead that is likely to contribute to the Rocky Fork Creek is 0.016 mg/L, which is below the surface water quality standard of 0.022 mg/L. Therefore, the maximum concentration of lead in groundwater is not contributing significantly to Rocky Fork Creek.

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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 Aexisting 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 Aexisting area of groundwater contamination.@

☐ If no - enter ANO@ status code in #8.

☐ If unknown - enter AIN@ status code in #8.

Rationale and Reference(s):

Based on the results of the investigation, there are sources of PCBs, VOCs, and SVOCs that will require further investigation and/or remediation beyond the scope of the current 3013 Order.

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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 AK Steel – Mansfield Works facility, EPA ID # OHD 004 157 418 located at Mansfield, OH. 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 groundwater" This determination will be re-evaluated when the Agency of significant changes at the facility.

contaminated
becomes aware

☐ NO - Unacceptable migration of contaminated groundwater is observed or expected.

☐ IN - More information is needed to make a determination.

Completed by (signature) _____ Date _____
 (print) Jill Groboski
 (title) Environmental Engineer

Supervisor (signature) _____ Date _____
 (print) George Hamper
 (title) Corrective Action Section Chief
 (EPA Region or State) 5

Locations where References may be found:

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