

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: Armstrong World Industries  
Facility Address: Liberty and Charlotte Streets, Lancaster, PA  
Facility EPA ID #: PAD 001 307 792

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 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 nonhuman (ecological) receptors is intended to be developed in the future.

**Definition of "Current Human Exposures Under Controls" EI**

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land and groundwater-use conditions (for all "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 groundwater 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"<sup>1</sup> above appropriately protective risk-based "levels" (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 (for any media)– skip to #8 and enter "IN" status code.

Rationale and Reference(s):

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**Response to Question #2 - Migration of Contaminated Groundwater Under Control Rationale & Reference(s)**

At the Armstrong World Industries (AWI) 67 acre site, ARM Group Inc. (ARM) (a contractor for AWI) sampled a total of 19 wells along the downgradient point-of-compliance (POC) boundary ( the northern property line) on one or more occasions between September 24, 2007 and April 2, 2009, and collected 75 water samples, which were tested for a variety of water quality constituents. The groundwater sampling and monitoring program followed the applicable provisions of the Pennsylvania Department of Environmental Protection's (PADEP's) Chapter 250 regulations and Act 2 Technical Guidance Manual.

Groundwater samples from the Site monitoring wells were analyzed for the following three categories of constituents: volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); and Target Analyte List (TAL) metals. Detected constituents were initially compared to the residential non-use aquifer standard for groundwater (MSC R-Non-Use-GW) pursuant to the Non Use Aquifer Determination (NUAD) approved for the Site by PADEP on September 15, 2008. Results of these comparisons indicate that all VOCs, SVOCs and metals were demonstrated to attain their respective State Healthwide Standard (SHS) (MSC R-Non-Use-GW).

A single exceedance of the MSC R-Non-Use-GW standard was reported in well RW-20 for toluene (115,000 µg/L) during the second quarterly sampling event (April 2008). A review of the four subsequent sampling events from this well indicates that toluene concentrations are below the MSC R-Non-Use-GW standard of 100,000 µg/L. All VOCs reported above their respective MSC R-Used-GW standard (i.e., benzene, toluene, ethylbenzene, xylene, TCE, vinyl chloride, and 1,1-DCA) were selected for further attainment demonstration assessment using fate and transport modeling. As detailed in the report, all VOCs were demonstrated to attain the applicable statewide health MSCs (i.e., MSC R-Used-GW or MSC R-Non-Use-GW) with the exception of toluene. In order to determine that reported toluene concentrations continue to reflect stable and declining trends, a minimum of two quarterly groundwater sampling events for toluene analysis will be completed from well RW-20 to demonstrate that established cleanup standards will be met. A Post-Remediation Care Plan (PRCP) detailing required post-remediation assessment and reporting has been completed.

See Final Groundwater Report Lancaster's Northwest Gateway – Armstrong Report September 2009 found in the Administrative Record.

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<sup>1</sup>"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"<sup>1</sup> 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"<sup>12</sup> )

\_\_\_\_\_ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"<sup>12</sup>) - 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):

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***Attainment Demonstration Summary***

A comparison of the groundwater quality results indicates that all VOCs, SVOCs and metals were demonstrated to attain their respective SHS MSC R-Non-Use-GW standards pursuant to the approved NUAD. Detected constituents exceeding their respective SHS MSC R-Used-GW standards were additionally selected for further study in order to demonstrate attainment of the SHS MSC R- Non-Use-GW standard.

***Volatile Organic Compounds***

As presented on the groundwater analytical data summary table (below), the concentrations of all VOCs in groundwater at the POC are below the MSC R-Used-GW or MSC R-Non-Use-GW standards, and the concentrations are stable or declining. As a result, all VOCs meet the applicable PADEP Chapter 250 Statewide Health Standards for either residential or non-residential use. Fate and transport analyses were performed for benzene, toluene, ethylbenzene, xylene, TCE, vinyl chloride, and 1,1-DCA to demonstrate that detected concentrations for these compounds would not exceed the MSC R-Used-GW standard beyond a distance of 1,000 feet downgradient from the property boundary within a period of 30 years, consistent with the Site's NUAD. The fate and transport model input values and the predicted 30-year maximum plume extent (i.e., distance downgradient of the POC that groundwater containing each respective VOC at a concentration in excess of its MSC R-Used-GW standard) for these constituents are summarized in the following table:

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<sup>1</sup> "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.

Constituent	Modeled Source Well ID	Modeled Source Area Concentration (µg/L)	MSC R-Used-GW (µg/L)	Modeled 30-Year Plume Extent (feet from Source)	Distance to Required MSC (R-Used-GW) Attainment Limit (feet from POC)
benzene	RW-20	15	5	180	1,000
toluene	RW-20	420,000	1,000	125	1,000
ethylbenzene	RW-20	570,000	700	320	1,000
total xylenes	RW-22	63,500	10,000	95	1,000
TCE	MW-502D	11.5 (realistic) 25 (worst-case)	5	160 760	1,000
vinyl chloride	RW-23	5	2	70	1,000
1,1-DCA	MW-502D	70	27	130	1,000

### Semi-volatile Organic Compounds

As presented on the groundwater analytical data summary table (below), the concentrations of all SVOCs in groundwater at the POC are below the MSC R-Used GW or MSC R-Non-Use-GW standards, and the concentrations are stable or declining. As a result, all SVOCs meet the applicable PADEP Chapter 250 statewide health standards for either residential or non-residential use, as indicated by the information presented in this report. To support the attainment demonstration for each of the SVOCs that exceeded an MSC R-Used-GW standard at the POC, a fate and transport analysis was performed for benzo(a)pyrene, bis(2-ethylhexyl)phthalate, n-nitroso-di-n-propylamine, and pentachlorophenol to demonstrate that detected concentrations for these compounds would not exceed the MSC R-Used GW standard beyond a distance of 1,000 feet downgradient from the property boundary within 30 years, consistent with the Site's NUAD. The fate and transport model input values and the predicted 30-year maximum plume extent (i.e., distance downgradient of the POC that groundwater containing each respective SVOC at a concentration in excess of its MSC R-Used-GW standard) are summarized in the following table:

Constituent	Modeled Source Well ID	Modeled Source Area Concentration (µg/L)	MSC R-Used-GW (µg/L)	Modeled 30-Year Plume Extent (feet from Source)	Distance to Required MSC (R-Used-GW) Attainment Limit (feet from POC)
benzo(a)pyrene	MW-3R	3	0.2	<5	1,000
bis(2-ethylhexyl)phthalate	MW-16D	30	6	550	1,000
n-nitroso-di-n-propylamine	RW-22	120	0.094	240	1,000
pentachlorophenol	GS-1 25	25	1	30	1,000

### Metals

As presented on the groundwater analytical data summary table (below), the concentrations of all metals in groundwater at the POC are below the MSC R-Used-GW or MSC R-Non-Use-GW standard, and the concentrations are stable or declining. As a result, all metals meet the applicable PADEP Chapter 250 Statewide Health Standards for either residential or non-residential use, as indicated by the specifics of this report. To support the attainment demonstration, a fate and transport analysis was performed for dissolved arsenic, lead, and manganese to demonstrate that detected concentrations would not exceed the MSC R-Used GW standards beyond a distance of 1,000 feet, downgradient from the property boundary within a period of 30 years, consistent with the Site's NUAD. The fate and transport model input values and the predicted 30-year maximum plume extent (i.e., distance downgradient of the POC that groundwater containing arsenic, lead, or manganese at a concentration in excess the MSC R-Used GW standards) are summarized in the following table:

Constituent	Modeled Source Well ID	Modeled Source Area Concentration (µg/L)	MSC <sub>R-Used-GW</sub> (µg/L)	Modeled 30-Year Plume Extent (feet from Source)	Distance to Required MSC (R-Used-GW) Attainment Limit (feet from POC)
arsenic	MW-3R	20	10	70	1,000
arsenic	RW-20/ RW-22	40	10	760	1,000
lead	MW-3R	24	5	500	1,000
manganese	ARM-1	1700	300	820	1,000

### *Non-Use Aquifer Determination*

Available information indicates that groundwater beneath the Site is not used anywhere within Lancaster City as a source of drinking water. According to AWI sources, there are no known users where direct contact with groundwater occurs within Lancaster. Because the City is extensively served by centralized public water supply, Lancaster has enacted an ordinance which prohibits the use of groundwater within the City for drinking water purposes. This institutional measure serves as the basis for establishing groundwater beneath the AWI site and surrounding area as a non-use aquifer under the PADEP Chapter 250 regulations.

During 2007, the PADEP completed a review of the area-wide NUAD request for the City of Lancaster, Pennsylvania. The request was submitted in January 2007. On November 20, 2007, PADEP made an NUAD by providing a letter to the City, stating that the requirements in Section 250.303 (c) and (f) of the Act 2 regulations have been met. Thus NUAD action by the PADEP would allow for the use of non-use aquifer MSCs within the City area designated in the submission.

In August 2008, ARM completed and submitted to PADEP a separate request for approval of an NUAD for areas of Manheim Township located to the north and hydraulically downgradient from the Site. Approval of this request was granted by PADEP on September 15, 2008. The approval will facilitate the groundwater cleanup of the Site by enabling the selection of (and attainment of) the attaining non-use aquifer MSCs.

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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 and Reference(s):

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There are no surface water bodies in close proximity to the Armstrong site.

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5. Is the discharge of "contaminated" groundwater into surface water likely to be "insignificant" (i.e., the maximum concentration<sup>2</sup> 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)?

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If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration<sup>3</sup> 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.

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If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration 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 concentrations<sup>3</sup> greater than 100 times their appropriate "level(s)," and if 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.

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If unknown - enter "IN" status code in #8.

Rationale and Reference(s): \_\_\_\_\_

<sup>2</sup> 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 implemented<sup>3</sup>)?

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<sup>4</sup> 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 a "NO" status, 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):

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<sup>3</sup> 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.

<sup>4</sup> 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):**

Groundwater monitoring has been on going at the identified AOCs since the early 1990s. Modifications to the monitoring network have been made with PADEP approval. However, groundwater monitoring is on going at the Armstrong facility and the adjacent property formerly impacted by migration of contaminated groundwater.

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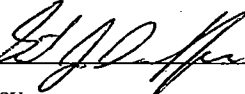
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8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting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

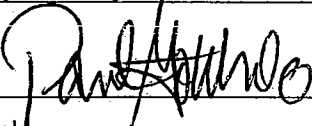
X YE – Yes, "Migration of contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the are expected to be "Under Control" at Armstrong World Industries facility, EPA ID PAD 001 307 792, located at Liberty and Charlotte Streets in Lancaster, PA. 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 7/31/2013  
Grant Dufficy

RCRA Project Manager

Supervisor: (signature)  Date 7/31/13  
Paul Gotthold

Assoc. Dir., PA Remediation, LCD

EPA Region III

Locations where References may be found

All reference documents are appended to the Environmental Indicator Final Report,  
which can be found at the PADEP South Central Office, 909 Elmerton Avenue,  
Harrisburg PA 17110 or USEPA Region III Office, Land and Chemicals Division,  
1650 Arch Street, Philadelphia, PA 19103

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