DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures 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 soil, groundwater, surface water/sediments, and air, 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 #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 "Current Human Exposures Under Control" 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 "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

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. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] 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 (from SWMUs, RUs or AOCs)?

	Yes	No	?	Rationale / Key Contaminants
Groundwater	_x__	___	___	_**See Below**_____
Air (indoors)[2]	___	_x_	___	_**See Below**_____
Surface Soil (e.g., <2 ft)	_x_	___	___	_**See Below**_____
Surface Water	___	_x_	___	_**See Below**_____
Sediment	_x_	___	___	_**See Below**_____
Subsurf. Soil (e.g., >2 ft)	_x_	___	___	_**See Below**_____
Air (outdoors)	___	_x_	___	_**See Below**_____

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

__x__ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

Rationale: - 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.

The site characterization included the following investigation activities:

1. 92 soil borings were drilled across the site;

2. 13 ground water monitoring wells were installed;
3. 111 soil samples were collected for laboratory analyses of inorganic and organic constituents;
4. Ground water sampling for laboratory analyses was performed on September 16, 2009, October 13, 2009, December 19, 2009 and January 29, 2010;
5. Six synoptic rounds of ground water levels were performed on December 20, 22 and 26, 2006, January 10, 2007, March 7, 2007, and January 29, 2010;
6. 24 soil gas samples were collected from throughout the site for volatile organic compounds (VOCs);
7. Five rounds of landfill gas sampling was performed on December 18, 2006, January 24, 2007, February 27, 2007, September 12, 2007 and December 2010;
8. A methane extraction and recovery test was performed in March 2007.

Ground water

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 4 of the 13 monitoring wells at EGW-9D, EGW-10, EGW-10D, and EGW-11. 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 installed during January 2013 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 below its MCL of 5 ug/L.

Air (Indoors)

The soil gas results indicate that a high concentration of VOCs in soil gas is present in the landfill near monitoring wells EGW-10 and EGW-10D. The predominant VOCs by concentration are PCE and TCE, detected at ESG-21 at concentrations of 7,500,000 micrograms per cubic meter (ug/m3) and 1,200,000 ug/m3, respectively. However, soil gas quality improves markedly as the property line is approached. For example, PCE and TCE were not detected or present at concentrations below the residential screening value in the soil gas samples at ESG-30A, ESG-30B and ESG-31. These sampling points are located on the western-most property line. At ESG-27 and ESG-28 at a depth of 4 ft, located along the southwestern property line toward Interstate I-95, TCE was not detected and PCE levels

dropped to a maximum concentration of 15 ug/m3. This concentration exceeds PCE's screening level for residential land use (which is 9.4 ug/m3) but below the industrial SL (which is 47 ug/m3) and indicates a steep downward concentration gradient compared to the results at ESG-21.

Field testing also indicates the presence of a significant yet isolated area of methane near the north-central part of the landfill. In this area of the site, methane levels ranged from 26.9% to greater than 99.9% by volume. Methane concentrations decreased to less than 1% toward the property boundary. The lower explosive limit (LEL) for methane is 5% by volume. Additional methane monitoring using a GEM2000 Gas Analyzer and Extraction Monitor was conducted in the metal storage shed, main warehouse, and interior rooms of the main warehouse to determine of methane gas was accumulating inside the buildings. Methane was not detected inside any of the buildings and interior rooms.

Surface and Subsurface Soils

Samples of surface and subsurface soils were collected and analyzed in accordance with the EPA-approved Work Plan and supplemental studies as directed by EPA and MDE. The sample results were compared to EPA Region III RSLs for industrial land use. The published RSLs for non-carcinogenic constituents were divided by 10 to account for cumulative effects.

With few exceptions, metals were detected in the soil at levels that were below their respective screening values. Virtually all of the relatively few soil sample results with metals concentrations above screening values are located below or adjacent to the main manufacturing building or within a discrete area of the landfill. As is typical for soils in Maryland, arsenic was the most prevalent metal detected at levels above its non-residential RSL, which is 1.6 mg/kg. The only other metals that were detected in at least one soil sample at a concentration above its screening value were antimony, cobalt, lead and iron. VOCs that were detected in soil samples above their respective RSLs were limited to a discrete area of the site within the landfill boundary. PCE was detected above its RSL in subsurface soil samples. The only other VOC that was detected above its RSL was hexachloroethane at two sample locations, co-located with PCE exceedances.

Semi-volatile organic compounds (SVOCs) and polycyclic aromatic compounds (PAHs) were virtually nondetect or detected at concentrations below their respective screening values. The only exceptions were from the 3 to 3.5 foot sample interval in one sample (ESB-54) collected by ERM in the northern part of the side adjacent to Eastern Avenue, and sample S-2 collected by MDE in 2000. MDE reported the S-2 sample as "background."

In sample ESB-54, benzo(a)pyrene (BaP) and dibenzo(a,h)anthracene (D(a,h)A) were detected at concentrations of 1.6 mg/kg and 0.310 mg/kg, respectively. The screening value for each of these PAHs is 0.210 mg/kg. The duplicate sample from this location showed much lower BaP and D(a,h)A concentrations of 0.044 mg/kg and non-detect at a detection level of 0.310 mg/kg, respectively. PAHs were not detected in the shallow 0 to 0.5 foot sample interval at this location. Notably, the boring log for this sample shows that the material was a black, granular fill that appears to be structural fill used for Eastern Avenue.

The other sample location was S-2, which ERM understands was a background sample collected by MDE in 2000. S-2 is located in the eastern most part of the former landfill. The sample results reported by MDE identified several PAHs, including BaP and D(a,h)A, present in the soil sample at concentrations above their respective screening values. Based on the preponderance of SVOC and PAH non detections and, if detected, concentrations below screening values throughout the rest of the site, the result for S-2 appears to be an anomaly and not representative of site conditions. Three soil samples were submitted for PCB analyses. These samples consisted of shallow (0 to 0.5 feet bgs) soil samples. PCBs were not detected in any of the samples.

Surface Water and Sediment

The only surface water present on site is a very small reach of storm water flow in the southwestern corner of the site. 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.

Eight sediment samples associated with the storm water sewer system and storm water channel were collected as part of prior investigations by MDE (2000) and Environ (2004). MDE's samples were analyzed for VOCs, SVOCs, pesticides, herbicides and metals, while Environ's were analyzed for metals. As with the soil sample results, the analytical results for the sediment samples were compared to EPA's RSLs for industrial land use (EPA, 2010). The RSLs for the non-carcinogenic compounds and metals have been divided by 10 for a Hazard Quotient of 0.1. The screening value used for lead was 800 mg/kg for industrial land use.

The only reported result for VOCs was 0.15B mg/kg of 2-butanone (methyl ethyl ketone) in one of MDE's samples. The results were qualified with a "B" indicated that it is likely an artifact of the laboratory and not representative of sediment quality. PCBs were not detected in any of MDE's samples, and all pesticide results were below their respective screening values. Trace levels of SVOCs were detected in one on-site sediment sample but at levels below their respective RSLs.

As with the soil results, the predominant metal detected above an RSL was arsenic. Arsenic was detected in all of the sediment samples above its RSL except for two samples. The on-site arsenic concentrations were all less than 4 mg/kg, except for Sed-1, where MDE reported a concentration of 14.7 mg/kg, which exceeds its RSL of 1.6 mg/kg.

MDE's sediment sample Sed-1 reportedly contained elevated concentrations compared to RSLs for cadmium, iron, and lead. However, the exact location of this sample within the open storm water channel is uncertain as well as any quality assurance procedures followed to ensure sample integrity and representativeness. A comparison of all of the on-site sediment results to Sed-1 indicate that this result is not indicative of sediment quality in the open storm channel. However, the exact location of this sample within the open storm water channel is uncertain as well as any quality assurance procedures followed to ensure sample integrity and representativeness. A comparison of all of the other on-site sediment results to this sample indicate that this result is not indicative of sediment quality in the open storm channel.

Air (Outdoors)

There are no air emissions from the facility as it ceased operation in 2007.

Reference(s)

Environ, 2004. Investigation of the On-site Landfill at the PEMCO Facility, Baltimore, Maryland, dated 29 November 2004, prepared by ENVIRON, prepared for Millennium Holdings, LLC.
MDE, 2000. Expanded site Inspection of the Pemco Corporation, dated April 2000, prepared by MDEERRP, prepared for USEPA Region III.
EPA, 2010. EPA Region III Risk Based Concentrations, Revised May 2010.
ERM, 2006. site Characterization Work Plan for 5601 Eastern Avenue
Baltimore, Maryland, Prepared by ERM for PEMCO, 6 December 2006.
ERM 2011. Report titled *site Characterization and Risk Assessment Report*, January 2011.

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 appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

	Potential **Human Receptors** (Under Current Conditions)						
"Contaminated" Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food[3]
Groundwater	No	No	No	No	No	No	No
~~Air (indoors)~~	___	___	___	___	___	___	___
Soil (surface, e.g., <2 ft)	No	No	No	No	Yes	No	No
~~Surface Water~~	___	___	___	___	___	___	___
Sediment	No	No	No	No	Yes	No	No
Soil (subsurface e.g., >2 ft)	No	No	No	No	No	No	No
~~Air (outdoors)~~	___	___	___	___	___	___	___

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

__x__ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Ground water

The site characterization determined that ground water impacts above drinking water screening levels (Maximum Contaminant Levels or EPA Region III tap-water RSLs) are limited to the site and not spreading. The site is currently shut down, and all of the buildings are unoccupied. Ground water is not used for potable purposes on site or in Baltimore City. Accordingly, no complete pathways of exposure to the ground water beneath the facility currently exist.

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Indoor Air Quality
The site is currently shut down, and all of the buildings are unoccupied. As documented above under Question No. 2, soil gas results indicate that a high concentration of VOCs in soil gas is present in the landfill. There are no buildings in this area of the site, and therefore there are no receptors. Soil gas samples at the property boundary show that volatile concentrations drop significantly.

Soil

As documented above under Question No. 2, the site characterization determined that soil has been impacted by certain metals, VOCs and PAHs. However, the facility is no longer operating, and is inactive. The only potential receptors under current conditions are possible trespassers but the facility is fenced with access restricted by security and a locking gate.

Surface Water and Sediment

As documented above under Question No. 2, 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 inactive and decommissioned 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. Sediment samples from the storm water sewer system and storm water channel were collected as part of prior investigations by MDE (2000) an Environ (2004). Arsenic, cadmium, iron and lead were detected in certain samples above their respective RSL for industrial land use. However, the facility is no longer operating, and is inactive. The only potential receptors under current conditions are possible trespassers but the facility is fenced with access restricted by security and a locking gate.

4 Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

__x__ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Field testing also indicates the presence of a significant yet isolated area of methane (landfill gas) near the north-central part of the landfill. Methane concentrations at the property boundary are negligible. There are no buildings in this area of the site, and therefore there are no receptors. Methane monitoring was also conducted in the metal storage shed, main warehouse, and interior rooms of the main warehouse (these areas are the closest structures to the landfill) to determine of methane gas was accumulating inside the buildings. Methane was not detected inside any of the buildings and interior rooms.

[4] If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

5 Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

_____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

_____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):

ERM performed a risk assessment using the data from the site characterization (ERM, 2011). The risk assessment was performed in accordance with the EPA-approved Work Plan (ERM, 2006). The risk assessment determined that under current conditions site conditions do not pose an unacceptable risk to human health.

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

_x__ YES - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the _Pemco_____ _____ facility, EPA ID # MDD003093499_____, located at **5601 Eastern Ave, Baltimore, Md** under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

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

Completed by (signature) Leonard E Hotham Date 9/3/2013
(print) Leonard E. Hotham
(title) Environmental Engineer

Supervisor (signature) _____ Date 9/3/2013
(print) Luis Pizarro
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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.