DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: EMD Chemicals Inc
Facility Address : 2909 Highland Avenue, Norwood, Ohio 45212-2498
Facility EPA ID#: OHD086438538

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

All previous relevant information about groundwater contamination at the EMD Chemicals Inc (EMD) Site has been reviewed. A document entitled Conceptual Model of Current Conditions (subsequently referred to as CMCC in this document) (CH2M HILL, 2005) presents available information into a high-level understanding of the Site's historical operations (including SWMUs/AOCs), hydrogeology, distribution, fate, and transportation of constituents of concern (COCs) in soil and groundwater. The CMCC references past investigations and relevant information obtained during Remedial Investigations/Feasability Studies performed under an Administrative Order On Consent and the Voluntary Corrective Action Agreement (VCAA), the current regulatory document for corrective actions at the Site. The CMCC is cited throughout this document and is the primary reference to support completion of this document.

Reference - Conceptual Model of Current Conditions, EMD Chemicals Inc, Cincinnati, Ohio; CH2M HILL, March 2005.

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 Determination 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).

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 providing or 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)

The following discussion provides a brief background and overview of information collected to date regarding known or reasonably suspected releases to groundwater media.

Groundwater occurs at the Site in a low-flow and low-yield perched condition, separated from a deeper regional aquifer by a series of low permeable aquitard units (CH2M HILL, 2005). The perched groundwater is not currently used nor anticipated to be used in the future for potable or non-potable water supply due to both the low-yield characteristics and State and Local government regulations regarding potable water well construction.

Based on the latest round of quarterly groundwater sampling performed in December 2004, contaminants that were detected in perched groundwater samples above appropriately protective levels are presented in Table 1.

TABLE 1
Constituents of Concern Maximum Concentrations

Constituent of Concern	Max. Conc. (ug/L)	EPA MCL (ug/L)
1,2-DICHLOROETHANE	980	5
BENZENE	420	5
CIS-1,2-DICHLOROETHENE	4400	70
TETRACHLOROETHENE	9.2	5
TRICHLOROETHENE	13000	5
VINYL CHLORIDE	660	2
1,4-DIOXANE	4600	None – USEPA R9 PRG* = 6.1

* = The published U.S. EPA, Region 9 preliminary remediation goal (PRG) of 6.1 ug/L in drinking (tap) water is for a lifetime cancer risk of 10^{-6}; Ohio EPA used the PRG of 61 ug/l during their preparation of a previous CA 750 resulting in a lifetime cancer risk of 10^{-5}.

COCs in groundwater are limited to approximately 2/3 of the Site(industrial land use), and an off-Site area, downgradient to the southeast of the Site. The off-site area impacted by COCs in groundwater consists of an interstate highway and railroad transportation corridor. No other properties are impacted by Site-related COCs in groundwater. Information regarding contaminant distribution both on-site and the off-site plume to the southeast is discussed in the CMCC (CH2M HILL, 2005).

References: Conceptual Model of Current Conditions, EMD Chemicals Inc, Cincinnati, Ohio; CH2M HILL, March 2005. Quarterly Ground Water Monitoring Reports 2004-2005, CH2M HILL. Confirmation Sample Collection Report, CH2M HILL, 12-16-05.

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 resources and its beneficial uses).

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):

The CMCC (CH2M HILL, 2005) presents/references the physical evidence and rationale why contaminated groundwater is expected to remain within the (horizontal and vertical) dimensions of the existing area of groundwater contamination. Key points presented and expanded upon in the CMCC are as follows:

- Areas with actual or potential releases, identified as Solid Waste Management Units (SWMUs) and Areas Of Concern (AOCs), were mitigated or addressed by 1988 with the majority of actual releases mitigated by the early 1980s.
- The vertical and horizontal extent of Site-related chemicals has been defined.
- Perched groundwater flows to the southeast in distinct hydrogeological units and is separated from the underlying regional aquifer by a series of confining units (aquitard units). As observed through environmental testing and sampling efforts, long-term unsustainable flow rates (as demonstrated by dewatering of the units during operation of interim measures) of approximately 5 gallons per minute were observed in the discontinuous Upper Sand unit with 2 – 2.5 gpm in the discontinuous Lower Sand unit. The Upper and Lower Sand units impacted by Site related COCs exist solely beneath the site and are not present downgradient of the site. The remaining perched water bearing units exhibited much lower, unsustainable flow rates (most wells bail dry during purging for sample collection). These rates and the unsustainable rates from the sand units are too low for long-term use as either a potable or non-potable water resource. Therefore, none of the perched groundwater units would be classified as an aquifer under Ohio Administrative Code 3745-50-10(A)(7).
- The primary constituents of concern (COCs) at the Site are Volatile Organic Compounds (VOCs), including some chlorinated VOCs, BTEX compounds (benzene, toluene, ethyl benzene, and xylenes), and 1,4-dioxane. However, little to no toluene, ethylbenzene, and total xylenes have been detected in groundwater samples collected during recent quarterly monitoring events and are primarily limited to on site monitor wells (TPF, 2005). COCs in groundwater were presented as a response to question 2 of this document.
- The area where perched groundwater is impacted covers approximately two-thirds of the Site and a downgradient, off-site area to the southeast. The impacted area of groundwater extending offsite is located in within an interstate highway and railroad transportation corridor and does not impact residential or other commercial/industrial land owners.
- Through an evaluation of the data over time and over distance, natural attenuation is observed to be decreasing the contaminant mass in both on-site and off-site areas.

- Some impacted perched groundwater containing COCs is intercepted by interim measures (further reducing contaminant mass) and COC mass in groundwater is also is reduced by natural attenuation mechanisms. The remaining perched groundwater containing COCs is ultimately intercepted by backfill material surrounding a 96-inch storm sewer to the east; and by the backfill material containing the Duck Creek concrete conveyance system to the southeast. COCs have not been detected in groundwater samples collected from monitor wells located on the east side of the 96-inch storm sewer or on the southeast side of the Duck Creek concrete conveyance system.

- Storm sewer backfill sampling along and downgradient of where the plume intersects the 96-inch storm sewer indicate a decrease in concentration to below reporting limits in the direction of water flow.

- Concentrations within the Duck Creek concrete conveyance system backfill and at a downstream discharge point to the concrete lined ditch portion of Duck Creek have been evaluated using sample results and modeling. The backfill contaminant concentration at the discharge point has been estimated at non-detection for chlorinated VOCs and Benzene and near the Region IX PRG for 1,4-dioxane in tap (drinking) water.

- Confirmatory sampling of ground water at the discharge point of the box culvert showed estimated detections of chlorinated VOCs well below their respective MCLs. Other contaminants were not detected.

- Some groundwater seeps have been observed discharging into the 96-inch storm sewer and Duck Creek concrete conveyance systems through cracks or joints in the structures with water from one seep (Sewer C location in the 96-inch storm sewer) containing COCs (as determined by sampling). However, these seeps exhibit extremely low flow (approximately 40 ml/2 minutes based on sample collection). Therefore, COCs would be diluted by the higher volume of water flow through the 96-inch storm sewer. The 96-inch storm sewer ultimately discharges into the Duck Creek concrete conveyance system.

- At the downgradient end of the flow system, where the Duck Creek box culvert discharges to an open concrete lined ditch, surface water sampling results indicated no detection of COCs above reporting limits.

Based on the data generated during the history of investigations performed at this Site and supplemented by the Site conceptual model (presented in the CMCC), the migration of contaminated groundwater is under control.

References: Conceptual Model of Current Conditions, EMD Chemicals Inc, Cincinnati, Ohio; CH2M HILL, March 2005. Quarterly Ground Water Monitoring Reports 2004-2005, CH2M HILL. Confirmatory Sampling Report, CH2M HILL, 12-16-05.

Footnotes:
[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 samples/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 location 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?

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 has been observed discharging through extremely low flow seeps in the 96-inch storm sewer which is conveyed to Duck Creek and through seeps in the Duck Creek concrete conveyance system. Samples have been collected from these seeps with subsequent laboratory analyses performed on the seep samples indicating no COC discharge to the storm sewer system with the exception of one location. This seep is located in the 96-inch storm sewer (referred to as Sewer C sampling location) and has consistently yielded samples containing COCs during recent quarterly monitoring events. Groundwater enters through the seep at extremely low flow (approximately 40ml/2 minutes) with seep water containing COCs diluted by the higher flow of water through the storm sewer. The 96-inch storm sewer conveys water to the concrete conveyance system of Duck Creek, which ultimately discharges to Duck Creek. Therefore, potentially affected surface water body is Duck Creek.

References: Conceptual Model of Current Conditions, EMD Chemicals Inc, Cincinnati, Ohio; CH2M HILL, March 2005. Quarterly Ground Water Monitoring Reports 2004-2005, CH2M HILL. Confirmatory Ground Water Sampling Report, CH2M HILL, 12-16-05.

4. 5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] 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)?

X — If yes – skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonable suspected concentration[3] 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 concentration[3] 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[3] 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):

As previously discussed, groundwater containing COCs has been observed slowly discharging through a seep in the 96-inch storm sewer. During the history of subsurface investigations, and on a quarterly basis since 2003, surface water samples have been collected from the seep and from the outflow of the Duck Creek concrete conveyance system to the concrete lined portion of Duck Creek (which appears to separate surface flow of Duck Creek from groundwater beneath the concrete lined system). COCs have not been detected above reporting limits in any of the samples collected from the outflow of the Duck Creek concrete conveyance system. Additionally, modeling has indicated that the concentrations of COCs other than 1,4-dioxane would be below MCLs and the concentration of 1,4-dioxane would be approaching PRGs in tap (drinking) water beneath the outflow of the Duck Creek concrete conveyance system (well below the criteria of "10 times their appropriate groundwater 'level"). In October 2005, sampling of ground water at the box culvert discharge point showed estimated detections of a few chlorinated VOCs which were well below their respective MCLs. Therefore, impacts to this surface water body, sediments, or to the ecological system do not appear to be of concern.

References: Conceptual Model of Current Conditions, EMD Chemicals Inc, Cincinnati, Ohio; CH2M HILL, March 2005. Quarterly Ground Water Monitoring Reports, 2004-2005, CH2M HILL. Confirmatory Ground Water Sampling Report, CH2M HILL, 12-16-05.

[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 to continue until a final remedy decision can be made and implemented[4])?

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, us/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 on the rationale presented in Question 5, this is not applicable.

[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 tot he surface waters, sediments or eco-systems.

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):

Additional groundwater monitoring and confirmation surface water sampling is scheduled during subsequent interim quarterly sampling events, prior to completion of the Corrective Measures Proposal (CMP) and acceptance by the U.S. EPA (CH2M HILL 2005). Interim quarterly groundwater monitoring will consist of monitoring a subset of groundwater monitor wells, seep, and surface water sampling locations including the Duck Creek outflow surface water sampling location. A final groundwater monitoring plan is anticipated as a component of the CMP.

References: Conceptual Model of Current Conditions, EMD Chemicals Inc, Cincinnati, Ohio; CH2M HILL, March 2005 Quarterly Ground Water Monitoring Reports, 2004-2005, CH2M HILL. Confirmatory Ground Water Sampling Report, CH2M HILL, 12-16-05.

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 EMD Chemicals Inc, Cincinnati Ohio Facility, EPA ID # OHD086438538 located at 2909 Highland Avenue, Norwood, Ohio 45212-2498. 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) Donald A. Heller Date 12-28-06
(print) Donald A. Heller
(title) Environmental Scientist

Supervisor (signature) [signature] Date 12/28/06
(print) Hak K. Cho
(title) Chief, Corrective Action Section
(EPA Region or State) Region 5

Location where References may be found:

Conceptual Model of Current Conditions, EMD Chemicals, Inc. CH2M HILL, March 2005

Quarterly Ground Water Monitoring Reports 2004-2005, CH2M HILL.

Confirmatory Ground Water Sampling Report, CH2M HILL, 12-16-05.

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