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: **_ Pemco Corporation _____**
Facility Address: **_5601 Eastern Ave Baltimore, Md _____**
Facility EPA ID #: **_ MDD003093499 _____**

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 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).

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):

Extensive work has been performed at the site under the oversight of the U.S. Environmental Protection Agency (EPA) and the Maryland Department of the Environment (MDE) to investigate environmental conditions at the former frit manufacturing facility owned by the PEMCO Corporation, located at 5601 Eastern Avenue, Baltimore, Maryland. Since 2006, PEMCO has been performing the work jointly under EPA's Facility Lead Program and Maryland's Voluntary Cleanup Program (VCP).

The work has been performed in accordance with the site Characterization Work Plan dated December 6, 2006 (ERM, 2006), which was prepared by Environmental Resources Management, Inc. (ERM) on behalf of PEMCO. EPA approved the Work Plan in January 2007. ERM has also undertaken several focused studies, approved by EPA and MDE, that augment the Work Plan. The results of the site characterization have been documented and submitted to EPA and MDE in a January 2011 report titled *Site Characterization and Risk Assessment Report* (ERM, 2011).

The site was formerly used to manufacture inorganic pigments and specialty glasses (frit). The facility ceased operations in September 2007. The facility was decommissioned in December 2007, and has been inactive since. The site includes a former on-site landfill that was used for the on-site placement of off specification frit, scrap metal, and facility debris until 1979 when it was capped with a vegetative cover reported to consist of 6 to 8 feet of clay loam as directed by the Maryland Department of Health and Mental Hygiene (MDE's predecessor).

Future re-development is expected to be non-residential. Ground water is not used a potable source on site or in Baltimore City. The site characterization indicates that the site is underlain by unconsolidated coastal plain sediments. The Arundel Clay, which is thick regional aquitard that consists of a dry dense clay, was encountered at the site at a depth of about 135 feet below grade. The Arundel Clay separates the site from deep water-bearing zones.

Footnotes:

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

The site characterization included the following investigation activities:

- 92 soil borings were drilled across the site;
- 14 ground water monitoring wells were installed;
- 111 soil samples were collected for laboratory analyses of inorganic and organic constituents;
- Ground water sampling for laboratory analyses was performed on September 16, 2009, October 13, 2009, December 19, 2009, January 29, 2010 and February 21, 2013;
- Seven synoptic rounds of ground water levels were performed on December 20, 22 and 26, 2006, January 10, 2007, March 7, 2007, January 29, 2010 February 21, 2013;
- 24 soil gas samples were collected from throughout the site for volatile organic compounds (VOCs);
- Five rounds of landfill gas sampling was performed on December 18, 2006, January 24, 2007, February 27, 2007, September 12, 2007 and December 2010;
- A methane extraction and recovery test was performed in March 2007.

In December 2006, 9 of the 13 monitoring wells, designated EGW-1 through EGW-9, were installed throughout the site. These wells were completed at depths of about 25 to 35 feet below ground surface (bgs), and ground water was not encountered in any of these wells. In September 2009, a deep monitoring well, EGW-10, was installed in the former landfill to a depth of approximately 85 feet bgs. In November and December 2009, a deeper monitoring well, EGW-10D, was installed next to EGW-10. EGW-10D was completed at a depth of about 131 feet bgs. In January 2010, the remaining monitoring well, EGW-9D was installed down gradient of EGW-10, and at elevations commensurate with the screen interval for EGW-10. EGW-9D was installed next to EGW-9, and was completed at a depth of about 55 feet bgs.

Synoptic water levels were collected on December 20, 22 and 26, 2006, January 10, 2007, March 7, 2007, and January 29, 2010 and February 21, 2013. On all occasions, all shallow monitoring wells (EGW-1 through EGW-9) were dry. On January 29, 2010, ERM measured the ground water level at monitoring wells EGW-9D, EGW-10, and EGW-10D. ERM also collected a ground water sample from each well using low flow sampling techniques. On February 2013, ERM installed a new well EGW-12, sampled well EGW-12, and measured the ground water level at monitoring wells EGW-9D, EGW-10, EGW-11, and EGW-12.

The site characterization indicates that ground water occurs on site at depths of about 30 feet or deeper. In fact, ground water was only encountered in 5 of the 14 monitoring wells at EGW-9D, EGW-10, EGW-10D and EGW-12. Based on topography and regional ground water flow conditions, ground water flows to the south/southwest from EGW-10/10D towards EGW-9D.

As directed by EPA and MDE, the ground water samples were analyzed for Target Compound List (TCL)Volatile Organic Compounds (VOCs) plus Tentatively Identified Compounds (TICs). The ground water samples from EGW-10, which is about 65 feet deep, showed elevated levels of tetrachloroethene (PCE), trichloroethene (TCE) and cis 1,2 dichloroethene (cDCE) and carbon tetrachloride compared to their respective Maximum Contaminant Levels (MCLs). Of these detections, the highest concentrations were PCE at 970 micrograms per liter (ug/L), TCE at 360 ug/L and cDCE at a concentration of 660 ug/L.

The fact that cDCE was detected along with PCE and TCE indicates that natural biodegradation of PCE is occurring. cDCE is produced through the natural reductive dechlorination of PCE and TCE. Chloroform was also detected at EGW-10 at a concentration of less than 10 ug/L but above EPA's Region III tap water Risk Screening Level (RSL) of 0.190 ug/L. Chloroform is a trihalomethane, which is a breakdown product of chlorination and a common contaminant in water supply systems. Its presence in the ground water sample may be indicative of a leaking water line.

Notably, VOCs were virtually non-detect at deeper monitoring well MW-10D, which is screened at the top of the Arundel Clay at a depth of about 131 feet. The only VOCs that exceeded their respective screening values were trace levels of bromodichloromethane at a concentration of 3 ug/L and chloroform at 22 ug/L. The tap water RSL

for bromodichloromethane is 0.120 ug/L. Most bromodichloromethane is also formed as a by-product when chlorine is added to water-supply systems.

Results of the water quality analyses for the new well EGW-12 indicate low levels of VOCs are present consistent with the prior soil gas results for this area (ESG-26). The concentrations of carbon tetrachloride (7.9 µg/L) and tetrachloroethene (13 µg/L) detected in the new well EGW-12 are significantly lower than at the center of the property (at well EGW-10) and are likely attributable to mixing of waters beneath the landfill where flow from the west and east converge at the former stream trace. The risk to off-site receptors west of EGW-12 due to vapor intrusion has been assessed based on the prior ESG-30 and 31 soil gas results, and found to be negligible.

VOCs were also non-detect at monitoring well EGW-9D, except for 1 ug/L of PCE at EGW-9D, which is bellow its MCL of 5 ug/L. These data, along with the soil gas results collected as part of the site characterization indicate that VOCs are not migrating towards the property boundary at levels of concern.

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 presence of ground water at the site is limited to depths greater than 30 feet bgs. The site characterization results indicate that the source of ground water impact is limited to an isolated area of a former on-site landfill used for the placement of off-specification frit, scrap metal, and facility debris until 1979 when it was capped with a vegetative cover reportedly of 6 to 8 feet of clay loam, as directed by the Maryland Department of Health and Mental Hygiene (MDE's predecessor).

As noted above, the facility has been inactive since 2007. The landfill has not been used since 1979. As such, there is no on-ongoing source of VOCs to ground water, as confirmed by the more than 100 soil samples collected from across the site as part of the site characterization. Based on the regional flow direction and local topography, ground water flow is to the south/southwest toward existing monitoring wells EGW-9D. Ground water quality data from this well showed that only PCE was present at a trace level of 1 ug/L and only in EGW-9D. Groundwater levels show a flat gradient concluding the groundwater is not moving. Vertically, the ground water quality data from deep monitoring well EGW-10D indicates that VOCs concentrations decrease significantly with depth, and that further vertical migration is restricted by the presence of the Arundel Clay. The presence of the Arundel Clay on site was confirmed by soil sampling performed during drilling for the installation of EGW-10D.

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

The data indicate that VOCs in ground water do not extend to the downgradient property boundary at levels above MCLs. The data also indicate that any vertical migration is limited to the underlying Arundel Clay aquitard. Although temporal ground water sampling data is limited to multiple sampling events in fall 2009, winter 2010, and February 2013, it is reasonable to interpret the existing ground water data as indicative of stabilized conditions. Specifically, the source of the VOCs in ground water is an area of the landfill. The landfill has been closed since 1979, which is more than 30 years ago. Since there is no on-going source, and the landfill was closed more than 30 years ago, and conditions have not changed appreciably at the landfill since 1979 (Other than adding the vegetative cap), it is reasonable to conclude that ground water conditions characterized by the existing monitoring well network represent stabilized conditions. Furthermore, ground water monitoring will be part of the site remedy.

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

_____ If yes - continue after identifying potentially affected surface water bodies.

___x_ 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):

The only surface water present on site is a very small reach of storm water flow. The storm water originates off site, and flows through a storm sewer line at the toe of the landfill. The storm sewer line also collects storm water from the site. The only exposed portion of the storm water channel is a small reach about 80 feet in length in the southwestern corner of the site. The fact that ground water occurs only at depth (greater than 30 feet deep) across the site indicates that ground water does not discharge into this channel.

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)?

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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[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):

The only surface water present on site is a very small reach of storm water flow. The storm water originates off site, and flows through a storm sewer line at the toe of the landfill. The storm sewer line also collects storm water from the site. The only exposed portion of the storm water channel is a small reach about 80 feet in length in the southwestern corner of the site. The fact that ground water occurs only at depth (greater than 30 feet deep) across the site indicates that ground water does not discharge into this channel.

[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, 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):

[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.

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 activities will be undertaken at the Facility to complete the corrective action process under the Resource Conservation and Recovery Act and Maryland's Voluntary Cleanup Program. The scope and nature of these activities will be developed in conjunction with EPA and MDE and may include additional ground water monitoring using the network of existing ground water monitoring wells at the site.

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 **Pemco Corporation** facility , EPA ID # **MDD003093499**, located at **5601 Eastern Ave Baltimore, Md**. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

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

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

Completed by _____ Date: 4/18/13
(print) Leonard E. Hotham
(title) Environmental Engineer

Supervisor _____ Date: 4/22/13
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