

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: Pine Bluff Arsenal
Facility Address: 10020 Kabrich Circle, Pine Bluff, Arkansas
Facility EPA ID #: AR0213820707

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?

 X If yes - check here and continue with #2 below.
 If no - re-evaluate existing data, or
 if data is 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, GPRRA). 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?

- X 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):

Pine Bluff Arsenal is approximately 15,000 acres, of which approximately 335 acres are suspected contaminated soil. Groundwater flows in a generally easterly direction toward the Arkansas River which forms the Eastern boundary of the facility. There are no groundwater wells on or down gradient of the facility in the Quaternary Alluvial aquifer. This aquifer is not used because of high chloride and sulfate levels, low yield, and the availability of high yield, high quality groundwater from the Sparta Sand aquifer. Several surface water bodies are potentially contaminated by contaminated groundwater. All of these water bodies flow into the Arkansas River with a flow of 708,000 liters per second.

A total of 79 monitoring wells are in the proposed groundwater monitoring plan. Most of these wells have been sampled on a regular schedule for several years. The most current data is included in the CMS directly or by reference.

Groundwater data are compared to the federal Maximum Contaminant Level (MCL), a tap water level, or an ecological screening level (CMS, 2004, Vol,5). Table 1 shows the constituents that exceed the MCL or tap water regulatory level in the current groundwater monitoring system. While the aquifer is not used for drinking water purposes on the Arsenal, this approach was used to be conservative. Prior to discharge into the Arkansas River, the potential exists for ecological exposures. The Arkansas Regulation 2, Surface Water, and ecological screening toxicity numbers are used.

References:

CDM 1996, Corrective Measures Study Groups I & II and Newly Identified Solid Waste Management Units, 2 Volumes, December 1996.

Washington Group 2002, Interim Measures Data Collection Summary Report - Final, Field Investigation of 17 SWMUs at Pine Bluff Arsenal, June 2002.

Washington Group 2004, Corrective Measures Study Groups I & II Solid Waste Management Units, 5 Volumes, May 2004.

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tnotes:

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)?

- X 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 and Reference(s):

Groundwater has and will continue to be monitored at SWMUs where waste was left in place. Volatile organic, semi-volatile organic, metals and pesticide contamination exists in the groundwater. Most groundwater flows to the east toward the Arkansas River. Locally to each SWMU, the direction can vary. Monitoring results for the past 10 years indicate that the contamination has moved little. The velocity of groundwater ranges from 0.3 feet/ year to 83 feet/ year (CMS 2004, Vol. 5). A monitoring plan is proposed for the facility that includes VOCs, SVOCs, Metals, and Pesticides. The surface waters, sediments, and limited biota will also be monitored to assure that ecological toxicity values are not exceeded.

References:

CDM 1996, Corrective Measures Study Groups I & II and Newly Identified Solid Waste Management Units, 2 Volumes, December 1996.

Washington Group 2002, Interim Measures Data Collection Summary Report - Final, Field Investigation of 17 SWMUs at Pine Bluff Arsenal, June 2002.

Washington Group 2004, Corrective Measures Study Groups I & II Solid Waste Management Units, 5 Volumes, May 2004.

1998 - 2003 Annual Groundwater Assessment reports, Pine Bluff Arsenal.

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“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.

4. Does “contaminated” groundwater **discharge** into **surface water** bodies?

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 X 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 and Reference(s):

Groundwater discharges to Phillips Creek, Tulley Creek, Production Creek, Arkansas River, and unnamed tributaries of these bodies, as well as ponds and wetlands. The smaller water bodies eventually discharge into the Arkansas River as well. The distance to the nearest surface water body, its location relative to the area of contamination, and the surface water body potentially effected is given in Table 2 (CMS 2004, Vol. 5).

References:

CDM 1996, Corrective Measures Study Groups I & II and Newly Identified Solid Waste Management Units, 2 Volumes, December 1996.

Washington Group 2004, Corrective Measures Study Groups I & II Solid Waste Management Units, 5 Volumes, May 2004.

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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.

X 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):

Constituents exceeding 10 times the regulatory limit are:

Constituent	Maximum	Regulatory Limit
Benzene	270000	5
Carbon Tetrachloride	350	5
Chloroform	15000	75
Chlorobenzene	200000	100
Methylene Chloride	420	4.3
1,1,2,2-Tetrachloroethane	2520	0.055
Tetrachloroethylene	59.1	5
Trichloroethylene	916	5

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1,2-Dichlorobenzene	11000	61
1,4-Dichlorobenzene	28000	75
Bis(2-ethylhexyl)phthalate	82	6
Naphthalene	180	6.2
alpha BHC	1.8	0.011
4,4-DDD	65	0.28
4,4-DDE	86	0.2
4,4-DDT	100	0.2
Delta BHC	0.58	0.037
gamma BHC (lindane)	2.8	0.2

Those constituents which exceed the regulatory limit by 10 times or greater were measured at monitoring wells adjacent to the SWMUs. Distances to the nearest corresponding surface water body ranges from 1520-3840 feet. For many of these locations, based on the distance to the surface water body, the hydraulic conductivity and the groundwater gradient, the amount of the contaminant that is potentially discharged into the surface water body is not of an ecological concern (CMS, 2004, Vol.5). For those SWMUs where contamination may potentially be of an ecological concern, a monitoring plan will be in place to sample and analyze sediment, surface water, biota, and groundwater.

References:

CDM 1996, Corrective Measures Study Groups I & II and Newly Identified Solid Waste Management Units, 2 Volumes, December 1996.

Washington Group 2004, Corrective Measures Study Groups I & II Solid Waste Management Units, 5 Volumes, May 2004.

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

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

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to continue until a final remedy decision can be made and implemented⁴)?

 X 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 "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):

Based upon information in the 2004 Corrective Measures Study, for those sites where groundwater to surface water interaction in excess of ecological screening levels monitoring will be done of the surface water, sediment, biota, and groundwater to assure that the ecological screening levels are not exceeded at the point of interaction. Because of the distance to surface water bodies and the very slow velocity of groundwater, only a minimal number of sites pose this potential risk to the ecology.

References:

CDM 1996, Corrective Measures Study Groups I & II and Newly Identified Solid Waste Management Units, 2 Volumes, December 1996.

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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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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?”
- X 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):

The groundwater monitoring plan is included in the 2004 Corrective Measures Study. It includes 79 groundwater monitoring wells. The new/ proposed wells will be sampled on a semi-annual basis for four years and all existing monitoring wells will be sampled annually for volatile organics, semi-volatile organics, metals, and pesticides. Ecological monitoring will be conducted in areas with the potential for groundwater to exceed the surface water regulatory levels at the interface of the two media. This potential is based on two risk assessments, one included in the 1996 CMS and one included in the 2004 CMS.

References:

CDM 1996, Corrective Measures Study Groups I & II and Newly Identified Solid Waste Management Units, 2 Volumes, December 1996.

Washington Group 2004, Corrective Measures Study Groups I & II Solid Waste Management Units, 5 Volumes, May 2004.

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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).

 X 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 Pine Bluff Arsenal _____ facility, EPA ID # AR0213820707, located at 10020 Kabrich Circle, Pine Bluff, Arkansas. 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 (signature) _____ Date 9/24/04
(print) Dianna Kilburn
(title) Geologist, P.G.

Supervisor (signature) _____ Date _____
(print) Jim Rigg
(title) Geologist Supervisor
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Locations where References may be found:

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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

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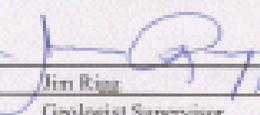
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YI - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Pine Bluff Arsenal _____ facility, EPA ID # _____, AR0213820707, located at _____, 10020 Katrich Circle, Pine Bluff, Arkansas. 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.

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 (print) Dianna Kilburn 9/24/04
 (title) Geologist, P.G.

Supervisor: (signature)  Date 9/24/04
 (print) Jim Rigg
 (title) Geologist Supervisor
 (EPA Region or State) Arkansas

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