APPENDIX A

STATEMENT OF BASIS
FOR
EMD CHEMICALS INC.
CINCINNATI, OHIO

OHD 086 438 538

INTRODUCTION

This Statement of Basis (SB) for EMD Chemicals Inc. (EMD) in Cincinnati, Ohio is being issued by the United States Environmental Protection Agency (U.S. EPA) to fulfill part of its public participation responsibilities under the Resource Conservation and Recovery Act (RCRA). The SB explains the proposed remedy at the facility. This remedy is proposed for addressing soil and ground water at the facility. In addition, the SB includes summaries of other remedies analyzed for this facility. The U.S. EPA will select a final remedy for the facility only after the public comment period has ended and the information submitted during this time has been reviewed and considered.

This document summarizes information that can be found in greater detail in the Remedial Investigation Report, the Update to Post-RI/FS Investigation Report, the quarterly technical progress reports, the Conceptual Model of Current Conditions, the Human Health Risk Assessment Addendum, the Final Draft Corrective Measures Proposal (CMP), and other documents contained in the administrative record for the EMD facility. U.S. EPA encourages the public to review these other documents in order to gain a more comprehensive understanding of the facility and RCRA activities that have been conducted there.

The U.S. EPA may modify the proposed remedy or select another remedy based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives. The public can be involved in the remedy selection process by reviewing the documents contained in the administrative record. U.S. EPA in this document informs the public of the location and availability of the administrative record.

LOCATIONS ADDRESSED BY THE CORRECTIVE ACTION

The EMD facility includes locations where materials which meet the definition of solid wastes at Title 40 Code of Federal Regulations (40 C.F.R.) Part 260.10 have been managed. These locations are termed solid waste management units (SWMUs). The principal SWMU to be addressed by the corrective action is known as the West Ravine (See Figure 2.). The proposed remedy will protect human health and the environment by the containment of waste, contaminated soil and contaminated ground water.

PROPOSED REMEDY

U.S. EPA proposes the following remedy to address contaminated soil and ground water at the EMD facility:

- Hydraulic containment along the southern property boundary to intercept potential releases from wastes contained in the West Ravine and the ground water containing the highest concentrations of contaminants of concern (COCs) thus preventing off-site migration of COCs above risk-based levels. The current hydraulic containment methodology proposed is a ground water collection trench and low permeability containment wall and continued operation of the existing French Drain collection system to prevent COCs in ground water above risk-based concentrations from migrating off-site. This will include the removal of the existing off-site Sump-562 and replacing it with a new on-site upgraded sump located in the trench;

- Continued operation of the existing French Drain collection system to prevent COCs in ground water from migrating toward the eastern property boundary;

- New surface cover and storm water management system over the entire known aerial extent of the buried waste in the ravine to reduce surface water infiltration into the West Ravine;

- Off-site waste (debris) will be removed and incorporated beneath the surface cover within the West Ravine;

- Institutional controls such as Uniform Environmental Covenants Act (UECA) restrictions in the property deed, and engineered controls to eliminate potential and future on-site human health exposure pathways.

In addition to the proposed containment components of the remedy, EMD has elected to perform the following enhancements which are intended to provide mass removal of contamination:

- *In-situ* remediation of impacted soils located in the former tank farm area; and

- Limited excavation of impacted soils in the vicinity of the existing off-site sump system.

FACILITY BACKGROUND

Site Description

The EMD facility is located at 2909 Highland Avenue, Cincinnati, Ohio, near the interchange of U.S. Interstate 71, State Route 562, and a Norfolk Southern (NS) railroad line (See Figure 1.). The western 6.62 acres of the facility fall within Norwood city limits, and the eastern 2.38 acres fall within Cincinnati city limits. This is an active facility with the majority of the area being covered with asphalt, gravel or concrete. A fence surrounds the property with 24 hour security, to limit access to authorized personnel. Along the southwestern portion of the site a 50-foot wide, tree and grass covered bluff drops in elevation from the site to Ohio Department of Transportation (ODOT) and NS right of ways. The topography of the site previously included two ravines, the West and East Ravines, which were associated with the Duck Creek drainage system. Except for the mouth of the West Ravine, the two ravines have been filled to grade over a period from approximately 1952 to 1971. No chemical wastes are known to have been disposed in the East Ravine. The mouth of the West Ravine consists of steep slopes eroded into fill material, which is vegetated with trees and brush. A drainage pipe at the mouth of the West Ravine allows perched ground water to drain from the filled portion of the ravine. This drainage is intercepted by Sump 562.

Land Use

The EMD facility is located in a mixed commercial/industrial setting northwest of the intersection of Interstate 71 and State Route 562, west of the NS railroad and east of various industrial and commercial properties. Several residential houses are located southwest of the facility, and one residential house is located on Highland Avenue northwest of the facility. EMD is in the process of purchasing this residential house with the intent of demolition of it to use the land. Highland Avenue is aligned east to west, and bisects the EMD facility.

The industrial use of the EMD property and the current use of the adjacent properties as transportation corridors are expected to remain the same for the foreseeable future.

Site Background

The EMD site has been used for industrial manufacturing, storage and distribution of organic and inorganic chemicals since the late 1940s. EM Science, EMD's corporate predecessor, purchased the property in 1977. The EMD property north of Highland Avenue was purchased in 1994 and has not been impacted by historical operations.

The West Ravine was a 5 to 25-foot deep depression that previously cut across the property. From approximately 1952 to 1971, previous owners of the property backfilled this ravine with soils, construction debris and off-spec chemical waste containers. The West Ravine was eventually filled to grade by the previous owners in order to increase the usable area of the facility.

In addition, there are two other significant areas where historical releases of wastes occurred: the area immediately south of Building 10 and the area immediately south of Building 4, inclusive of the former tank farm. Both of these impacted areas were likely the result of drainage from sewer lines, drains and process pipes that migrated to the West Ravine. There are also localized areas of soil contamination south of Building 10. These releases will be addressed collectively in the proposed remedy for the West Ravine.

The manufacture, packaging and storage of solid and liquid industrial chemicals predominantly occurred in a group of buildings in the central portion of the EMD property south of Highland Avenue, and near the southern property boundary at Building 4. A former above ground and underground storage tank farm, which had been located partially within the West Ravine, was used for storing organic solvents which included 1,4-dioxane. COCs were likely released from this area and from past operations in the Building 4 area. These are the most likely sources of the currently observed concentrations of dissolved 1,4-dioxane in soil and ground water.

Hydrogeological Setting

The geology in the vicinity of the EMD facility generally consists of fill underlain by approximately 70 feet of discontinuous sand, gravel, silt and clay. These units contain sparse amounts of ground water. This ground water is considered "perched" as it is separated from a regional aquifer, the Norwood Trough Aquifer described below, by a series of 10 to 30 feet of unsaturated low permeability confining layers that act as aquitards. The perched ground water generally flows to the southeast and is not a plausible source of potable water. The calculated average rate of cumulative ground water flow through the units surrounding and beneath the West Ravine is a cumulative average of 0.5 gallons per minute, with a velocity of less than 0.2 feet per day.

The Norwood Trough Aquifer has an upper layer of approximately 85 feet of unsaturated partially cemented sand and gravel deposits that exhibit low permeability and act as a confining zone. Below this confining zone, the aquifer consists of approximately 75 feet of saturated sand and gravel. Subsurface investigations at the EMD site have demonstrated that there is no connection between the perched ground water and the Norwood Trough Aquifer.

The nearest surface water is Duck Creek (See Figure 1.), which is contained over much of its length within an underground box culvert that generally runs parallel to Interstate 71. From the outlet of the box culvert, the flow of Duck Creek is contained within a 3,000 foot concrete swale. As determined during facility investigations, off-site ground water flow from lower aquifers beneath the EMD facility runs south-southeastward and drains into the backfill surrounding the Duck Creek box culvert. Based upon modeling, this ground water flow rate is assumed to be 30 gallons per day.

Contaminants of Concern

Initial site sampling during the early stages of the investigation included the comprehensive list of contaminants found at 40 C.F.R. Part 264, Appendix IX and radionuclides. Through assessment of the contaminants actually detected at the site and site-specific knowledge (i.e., chemicals either not used or not known to be present at the facility), EMD developed a site-specific COC list.

Dissolved COCs detected at the site include benzene, toluene, ethylbenzene, xylenes, chlorinated volatile organic compounds (VOCs) and 1,4-dioxane. The contaminants are detected in the perched ground water beneath approximately two-thirds of the site and a downgradient off-site area to the southeast. Monitoring of the ground water has shown off-site contaminant concentrations to be stable or decreasing. The off-site ground water contamination is migrating beneath ODOT right of way for State Route 562 and Interstate 71. No residential areas are affected. The contaminant which is the most widely dispersed is 1,4-dioxane.

The COCs have not migrated significantly in soils, and most contaminants detected at the mouth of the West Ravine appear to have been the result of earlier discharges from the drainage pipe and overland flow which occurred before the discharges were intercepted by collection Sump 562 which has been in operation since 1982. The contaminant which is most widely dispersed in soil is 1,4-dioxane.

Surface water samples have been collected quarterly from Duck Creek at locations both upstream and downstream from the site, each calendar quarter since the third quarter of 2004. Dissolved COCs have not been observed above drinking water maximum contaminant levels (MCLs) in any of the quarterly surface water samples. In addition, supplemental investigations requested by the U.S. EPA and which EMD performed in October 2005 demonstrated that COCs are not present in the ground water downgradient of the Duck Creek box culvert or in the backfill of the box culvert at its downstream terminus. Most of the ground water flowing into the box culvert is not contaminated; contaminants in the impacted ground water are probably greatly diluted in the downstream creek flow.

WORK PERFORMED TO DATE

Voluntary Actions Taken by EMD

In the 1980s and early 1990s EMD voluntarily addressed potential areas that may contribute to the off-site migration of COCs by installing the Interim Measures which are discussed below.

Interim Measures

A ground water collection trench (French Drain) was installed between 1987 and 1988 in the approximate location of the former East Ravine, in order to intercept contaminated ground water migrating east and southeastward from the West Ravine.

The French Drain system was supplemented by the installation of extraction well P6A in 1992, which is designed as a backup system to control the hydraulic gradients east of the French Drain when necessary.

Sump 562 was installed at the mouth of the West Ravine in 1982, in order to intercept and collect storm water and seepage from the West Ravine fill.

The current storm water management system was upgraded in 1990 and is designed to prevent storm water from contacting buried waste, and to allow storm waters (not impacted by facility operations) to bypass soils and waste in the mouth of the West Ravine.

In addition, the old tank farm was removed in 1990 and a new, fully contained tank farm was constructed on another portion of the site.

OEPA Administrative Order on Consent Activities

The effort to complete the environmental assessment of the site and move toward final corrective action was formalized under an Administrative Order on Consent (Order), signed by the Ohio Environmental Protection Agency (OEPA) and EMD in 1992. The Order required completion and submittal of an OEPA approved Remedial Investigation and Feasibility Study (RI and FS).

Interim measures continued with additional improvements to the storm water management system, and the assessment and removal of small localized areas of soil contaminated with mercury and PCBs.

The required Environmental Indicator for "Current Human Exposures Under Control" (EI code CA725) was completed and submitted to OEPA, which gave its concurrence on April 20, 2002.

The RI was determined to be complete and approved by OEPA in 1996. The FS, which identified potential final corrective actions, was determined to be complete and approved by OEPA in 2004, which satisfied the terms of the Order.

VOLUNTARY CORRECTIVE ACTION AGREEMENT

On September 23, 2004, the U.S. EPA and EMD entered into a Voluntary Corrective Action Agreement (VCAA) for the completion of corrective action at the facility. This VCAA required the following:

- EMD will update the status of all SWMUs and areas of concern (AOC) which were identified in the 1990 Preliminary Assessment/Visual Site Inspection (PA/VSI) which was performed by the U.S. EPA;

This requirement was fulfilled by EMD's submission of a document entitled Technical Memorandum Addressing Conditions at the SWMUs and AOCs Specified in the PA/VSI Report – EMD Chemicals Norwood Facility, on December 22, 2004.

- EMD will submit its Environmental Indicator demonstration that "Migration of Contaminated Ground Water is Under Control" (EI code CA 750);

This requirement was fulfilled by EMD's submission of its draft CA 750 report in March 2005. EMD collected confirmatory ground water samples in support of the CA 750 in October 2005 and reported these in a December 2005 Technical Memorandum. U.S. EPA gave its concurrence to the CA 750 on December 28, 2006.

- EMD will conduct human health risk assessments as necessary to produce a Final Corrective Measures Proposal (CMP) for submission to the U.S. EPA;

EMD initially submitted the Human Health Risk Assessment Addendum (HHRAA) to the 1996 baseline risk assessment (included in the 1996 RI report) to the U.S. EPA in March 2005. This Addendum addresses potential exposures to contaminated soil for construction workers at the mouth of the West Ravine. After discussions by the parties of the human health risk assessment, the HHRAA, inclusive of all modifications, was accepted without additional comment by U.S. EPA on October 25, 2006.

EMD completed its Update to Post RI/FS Investigations Report, which describes investigations performed in support of the on-going corrective action process, in March 2005 and this document is supplemented by annual reports to the U.S. EPA, summarizing all field activities and data collected during the year.

EMD submitted the Final Draft CMP to U.S. EPA on November 3, 2006.

- U.S. EPA will provide the public with an opportunity to review and comment on the Final CMP and SB by means of a public notice. After consideration of the significant public comments U.S. EPA will provide a Response to Comments and the Notice of Final Decision;

- In accordance with Ohio's UECA, EMD will file the appropriate restrictive covenants to the property deed such as limiting future land use to industrial/commercial, protecting the ground water collection system, restricting construction on portions of the West Ravine cover, and other measures which may be necessary to support the remedy through institutional controls; and

- EMD will submit a Final Completion Report when the remedy is constructed and the associated restrictive covenants have been recorded by the Hamilton County Auditor.

STATUS OF SWMUs AND AREAS OF CONCERN INVESTIGATED

Eleven SWMUs and two areas of concern (AOCs) were identified by the U.S. EPA during its 1990 PA/VSI. The current statuses of the SWMUs and AOCs were reassessed as required by the VCAA and reported to the U.S. EPA on December 22, 2004.

SWMUs 6 through 10 (See Figure 2.) were investigated via soil and ground water sampling during the RI. SWMUs 6 through 9 were related to past site operations where releases of chemicals occurred that may have contributed to soil and ground water contamination beneath and off of the site. Chemical wastes from some of these SWMUs were reportedly routed via floor drains to the West Ravine during historical operations. Discharges to the West Ravine from these SWMUs were mitigated between the 1950s to the early 1980s by rerouting the pipelines from the floor drains to the facility's process sewer, which directed waste waters to the facility's pH neutralization tank, before discharges to the municipal sewer system. The Former Tank Farm (SWMU 8) was taken out of service in 1988 and removed in 1990, and replaced by a newly constructed tank farm which is located on the east-central portion of the facility.

SWMU 10 consists of the West Ravine leachate and storm water collection sump area (Sump 562), which was installed to capture leachate and drainage from the West Ravine. The West Ravine was a surface water erosional feature that was filled in stages with varying fill material as the site was developed between the 1950s and early 1970s. The northwestern portion was filled with soil and construction debris. The central and southeastern portions were filled with construction debris, and off-spec chemical waste containers, including glass bottles and debris from a building which was damaged by fire.

The last containers were placed in the West Ravine in the early 1970s. Given the length of time which has passed since wastes have been placed in the West Ravine, and the exposure of the wastes to precipitation and ground water, it is expected that most or all of the containerized wastes (with the exception of intact glass containers) would have been released over time. Owners of the facility constructed a 16-inch clay pipeline in sections at the base of the ravine as it was filled for the drainage of ground water from the unit. This pipeline presently discharges to Sump 562. Periodic sampling of the water discharged from the pipeline during investigations at the EMD facility has shown contaminant levels to be consistent, with no elevated "spikes".

The remaining SWMUs and AOCs did not require investigation during the RI. These SWMUs are either active units related to current facility operations, have been closed, or will be closed as part of the final corrective measures. After its acquisition of the site, EMD has worked to upgrade its processing systems and enacted procedures to mitigate releases and potential releases of contaminants from the facility.

SUMMARY OF FACILITY RISKS

Potential Human Health Risks

EMD has evaluated potential human health risks associated with the facility based on industrial land use for on-site conditions. Off-site conditions were evaluated with the assumption that use of adjacent downgradient properties (ODOT/NS transportation corridor) would remain the same. These risk evaluations presented in the RI and the Human Health Risk Assessment (HHRA) Addendum reached the following conclusions:

- On-site exposures resulting in risks above U.S. EPA risk reduction goals were found to be associated with the following scenarios: (1) workers potentially exposed to concentrations in indoor air above U.S. EPA risk reduction goals due to vapors potentially migrating from soils containing high concentrations of VOCs, and (2) construction workers potentially exposed through inhalation of vapors, and through direct contact with soils or waste in the West Ravine, resulting in soil ingestion or dermal contact with high concentrations of VOCs;

- The only identified, complete off-site exposure pathways were associated with a construction worker scenario in a limited area at the base of the West Ravine. In 2006, revised risk calculations were performed on soil sample data results from a May 2006 sampling exercise. This was done to determine whether current conditions indicate that risks due to COCs have decreased so that they are at or below risk based levels; and

- Site contamination was found not to pose a significant risk to identified or anticipated on-site ecology and no complete or significant ecological receptor exposure pathways were observed on or off-site in relevant areas.

Indoor Air Risks

The original Baseline Risk Assessment evaluated a range of potential exposure scenarios for the chemicals detected in soil and ground water at the site. In many cases, these scenarios involved hypothetical future land uses (such as residential land use) and exposure pathways that are highly unlikely to be complete. For the pathways and scenarios likely to be complete, the Baseline Risk Assessment identified potential exposures higher than a noncancer hazard index of one associated with exposures of construction workers. The HHRA Addendum updated the Baseline Risk Assessment to include evaluation of potential risks to on-site EMD workers from indoor vapor intrusion.

The excess lifetime cancer risk (ELCR) associated with vapor intrusion of carcinogenic COCs in soil was higher than $1x10^{-4}$ under a reasonable maximum exposure scenario and a noncancer hazard index slightly greater than one. The key assumption for this scenario is that an individual is located for 8 hours/day, 250 days/year for 25 years in a building that is situated over concentrations in both soil and ground water that represent the 95% upper confidence level on the average across the site. This is a conservative estimate of the potential risks because it is unlikely that the contaminant distribution in soil would achieve these high exposure levels, nor that an individual would be located continuously near concentrations in soil or ground water that might provide these high exposure levels.

EMD uses passive-diffusion organic vapor monitors to sample indoor air for a wide range of organic vapors. The monitors are analyzed using National Institute for Occupational Safety and Health (NIOSH) methods, with analytical reporting limits that provide estimates of concentrations in air which can be compared with appropriate occupational exposure limits. Exposure monitoring conducted at the EMD facility to date has reported that all concentrations in air fall below OSHA Permissible Exposure Limits (PELs).

Regarding the locations of buildings over buried wastes and contaminated soil, EMD has evaluated historic site information, aerial photographs and plot plans. The only buildings that are located over limited areas of the West Ravine are Buildings 17 and 4. The northeast corner of Building 17 (about 10% of the building's area) is restricted to a limited area in the middle portion of the West Ravine. This part of Building 17 which overlies the West Ravine is a slab on grade, with no subsurface basement. The southern portion of Building 17 has a basement that extends approximately 5 to 6 feet below ground surface and is located to the west and south of the West Ravine, not over it.

Less than 5% of Building 4, the southeastern corner, is located over a small area of the West Ravine. As discussed below, Building 4 is equipped with ventilation systems.

There are no other buildings or portions of buildings located over the West Ravine.

Buildings at the EMD facility have general dilution ventilation (i.e. normal heating – ventilating and air conditioning (HVAC) systems) or a combination of general dilution ventilation and local exhaust ventilation as appropriate for the operations which occur in a given area.

Examples of buildings with local exhaust ventilation controls include Buildings 4 and 17. Building 4 is divided into three separate "rooms" – B4, B4A and the Waste Department. Room B4 has two separate blower/exhaust systems with 4" diameter air ducts connected to each work station. B4A also has two separate blower/exhaust systems with one bench top hood and 4" ducts at each work station. The Waste Department has one blower/exhaust system with a 4" diameter duct at one work station. One portion of Building 17 (the basement) has one blower/exhaust system with 3" ducts connected to each work station and an additional blower/exhaust system with a 3" duct that runs continuously at night and on weekends. The other portion (the ground floor) has one blower/exhaust system connected to nine bench top fume hoods, one blower/exhaust system with a 4" duct at a work station, and an additional blower/exhaust system with a 3" duct which runs continuously at night and on weekends. As discussed, ventilation controls maintain concentrations of organic vapors below occupational exposure limits in indoor air.

Construction Worker Exposure Risk

The ELCRs for construction workers either in on or off-site locations fall within the risk reduction range of $1x10^{-6}$ to $1x10^{-4}$, and are not associated with a significant noncancer health risk.

The HHRA Addendum identified the potential for excess noncancer health effects to construction workers excavating off-site soil in the area of the mouth of the West Ravine. Based on investigations to date, the soils located at the mouth of the West Ravine contain the highest concentrations of COCs in off-site soils impacted as a result of historical operations. The noncancer risks were driven primarily by elevated concentrations of carbon tetrachloride detected in soil samples collected by EMD from two test borings in 1997. As part of EMD's corrective measures evaluation, these locations were resampled for EMD's site-specific list of VOCs in May 2006, and updated risks were calculated for construction worker exposure to off-site soils.

This resampling and analysis showed substantial decreases in concentrations of carbon tetrachloride in soil at the mouth of the West Ravine. This resulted in corresponding reductions in estimated noncancer risks to construction workers. Concentrations of other compounds (primarily 1,2 dichloroethane and vinyl chloride) increased in these soil samples. The increased concentrations are likely caused by a combination of factors which include the formation of degradation products and the variability in distribution of chemicals within the volume of soil. These concentrations of vinyl chloride and 1,2 – dichloroethane were included in the HHRA Addendum calculations which demonstrated that the ELCRs for on or off-site construction workers are within the risk reduction range of $1x10^{-6}$ to $1x10^{-4}$. Based on the conclusions drawn in the Conceptual Model of Current Conditions that indicate that no off-site sources of contamination exist, current monitoring data that indicate that concentrations of COCs in ground water are stable to decreasing, the interim corrective measures already taken by EMD, and future corrective measures that will control potential from the West Ravine by both containing buried

waste and intercepting contaminated ground water which flows through the former ravine, it is unlikely that concentrations of COCs in off-site soils will increase over time.

The estimated noncancer hazard index for liver effects in construction workers decreased substantially based upon the new sampling results. However, the estimated noncancer hazard index for kidney effects increased slightly. These changes correspond to the relative decreases of some VOCs (carbon tetrachloride) and increases in others (1,2 dichloroethane). Overall, the highest hazard index was 1.1, based on kidney effects from potential exposure to 1,2-dichloroethane.

The key assumption for the reasonable maximum exposure scenario is that an off-site construction worker is always exposed to the 95% upper confidence level on the average concentrations in both soil and ground water, and that the worker is always located at the mouth of the West Ravine. Use of the 95% upper confidence level on the average provides a very conservative indication of potential human health risks. Because risks under the reasonable maximum exposure case do not substantially exceed a noncancer hazard index of 1.0, it is concluded that soil and ground water contaminants off-site do not pose significant noncancer health risks to construction workers. However, the potential risk will be addressed by the interceptor trench that will be designed to mitigate future VOC migration to off-site soils. Based on the investigations and studies performed to date, the implementation of corrective measures in combination with natural attenuation, will cause the continued and likely accelerated degradation of existing contaminant concentrations in off-site soils over time.

The HHRA Addendum, including all revisions requested by the U.S. EPA, was accepted without additional comment by the Agency on October 25, 2006.

Off-Site Ground Water

EMD Chemicals Inc. is proposing to install a ground water containment system at the property boundary to assure that COC concentrations remain below risk based goals at the property boundary point of compliance. Off-site concentrations of COCs in ground water are currently below the calculated risk reduction goals for this site, which are explained as follows. It is anticipated that that COC concentrations in off-site ground water will be reduced by natural attenuation over time. Evaluation of potential exposure pathways to contaminants in ground water took into consideration the industrial/commercial land use classification and zoning around the site. Potential exposures and risks were evaluated using current reasonably anticipated future land use.

As discussed in the HHRA Addendum, the only potentially complete exposure pathway from off-site contaminated ground water is to construction workers who might perform intrusive work. The HHRA Addendum evaluated the risks to construction workers who might become exposed to constituents detected in the off-site ground water. Using the data gathered from the quarterly ground water monitoring which has been performed since 2003, the HHRA Addendum established that the risk to construction workers via this pathway is currently within or lower than the risk reduction range of 1 in 10,000

($1x10^{-4}$) to 1 in 1,000,000 ($1x10^{-6}$), or more specifically, at a risk reduction less than 1 in 100,000 ($1x10^{-5}$).

In accordance with these conclusions, the following risk-based point of compliance (i.e., the EMD property boundary) cleanup standards were established based on the assumption that construction workers may become exposed through dermal contact and by inhalation of vapors emitted from ground water which may pond in excavations:

Chemical	**Proposed Risk-Based Cleanup Standard (mg/L*)**
1,2 – dichloroethane	13
cis 1,2 – dichloroethene	9.4
1,4 – dioxane	1,000
benzene	2
tetrachloroethene	0.28
trichloroethene	3.5
vinyl chloride	1.25

* Parts per million

These off-site cleanup standards are based on a $1x10^{-5}$ increased lifetime cancer risk and a non-cancer hazard quotient of 1. These cleanup standards assure that cumulative risk from multiple contaminants in ground water will fall within U.S. EPA's desired risk reduction range of $1x10^{-4}$ to $1x10^{-6}$. As stated above, these standards have been consistently met over the past four years in off-site contaminated ground water without implementation of the proposed corrective measures.

The proposed risk-based cleanup standards are currently being met and concentrations of COCs in off-site ground water are expected to decrease over time through natural attenuation following installation and operation of the proposed corrective measures. To ascertain that the level of protectiveness remains, will monitor the downgradient off-site ground water for the COCs listed above at the following frequency:

- 1 – 3 years post-implementation: Semi annually in April/May and in October/November;
- 4 – 5 years post-implementation: Evaluate the first 3 years of data to assess containment and COC monitoring strategy, and
- Beyond 5 years post-implementation: Assess the need for future monitoring.

Ecological Risks

An ecological risk evaluation completed during the RI process determined that the overall potential for long or short term ecological risks at the site or at associated off-site locations was negligible. Relatively few flora or fauna were identified due to the industrial nature of the area.

EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

Corrective Action Objectives

The following objectives are to be considered when final corrective measures (final remedy) are selected:

- The remedy must be protective of human health and the environment;
- The source(s) of contaminant release must be controlled;
- The remedy must comply with applicable standards for waste management (eg. Clean Water Act, Clean Air Act, etc.);
- The remedy must be cost effective;
- The remedy must be designed for long term reliability and effectiveness, and
- The remedy should reduce the toxicity, mobility or volume of wastes.

Evaluation of Alternatives

As part of the final remedy identification and proposal development, several remedial technologies and actions have been evaluated for their ability to meet corrective action objectives for the EMD site. Corrective measures study evaluations have focused on four basic alternatives:

- No Action;
- *In-Situ* Treatment;
- Source Removal/Excavation, and
- Containment with Institutional Controls.

Of the four options, on-site containment and limited excavation were found to be the most protective of human health and the environment and cost effective. The corrective measures alternatives are discussed below.

Alternative 1 – No Action

A no-action approach would leave waste, impacted soil and ground water in place, with no containment or exposure controls. This approach results in the following:

- No protection against potential future releases of contaminants that could migrate off-site, and

- No controls to prevent unacceptable risk associated with: (1) excavation into the West Ravine waste by future property owners; (2) on-site risks to indoor air quality, and (3) excavation into soil and ground water which contain COCs above site risk based levels for construction workers in affected areas outside of the West Ravine.

Natural attenuation processes would continue. However, there would be no means to verify or monitor its progress.

The No Action alternative does not provide the level of protection for human health and the environment that the U.S. EPA and EMD have incorporated into the site's corrective action objectives. Therefore, the U.S. EPA and EMD do not consider "No Action" to be a viable final remedy.

Alternative 2 – In Situ Treatment

The *In-Situ* treatments such as soil flushing, bioventing and hydraulic fracturing were removed from consideration during the screening process because any one treatment cannot address all contaminants of concern and/or would be ineffective because of the physical nature of the geology beneath the site. The October 25, 1996, *Remedial Investigation Report* describes the geology of the West Ravine area as a complex series of clay, silty clay and sandy layers which are not always horizontally continuous. The permeability of these layers varies from very low in the portions which are predominantly clay to more moderately permeable where more sand is present. EMD also determined that the exact locations of chemical waste burial in the West Ravine cannot be determined because of both the random nature of waste disposal during the filling of the unit, and the presence of buried concrete and other hard debris which hinder drilling operations. *In-Situ* treatment technologies are usually implemented through a process of drilling into the underlying wastes and geology. The *In-Situ* approach would result in the following:

- Require multiple technologies to address all contaminants of concern that could not be implemented concurrently;

- Inconsistent response from pumping of vapor extraction because of the low permeability and heterogeneous nature of the site geology;

- Inability of vapor extraction to extract all COCs (i.e., 1,4 – dioxane), and

- Would not address buried wastes.

In-Situ treatment methods do not appear to meet all corrective action objectives for the site. Therefore, this option was not given further consideration.

Alternative 3 – Source Removal/Excavation

Although the wastes buried in the West Ravine are currently stable, source removal would greatly reduce the potential for unacceptable exposures to hazardous materials and future releases to soil and ground water. Source removal would require an excavation project which would include:

- Excavation and stabilization of West Ravine waste, and transportation of the waste to an incineration facility for destruction;

- Excavation of all soils that have concentrations of contaminants above calculated removal levels, and

- Monitoring of ground water to assure compliance with risk reduction goals associated with both construction workers and indoor air pathways.

Such a large-scale excavation project would, however, raise the following issues:

- Excavation and stabilization of waste during construction present an exposure risk that does not currently exist. Removal and transportation activities would likely result in unacceptable releases of COCs to human and environmental receptors through volatilization of contaminants and unpredictable chemical reactions caused by the mixing of wastes that had been in separate containers;

- Excavation will likely not address the entire volume of soil and ground water which create on-site risks, due to the logistics of excavating to the depth necessary within an active commercial facility;

- Excavation may jeopardize the foundations of adjacent buildings, and

- Even limited excavation of soil and waste will cause the EMD facility to shut down for a period of months.

Many of the issues identified above also make this a costly option. Excavation of the mouth to the middle of the West Ravine, which is beneath operating portions of the EMD facility, was assessed at $15 million under the OEPA *Feasibility Study.* Also, because much of the excavated wastes would be considered listed hazardous wastes under RCRA, these materials would have to be treated by incineration, which could cost an estimated $150 million.

Alternative 4 - Containment with Institutional Controls

This set of remedial options is focused on engineered controls to provide containment of wastes in the West Ravine and the capture of contaminated ground water which flows from the facility, combined with institutional controls to prevent the exposure of human and environmental receptors to contaminants. This alternative is protective of human health and the environment and provides the following benefits:

- On-site containment of identified environmental risks;
- West Ravine waste is maintained in its current stable condition;
- Infiltration of surface water into West Ravine waste is controlled by the cover and storm water management system;
- Any potential future releases of COCs into ground water from West Ravine wastes would be hydraulically contained thus preventing off-site migration of COCs;
- Capture of ground water migrating through on-site contaminated soil, which will assure that concentrations of COCs in off-site ground water remain below risk-based levels, which will allow natural attenuation to continue to decrease COC concentrations over time;
- Mass removal of contaminants via ground water interception and *in-situ* remediation at the former tank farm area;
- No releases of contaminants that could impact human health and the environment, which would be caused by any alternative which proposes intrusive excavation of waste from the West Ravine;
- Long term monitoring of ground water for the COCs at the point of compliance (i.e., the facility boundary) as described on Page 14 of this SB, ensuring the efficacy of the containment, and

- Institutional controls that will run concurrent with the land, to restrict future land use, prohibit the use of ground water for potable purposes, and ensure the maintenance of the cover and ground water capture system.

For the reasons listed above, this option will be protective of human health and the environment during construction and during operation.

The present estimated cost of construction is $7.6 million, with approximately $90,000 per year in O&M and monitoring costs.

The U.S. EPA proposes Alternative 4 as the final corrective measures for EMD Chemicals Inc.

SCOPE OF FINAL CORRECTIVE MEASURES

The proposed final corrective measures would be constructed as illustrated in Figure 3. This remedy should achieve the corrective action objectives as described below.

Containment of Contaminated Ground Water via Collection Trench and Low Permeability Containment Wall

Contaminated ground water that is migrating toward the southern property boundary will be collected in an interceptor trench to prevent off-site migration of COCs above risk-based goals. Although the ground water currently migrating off-site to the southeast does not contain COCs at concentrations above current land use scenario risk reduction goal of 1×10^{-5}, capturing this ground water will ensure that concentrations of COCs that have already flowed off-site will be reduced over time through natural attenuation.

The ground water collection trench will be installed in the area shown in Figure 3. The trench will be excavated to the elevation of the bottom of the perched aquifer, and will be filled with gravel to promote gravity flow to a central sump. From the sump, the contaminated ground water will be pumped back to the EMD facility, processed through EMD's existing pretreatment system, and will be discharged to the local publicly owned treatment works as permitted by the City of Cincinnati. Currently, the average amount of water discharged to the local POTW is anticipated to be approximately 10 gallons per minute for the combined collection trench and French drain system. The City of Cincinnati is aware of EMD's intent to perform corrective action at the West Ravine, which would include the continued discharge of extracted ground water to its POTW, and EMD and the City will modify the discharge permit as necessary as the ground water extraction system commences operation.

In addition to a collection trench, a low permeability containment wall will be installed hydraulically downgradient of the collection trench. The wall will provide structural protection for the collection trench, and will provide a secondary benefit of added containment. The wall will extend along EMD's property line, and will be designed so that potential future expansion of the highway alongside the EMD property will not adversely affect the long term integrity of the remedy. This containment wall will be installed prior to the ground water collection trench for easier construction of the trench and to provide a measure of isolation of construction activities from State Route 562.

Water collected at the French Drain and Sump 562 is currently processed through the existing pre-treatment and pH neutralization system, then discharged to the publicly owned treatment works (POTW) under EMD's permit with the City of Cincinnati. Ground water collected by the proposed collection trench and new on-site sump will be processed and discharged with the ground water collected by the French Drain as part of the final remedy. EMD's existing permit with the POTW will be modified as required.

Containment of Ground Water via French Drain/Well P6A System

The existing French Drain ground water collection system will continue to operate to prevent impacted ground water containing site COCs at concentrations above risk based levels from migrating to the eastern property boundary. This system captures ground water from the perched aquifer beneath the central portion of the property. Recovery well P6A will be retained as a backup to the French Drain system.

Containment of Waste via Ravine Cover/Storm Water Management System

In order to provide effective containment of the wastes contained in the West Ravine, and to minimize or eliminate the release of contaminants from these wastes, the cover system will be designed and constructed to meet the Federal cover design requirements found at Title 40 Code of Federal Regulations §264.552(e)(6)(iv). The cover system will meet the following performance criteria:

- Provide long-term minimization of surface water infiltration into the soil and materials contained in the West Ravine;
- Function with minimal maintenance;
- Promote drainage and minimize erosion or abrasion of the cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained, and
- Have a permeability less than or equal to the permeability of any bottom liner or natural subsoils present.

In addition to meeting the performance criteria listed above, the cover system will virtually eliminate the infiltration of surface water and will prevent direct to wastes by humans or burrowing animals. Soils consolidated and backfilled at the mouth of the West Ravine will be amended with clean fill and compacted in lifts to achieve compaction specifications that will minimize settling. In addition, the concrete cover system will be reinforced to prevent cracking.

The proposed cover system to be constructed over the West Ravine will consist of reinforced concrete over a compacted subgrade which will minimize settling. The permeability range of concrete is 10^{-10} to 10^{-11} centimeters per second (cm/sec), which is much less than the permeability of the natural subsoil beneath the unit (10^{-6} to 10^{-9} cm/sec). The concrete will be inspected periodically as specified in and an operations and maintenance (O&M) manual that will be prepared upon completion of design. The O&M manual will also contain procedures to repair any cracks in order to maintain integrity of the cover.

At the southern margin of the West Ravine near the ground water capture trench and retaining wall, the cover system will be sufficiently sloped away from the wall to direct surface water flow to catch basins, to prevent ponding. The rest of the (concrete) cover system will be sloped for drainage of surface runoff into catch basins and grated channels, which will direct flow to EMD's existing storm water sewer system for discharge under the company's existing National Pollutant Discharge Elimination System permit, which will be amended as necessary.

As part of facility modernization plans and the proposed corrective measures, storm water will be managed through an upgrade of the existing storm drainage system to be compatible with the new surface cover system. Storm water will be captured and diverted away from the West Ravine area through conveyance piping that will ultimately deliver the storm water to Duck Creek.

Removal of Off-Site Waste

During construction activities, visible and accessible wastes associated with on-site activities will be removed from off-site construction areas. This waste is thought to include concrete demolition debris. This waste could also include broken or intact bottles of off-spec chemicals that were historically buried in the West Ravine, although previous investigations indicate that off-site waste is expected to consist primarily of construction debris. Waste materials which have been removed from off-site will be placed into the West Ravine to be managed in place within the containment system.

Vapor Controls through Institutional and Engineered Controls

Institutional and engineered controls are proposed to manage the potential on-site air exposure pathway identified in the HHRA Addendum. The potential excavation exposure pathways will be addressed on-site through currently practiced facility guidelines and physical indoor air management.

EMD will create and utilize documented facility guidelines and health and safety plans to ensure that all staff and subcontractors adhere to the site-specific health and safety plan. The 24-hour surveillance and fencing of the facility prevents unauthorized and uninformed personnel from accessing the site and circumventing these controls. Current normal operating procedures and industrial hygiene practices in conjunction with adequate indoor air exchange through building ventilation systems will continue to prevent exposure by assuring that workers are protected via engineered controls along with safe operating procedures, and that indoor air exchange rates are great enough to provide the necessary level of protection against potential vapor intrusion.

A documented facility management plan will be created and will remain in place to detail the indoor air quality control procedures.

Institutional Controls

Institutional controls are proposed to manage the potential on-site construction worker exposure pathways identified in the HHRA Addendum. This potential excavation exposure pathway will be addressed on-site through currently practiced facility guidelines and through the filing of a deed restriction for the property with the Hamilton County Ohio Auditor's Office. EMD will create and utilize documented facility guidelines and health and safety plans to ensure that all staff and subcontractors adhere to the site-specific health and safety plan when performing subsurface excavation work. The 24-hour surveillance and fencing of the property prevents unauthorized and uninformed personnel from accessing the site and circumventing these controls.

These procedures will be part of a documented facility management plan that will detail the subsurface work restrictions.

A restriction which limits the use of the land to industrial use only will be enacted through a deed restriction that will be carried as a restrictive covenant to the property through all land ownership transfers (run concurrent with the land). The deed restriction will deter the following:

- Prohibit residential or recreational use of the property;
- Subsurface excavation without proper controls and personal protective equipment;
- Potable use of perched ground water (also currently restricted from use under the Ohio Administrative Code Rule 3701-28-10), and

- Construction of buildings without proper engineered and institutional controls.

Remedy Supplement – Former Tank Farm

In order to supplement the final corrective measures at the West Ravine, EMD will undertake additional measures to reduce soil and ground water contamination in the former tank farm area, thereby reducing a source of ground water contamination. Although this remedy is not an essential part of the overall corrective measures for the West Ravine, the removal of contamination at the former tank farm area will reduce contaminant loading at the ground water collection trench, which is designed to intercept all ground water which flows beneath this location.

Based on existing data, the horizontal and vertical extent of contamination beneath the former tank farm area has been delineated in the Conceptual Model of Current Conditions. The principal contaminants are 1,4-dioxane, chlorinated hydrocarbons and benzene. The potential risks from exposure to these contaminants were evaluated in the HHRA Addendum.

In addition to trespassers, risks to outdoor industrial workers and construction workers were assessed in the HHRA Addendum. The risk to these groups fell within the target risk range of $1x10^{-4}$ to $1x10^{-6}$, and below a noncancer hazard index of 1. The potential risk to indoor industrial workers is $3x10^{-4}$, slightly higher than the upper end of the target risk range.

The majority of the former tank farm area is located above what had been the western slope of the West Ravine, approximately 90% within the footprint of the West Ravine (Figure 2). Therefore, 90% of the former tank farm area falls within the boundary of the concrete cover and institutional controls which are proposed as parts of the final corrective measures.

EMD's corrective measures in the West Ravine will include *in-situ* treatment of contamination in the former tank farm area. The purpose of this activity will be to reduce COC mass in the ground water at this area. Because the former tank farm is located immediately upgradient from EMD's proposed ground water containment system, ground water flowing through the former tank farm area will ultimately be captured by the system's hydraulic containment trench.

The supplemental corrective measures at the former tank farm area will consist of the following (Ref. Figure 4):

- Installation of *in-situ* chemical oxidation (ISCO) injection wells completed below the water table and screened in two separate water bearing formations located in the former tank farm area. Figure 4 identifies the approximate locations of these wells. The exact number of wells is dependent on drilling conditions due to subgrade construction debris. It is expected that no fewer than 14 and no more

than 19 injection wells will be installed. The actual ongoing design work may result in some changes in the number or locations of wells. If this occurs, EMD will submit such changes to U.S. EPA for review and approval.

- Nested piezometers and/or ground water monitoring wells will be installed at approximately seven locations within the former tank farm area which will allow EMD to monitor the hydraulics of the ISCO injection and to evaluate its impacts. Figure 4 identifies the approximate locations of these monitoring points.

- An oxidant chemical will be injected through the ISCO wells and may, if technically beneficial, to be followed by injection of potable water to assist pushing the injected chemical further into the subsurface. No fewer than three and no more than four injections of the oxidant chemical will occur at each injection well, unless a well or wells are determined to be technically ineffective (as explained below). The final number of injections will be dependent on evaluation data (see bullet points below regarding asymptotic conditions and technical ineffectiveness). Oxidant chemicals which are currently being considered are activated sodium persulfate or modified Fenton's Reagent. Bench scale testing will be performed during design to determine the optimum approach.

- Performance monitoring will be conducted both during and following injection events to determine the effectiveness of injection and the time between chemical injection events. Performance monitoring will consist of the following:

  During/immediately following injection – (1) Injection rate of chemical injected; and (2) hydraulic response monitoring via water level measurement at monitoring wells and piezometers.

- Post-injection monitoring consisting of collecting and analyzing ground water samples from the monitoring wells to determine the reduction of COC mass in ground water. The performance monitoring event schedule follows:

  First event – performed 2 to 4 months after injection.

  Second event – performed 6 to 7 months after injection.

- The number of injections will be evaluated by a review of the performance monitoring data. The number of planned injections will be reduced or discontinued if one of the following conditions are observed:

  Asymptotic conditions ("knee" of the graphic curve) are observed with respect to reduction of COC concentrations in ground water in the treatment zone, indicating that injected oxidants have reached the limit of ability to reduce contaminant mass, or

Low permeability (tight) subsurface conditions cause ineffective delivery of oxidant chemical into the target soil horizon through the injection wells. A well will be considered technically ineffective in this circumstance, and will be properly abandoned (closed) and removed from the list of injection wells.

- Before shut down and dismantling of the treatment system, EMD will prepare a report of findings of the oxidation treatment program and will submit this report for U.S. EPA review and approval.

- EMD will prepare and submit all paperwork required to comply with OEPA regulations for underground injections.

- All monitoring and injection wells will be properly abandoned (closed) in accordance with OEPA regulations once their use is discontinued for this activity.

Remedy Supplement – Limited Excavation of Off-Site Soils

As previously discussed, Sump 562 will be removed during construction of the final corrective measures. As part of the removal, EMD will also remove soils from around the sump which are determined to be contaminated through visual screening and field instruments (e.g., photo ionization detector). The excavation of these soils will be limited by physical barriers such as the railroad bridge and the highway.

PERFORMANCE STANDARDS FOR FINAL CORRECTIVE MEASURES

On-Site Performance Standards

Effectiveness of containment (of waste and contaminated ground water) will be demonstrated through the following observations:

- Stable surface conditions are maintained in areas where subsidence is possible, and
- Concentrations of contaminants in ground water do not increase and will likely decrease.

Effectiveness of engineered controls will be demonstrated through the inspection of the following:

- Site cover will be monitored for cracks and erosion, and
- The condition of the fencing around the site will be inspected for integrity.

Institutional controls will include:

- Deed restriction ensuring industrial use of property is filed, and
- Site operational practices and controls are implemented to protect workers.

Off-Site Performance Standards

Visible and accessible wastes associated with on-site activities will be removed.

Off-site soils in the vicinity of Sump 562 which are identified as contaminated by visual screening and field instruments (e.g., photo ionization detector) will be removed to the extent practical during construction of the final corrective measures. Excavation will be limited by physical constraints, such as the highway and railroad bridge.

Off-site perched ground water is not a potable water source because (1) yields of water from monitoring wells are unsustainable; (2) current land use of the off-site area of concern (railroad corridor and transportation corridor) where perched ground water containing COCs exists prohibits construction of potable water wells, and (3) installation of potable ground water wells in proximity to known ground water contaminant sources is prohibited by Ohio Administrative Code Rule 3701-28-10.

Point of compliance is the EMD facility boundary.

PERFORMANCE MONITORING OF FINAL CORRECTIVE MEASURES

The general monitoring program designed to demonstrate that the performance standards will be met by the proposed final corrective measures will consist of the following elements.

Containment

Performance monitoring for containment will consist of the following:

- Effectiveness of engineered controls installed to virtually eliminate surface water infiltration into the waste and to help prevent direct contact with the soils will be demonstrated through visual monitoring for cracks in surface cover and building foundations, subsurface subsidence and soil erosion;

- Ground water level monitoring and mapping will be conducted in order to assess hydraulic containment at the point of compliance;

- Sampling of ground water from downgradient monitoring wells and its analysis for the COCs at the frequency specified on page 14 of this SB, and

- Monitoring of effluent from the ground water collection trench will be performed to determine if releases of chemicals from the West Ravine are occurring, as indicated by a "spike" in contaminant concentrations, which would require additional confirmatory samples and inspection of the cover system.

Risk reduction goals will be used as performance standards at the point of compliance for the final corrective measures. The point of compliance will be the southern property boundary from the western extent of the EMD property to the NS railroad bridge, and the eastern property from the northeast property corner to the NS railroad bridge. MCLs are not applicable because the ground water is not a source of drinking water.

Containment will be confirmed through off-site COC monitoring, discussed below, and through ground water elevation monitoring at the monitoring wells utilized in the pre-remedy installation quarterly ground water sampling events. During the first year of this proposed monitoring, ground water levels will be gauged on a quarterly basis to demonstrate that hydraulic control is being achieved by the corrective measures and to establish a baseline for ground water flow with the remedy in place. For four years following this one year demonstration, the number of monitoring wells and the frequency of gauging will be reduced to a subset that will monitor for significant departures from the baseline, which may indicate that hydraulic capture may not be occurring. The number of wells and the frequency of monitoring will be evaluated based on the data, and the proposed new monitoring plan will be submitted to the U.S. EPA. Termination standards for ground water elevation monitoring will include a demonstration that the system can maintain consistent hydraulic containment for a period of five years.

Effluent monitoring will begin concurrently with the monitoring well static water level gauging. Effluent monitoring for COCs will be performed on a monthly basis for the first two years, at which time the sampling schedule may be re-evaluated. Concentrations observed in the effluent will be measured against the POTW discharge permit requirements.

Visual inspections of remedy components will occur monthly for the first year and quarterly for the next four years. At the end of this five year period, the frequency of inspections will be re-evaluated. Surface inspections will consist of visual observations of the entire surface cover in the area of the remediation system to determine if subsidence, erosion or significant fractures of the cover have occurred. Visual inspection of the retaining wall for seeps and of the security fence for integrity will also be performed.

The results of visual inspections and the monitoring of effluent and ground water will be reported to the U.S. EPA on a quarterly basis in the Quarterly Progress Reports which EMD has been submitting to the Agency under Condition VII.B. of the Voluntary Corrective Action Agreement. The reporting frequency may be modified upon discussion and agreement between U.S. EPA and EMD.

COC Monitoring

To assess the post-implementation trend of COC concentrations in off-site ground water, samples will be collected from selected monitoring wells by the following schedule:

- 1 – 3 years post-implementation: Semi annually in April/May and in October/November;
- 4 – 5 years post-implementation: Evaluate the first 3 years of data to assess containment and COC monitoring strategy, and
- Beyond 5 years post-implementation: Assess the need for future monitoring.

The purpose of the 1 – 3 year proposed schedule is to perform COC monitoring at the typical high precipitation period (April/May) and low precipitation period (October/November) times of the year. If data trends indicate that the hydraulic containment system is achieving containment through ground water elevation measurements, and that off-site COC concentrations in the ground water are stable or decreasing, the frequency of COC monitoring may be changed to annual. If U.S. EPA and EMD agree that concentrations of COCs in off-site ground water are stable or decreasing after five years of COC monitoring, additional scheduled monitoring is not currently anticipated to be necessary. However, U.S. EPA and EMD may elect to conduct additional periodic monitoring beyond the five year schedule described above.

PUBLIC PARTICIPATION

The U.S. EPA is soliciting comments from the public on the corrective measures alternatives presented in this document for EMD Chemicals Inc. The U.S. EPA has scheduled a public comment period of 45 days from August 5, 2008, to September 19, 2008, in order to encourage public participation in the decision process. During the public comment period, the U.S. EPA will accept written comments on the proposed action. The public may submit written comments, questions and requests for a public meeting to the following address:

United States Environmental Protection Agency, Region 5
Remediation and Reuse Branch (LU-9J)
77 West Jackson Boulevard
Chicago, IL 60604
(800) 621-8431
Attention: Don Heller

The administrative record is available for public review at the following two locations:

Cincinnati Public Library, Norwood Branch
4325 Montgomery Road
Cincinnati, Ohio

And

United States Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604
Attention: Don Heller

After U.S. EPA's consideration of the public comments that are received, they will be summarized and responses will be provided in a Response to Comments document. The Response to Comments document will be drafted after the conclusion of the public comment period and will be incorporated into the administrative record.

APPENDIX B

To be recorded with Deed Records - ORC § 317.08

ENVIRONMENTAL COVENANT

This Environmental Covenant ("Environmental Covenant") is made as of the _____ day of ____, 201__, by and among EMD Chemicals Inc., a New York corporation, f/k/a EM Industries Incorporated ("EMD"), which is the Owner of the property located at 2909 Highland Avenue, Cincinnati, Ohio ("Property") (as further defined below) and the Holder (as further defined below), pursuant to Ohio Revised Code ("ORC") §§ 5301.80 to 5301.92 for the purpose of subjecting the Property and the Restricted Areas (as further defined below) to the Activity and Use Limitations and to the rights of access described below.

Recitals

Whereas, the Property may be subject to Sections 3008(h) and 7003 of the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6928(h) and 6973.

Whereas, on September 27, 2004, EMD entered into a Voluntary Corrective Action Agreement ("VCAA") with the U.S. Environmental Protection Agency ("U.S. EPA") to investigate and remediate the source of contamination located at the Property. Pursuant to the VCAA, EMD completed a RCRA Facility Investigation ("RFI"), Environmental Indicators Reporting, a Corrective Measures Proposal ("CMP"), and a Final CMP to investigate, and as necessary, stabilize and remediate releases of hazardous wastes or hazardous constituents, as defined by 42 U.S.C. §6903 and 40 C.F.R. Part 261, at or from the Property.

Whereas, on August 4, 2008, U.S. EPA issued for public notice and comment the Statement of Basis for the Property. On November 5, 2008, U.S. EPA issued the Notice of Final Decision and Response to Comments for selection of the corrective measures ("NFDRC") at the Property.

Whereas, the NFDRC provides for engineering controls, including: removal of off-Property waste and consolidation with on-Property waste; containment and management of on-

Property waste in-place; treatment of certain on-Property contaminated ground water; and, containment of on-Property contaminated soils and materials and ground water. The NFDRC also provides for institutional controls. Institutional controls include specific Activity and Use Limitations to limit use of the Property to non-residential uses (i.e., commercial or industrial) and the prohibition of use of Perched Ground Water (as defined below) from beneath the Property. Institutional controls also require implementation of an Operation & Maintenance Plan ("O&M Plan") to ensure that the engineering and institutional controls continue to function as designed to meet corrective action objectives.

Whereas, on _____, 201__, EMD Chemicals, Inc. and U.S. EPA entered into an Administrative Order on Consent ("AOC") signed by EMD on _____, 201__ and signed by U.S. EPA on _____, 201__ with Docket No. _____. The AOC was issued as part of U.S. EPA's authority to require environmental remediation and corrective measures under RCRA, 42 U.S.C. §§ 6901 et seq. The NFDRC issued by the U.S. EPA, and the actions to be carried out by EMD Chemicals pursuant to the AOC, constitute an Environmental Response Project, as defined by § 5301.80(E) of the Ohio Revised Code.

Whereas, U.S. EPA maintains an Administrative Record related to its selection of the Corrective Measures for the Property ("NFDRC Administrative Record") at U.S. EPA, Region 5, Land and Chemicals Division, RCRA Records Center, 7th Floor, 77 West Jackson, Chicago, Illinois, 60604-3590 and at the Cincinnati Public Library, Norwood Branch; 4325 Montgomery Road; Cincinnati, Ohio.

Whereas, the Owner and Holder hereto have agreed to (i) allow a permanent right of access over the Property to the Access Parties (as defined below) for purposes of implementing, facilitating or monitoring the NFDRC, and (ii) impose Activity and Use Limitations on the Property as covenants that will run with the land for the purpose of protecting human health and the environment.

Whereas, pursuant to ORC § 5301.81(B), the right of the U.S. EPA as an agency under ORC §§ 5301.80 to 5301.92, and under this environmental covenant, is not an interest in real property.

NOW, WHEREFORE, Owner, Holder and U.S. EPA ("Parties") agree as follows:

1. Definitions All capitalized terms, except those defined elsewhere in this Environmental Covenant, shall be defined as set forth in this Paragraph 1. A capitalized term in this Environmental Covenant which is not otherwise defined in this Environmental Covenant shall have the same meaning as set forth in Sections 5301.80 to 5301.90 of the Ohio Revised Code or RCRA.

A. "Agency" means the U.S. EPA and any successor agency and its respective officers, employees, agents, contractors and other invitees. For the purposes of this Environmental Covenant, the U. S. EPA is the agency which determines or approves the Environmental Response Project pursuant to which this covenant was created. U.S. EPA is also responsible for overseeing the NFDRC, corrective measures, and Activity and Use Limitations at the Property and therefore, is the "Agency" as defined in ORC §5301.80(B) and the "Applicable Agency" as that term is used in ORC §§5301.80-5301.92.

B. "Access Parties" mean the Ohio Environmental Protection Agency ("Ohio EPA") and U.S. EPA and their respective officers, employees, agents, contractors and other invitees (collectively, "Access Parties").

C. "Administrative Order on Consent" ("AOC") means the AOC entered into between EMD Chemicals., Inc. and the U.S. EPA which was signed by EMD on _____, 201__ and signed by U.S. EPA on _____, 201__ with Docket No. _____. The AOC was issued as part of U.S. EPA's authority to require environmental remediation and corrective measures under RCRA.

D. "Final Corrective Measures Proposal" ("Final CMP") means the Final Corrective Measures Proposal documenting the Corrective Measures proposed by EMD to complete corrective action objectives for the Property.

E. "Holder" means EMD Chemicals Inc., a New York corporation, whose address is 2909 Highland Avenue; Cincinnati, Ohio, and its successor and assigns.

F. "Industrial/Commercial Activities" means, but is not limited to, any or all of the following: (i) wholesale and retail sales and service activities including, but not limited to retail stores, and automotive fuel, sales and service facilities; (ii) governmental, administrative and general office activities, (iii) manufacturing, processing, packaging, handling and warehousing activities, including, but not limited to, production, storage and sales of durable goods and other products; (iv) research and development, including all ancillary and supporting activities incident thereto; (v) other office and warehousing activities, including but not limited to production, processing, storage and sales of chemicals, chemical intermediates, blend-stocks, feed-stocks and/or by-products, durable goods; and (vi) activities which are consistent with or similar to the above listed activities together with related parking areas and driveways, but excludes Residential and Other Prohibited Activities.

G. "Notice of Final Decision and Response to Comments" ("NFDRC") means the Notice of Final Decision and Response to Comments for selection of the corrective measures at the Property issued by U.S. EPA on November 5, 2008.

H "NFDRC Administrative Record" means the Administrative Record which U.S. EPA maintains related to its selection of the final corrective measures for the Property. U.S. EPA maintains the NFDRC Administrative Record at U.S. EPA, Region 5; Land and Chemicals Division; RCRA Records Center, 7th Floor; 77 West Jackson Blvd.; Chicago, Illinois, 60604-3590 and at the Cincinnati Public Library, Norwood Branch; 4325 Montgomery Road; Cincinnati, Ohio. The NFDRC Administrative Record includes the Final CMP, the Operation & Maintenance Plan, and the Environmental Response Project Health and Safety Plan ("HASP").

I. "Owner" means EMD Chemicals Inc., a New York corporation, whose address is 2909 Highland Avenue, Cincinnati, Ohio and its successors and assigns.

J. "Operation & Maintenance Plan" ("O&M Plan") means the Operation & Maintenance Plan for the institutional and engineered controls at the Property required to be

submitted by EMD Chemicals, Inc. and approved by U.S. EPA following completion of construction of the corrective measures in accordance with the schedule contained in the AOC..

K. "Perched Ground Water" means, as described in the Final CMP and the NFDRC, the ground water found within the fill, upper till, upper sand, and lacustrine geologic units beneath the Property and which does not include the deeper regional aquifer (the Norwood Trough Aquifer), and which is separated from the deeper regional aquifer by a series of 10 to 30 feet of unsaturated, low permeability confining layers that act as aquitards.

L. "Residential and Other Prohibited Activities" means, but is not limited to, any or all of the following: (i) single and multi-family dwellings and rental units; (ii) day care centers and preschools; (iii) educational and religious facilities (except as used in connection with an allowed commercial/industrial activity); (iv) hospitals, assisted living facilities and other extended care medical facilities and medical and dental offices; (v) restaurants and other food and beverage services (except as used in connection with an allowed commercial/industrial activity); (vi) indoor or outdoor entertainment and recreational facilities; (vii) hotel and motels; and (viii) transient or other residential facilities.

M. "Statement of Basis" means the document issued by U.S. EPA on August 4, 2008 for public notice and comment, setting forth the corrective measures which the U.S. EPA proposed for the Property, subject to public comment. The Statement of Basis was developed from the Final CMP and other documents contained in the NFDRC Administrative Record.

N. "Transferee" means any future owner of any interest in the Property or any portion thereof, including, but not limited to, owners of an interest in fee simple, mortgagees, easement holders, and/or lessees.

2. Environmental Covenant. This instrument is an Environmental Covenant executed and delivered pursuant to §§ 5301.80 to 5301.92 of the Ohio Revised Code. Owner joins in this Environmental Covenant in order to subject its interest in the Property which it may now or hereafter hold to the terms of this instrument.

3. Property and Restricted Areas. The Property is comprised of three parcels of real property, which together contain approximately 8.7 acres located in Cincinnati, Ohio and the City of Norwood, Ohio, and which are subject to the environmental covenants set forth herein ("Property"). The Property is more particularly described in **Exhibit A** attached hereto and incorporated herein (the "Property"). Exhibit A provides the Hamilton County Auditor's Parcel ID's and recorded acreage for each parcel along with a legal description for each of the three parcels that comprise the Property. The Property is outlined by heavy black line on the copy of the Hamilton County, Ohio Auditor's tax map attached hereto as **Exhibit B.** There are three Restricted Areas on the Property that are subject to the certain Activity and Use Limitations described in Paragraph 4, below. Legal descriptions for the three Restricted Areas are provided in **Exhibit C** along with a map illustrating the location of each of the Restricted Areas. The three distinct Restricted Areas are described as follows:

A. Restricted Area 1 includes the lower and middle portion of the West Ravine (including the entire former tank farm area), where waste placement historically occurred. Restricted Area 1 includes the cover system, the storm water management controls, the

collection trench, the low permeability containment wall, and the two groundwater collection sumps.

B. Restricted Area 2 includes an area south of Building 10 and an area southeast of Building No. 4, where historical releases of hazardous constituents have resulted in impacts to soil and Perched Ground Water.

C. Restricted Area 3 includes the French Drain System.

Unless otherwise indicated in this Environmental Covenant, all references to the Property include the Restricted Areas.

4. Activity and Use Limitations on the Property.

Owner agrees and covenants, for itself and its successors in title, as follows:

A. The Property (i) may only be used for Industrial/Commercial Activities and (ii) shall not be used for Residential and Other Prohibited Activities.

B. Perched Ground Water underlying the Property shall not be extracted or used for any purpose, potable or otherwise, except for investigation, monitoring or remediation of the Perched Ground Water or in conjunction with construction or excavation activities or maintenance of subsurface utilities. Perched groundwater shall only be extracted pursuant to the site-specific Health and Safety Plan.

C. Upon approval by the U.S. EPA in accordance with the approved schedule contained in the AOC, the O&M Plan shall be implemented by EMD at the Property to ensure continued operation and maintenance of the corrective measures.

D. There shall be no use of the Restricted Areas of the Property in a manner that interferes with or impairs the integrity or protectiveness of the corrective measures which have been implemented and are required by the NFDRC or the AOC. Specifically, there shall be no surface or subgrade (below ground surface) use of the Restricted Areas that: 1) causes a breach in, or increase in permeability of, the West Ravine cover system or the low permeability containment wall at the south end of the West Ravine, 2) prevents or reduces transport of ground water in the high permeability ground water collection trench that connects to the extraction sump, or 3) that reduces the ability of the French drain system to intercept and collect ground water migrating to the east and southeast of the West Ravine area through the Upper Sand Unit.

E. There shall be no subgrade construction or excavation work within any of the Restricted Areas without implementation of the site-specific Health and Safety Plan (HASP), maintained at the Property, to address potential construction worker exposures to contaminants in subsurface soils or Perched Ground Water.

F. If any surface or subgrade use of Restricted Area #1 increases the permeability of the cover system, the Owner or Transferee shall promptly repair the breach to prevent infiltration of precipitation and shall promptly report the breach to the Agency.

G. Any new buildings or structures located partially or completely within Restricted Areas 1 or 2, or within the footprint of the area currently occupied by Building 3, shall be designed and constructed with passive and/or active engineering controls (e.g., passive vapor barriers or active ventilation systems), as required, to mitigate potential vapor intrusion and indoor air exposures to acceptable levels, consistent with the NFDRC (i.e., where necessary to reduce excess lifetime cancer risk from indoor air inhalation maintained to less than 1×10^{-4} and noncarcinogenic hazard index from indoor air inhalation to less than 1.0).

5. Running with the Land. This Environmental Covenant shall be binding upon the Owner and all assigns and successors in interest, including any Transferee, and shall run with the land, pursuant to ORC § 5301.85, subject to amendment or termination as set forth herein.

6. Access to the Property. Pursuant to ORC Section 5301.82(A)(6), Owner agrees that the Access Parties and the Holder may have right of access to the Property for implementation or enforcement of this Environmental Covenant. Specifically, the right of access is granted for the following purposes: a) monitoring the corrective measures, b) verifying any data or information submitted to the U.S. EPA, c) conducting investigations relating to contamination at or near the Property, d) obtaining samples, e) assessing Owner's compliance with the AOC, and f) determining whether the Property is being used in a manner that is prohibited or restricted pursuant to the AOC and this environmental covenant. The access rights agreed to herein do not limit any statutory authority of the Access Parties nor do they provide any rights against the Access Parties. The right of access agreed to under this Paragraph 6 shall be irrevocable while this Covenant remains in full force and effect.

7. Owner Duty to Execute Environmental Covenant. Owner agrees to properly execute this Environmental Covenant so that it runs with the land, provides the Agency with the authority to seek injunctive or other equitable relief for its violation pursuant to ORC 5301.91(A)(1)-(4), and is in compliance with ORC Section 5301.80 to 5301.92. Owner agrees to provide the institutional controls with respect to the Property that are set forth in this Environmental Covenant. Owner executes and delivers this Environmental Covenant to satisfy and implement and maintain the institutional controls identified in the NFDRC and AOC.

8. A. Notice Prior To Conveyance. At least 60 days prior to any transfer of the Property or any portion thereof, Owner shall give written notice: (i) to the Transferee regarding the AOC and any Activity and Use Limitations regarding the Property; and (ii) to U.S. EPA and the Ohio EPA regarding the proposed Transfer, including the name and address of the Transferee and the date on which the Transferee was notified of the AOC and any Activity and Use Limitation. The notice to EPA shall also include a copy of the proposed deed or other documentation evidencing the conveyance, a legal description of the Property (or portion thereof) being transferred, a survey map of the Property being transferred; and the closing date of the transfer of ownership of the Property. Any transfer of the Property shall be completed in accordance with Paragraphs 7-8 of the AOC.

B. Each instrument hereafter conveying any interest in the Property or any portion of the Property shall contain a notice of those Activity and Use Limitations, and access agreements set forth in this Environmental Covenant which are applicable to the Property or that portion of the Property to be conveyed, and provide the recorded location of this Environmental Covenant. For instruments conveying any interest in the Restricted Areas or any portion thereof,

the notice shall be substantially in the form set forth in **Exhibit D**. For instruments conveying any interest in the Property or any portion thereof that does not include the Restricted Areas, the notice shall be substantially in the form set forth in **Exhibit E**. Owner (or Transferee and each subsequent Transferee after Owner) shall notify the Agency and Holder within thirty (30) days after each conveyance of an interest in any portion of the Property. The notice shall include the name, address, and telephone number of the Transferee, a copy of the deed or other documentation evidencing the conveyance, a legal description of the real property being transferred, a survey map of the real property being transferred; and the closing date of the transfer of ownership of the real property.

9. Amendment or Termination. This Environmental Covenant may be modified, amended or terminated while Owner owns the property only by a writing signed by Owner, the Holder, and U.S. EPA pursuant to ORC Section 5301.90 and other applicable law. Amendment means any changes to this Environmental Covenant with the formalities required for the execution of a deed in Ohio which is recorded in the Office of the Recorder of Hamilton County, Ohio. Upon transfer of all or any portion of the Property, Owner waives any rights that it might otherwise have under Section 5301.90 of the Ohio Revised Code to withhold its consent to any amendments, modifications, or termination of this Environmental Covenant with respect solely to the transferred real property, to the extent that it has transferred its interest in that portion of the Property affected by said modification, amendment or termination. The rights of Owner's successors in interest as to a modification, amendment or termination of this Environmental Covenant shall be governed by the provisions of Section 5301.90 of the Ohio Revised Code.

10. Representations of Owner. Owner represents and warrants to the other signors hereto that (A) Owner is the sole owner of the Property, (B) Owner holds fee simple title to the Property which is free, clear and unencumbered except for those encumbrances listed in **Exhibit F**, which are fully incorporated by reference herein, (C) Owner has the power and authority to make and enter into this Environmental Covenant and to grant the rights and interests herein provided and to carry out all obligations hereunder, (D) this Environmental Covenant has been executed and delivered pursuant to the NFDRC and AOC, and, (E) this Environmental Covenant will not materially violate or contravene or constitute a material default under any other agreement, document or instrument to which Owner is a party or by which Owner may be bound or affected.

11. Right to Enforce Agreement Against Owner. Compliance with this Environmental Covenant may be enforced pursuant to ORC §5301.91 or other applicable law. Failure to timely enforce compliance with this Environmental Covenant or the Activity and Use Limitations contained herein by any party shall not bar subsequent enforcement by such party and shall not be deemed a waiver of the party's right to take action to enforce any non-compliance.

12. Compliance Reporting Owner and any Transferee shall submit to the U.S. EPA and Holder(s) on an annual basis, with this first such report due on _____, 201_, a written certification, which complies with the requirements of Ohio Administrative Code 3745-50-42(B)-(D), that the Activity and Use Limitations of this Environmental Covenant remain in place and are being complied with.

13. Future Cooperation; Execution of Supplemental Instruments. Owner agrees to cooperate with U.S. EPA to assist it in implementing the rights granted it under this Environmental

Covenant and, in furtherance thereof, agrees to execute and deliver such further documents as may be requested by U.S. EPA to supplement or confirm the rights granted hereunder.

14. Cumulative Remedies; No U.S. EPA Waiver of Authority or Assumption of Obligations. All of the rights and remedies set forth in this Environmental Covenant or otherwise available at law or in equity are cumulative and may be exercised without regard to the adequacy of, or exclusion of, any other right, remedy or option available hereunder or at law. The failure to exercise any right granted hereunder, to take action to remedy any violation by Owner of the terms of this Environmental Covenant, or to exercise any remedy provided herein shall not be deemed to be a waiver of any such right or remedy and no forbearance on the part of U. S. EPA and no extension of the time for performance of any obligations of Owner hereunder shall operate to release or in any manner affect U. S. EPA's rights hereunder. No action or decision by U.S. EPA related to environmental remediation at the Property shall independently give rise to judicial review under this Environmental Covenant. Nothing in this Environmental Covenant shall restrict the U. S. EPA from exercising any authority it may have under applicable law. U.S. EPA reserves all of its statutory and regulatory powers, authorities, rights, and remedies, both legal and equitable. Except as set forth in this Environmental Covenant, U.S. EPA does not assume any obligations under this Environmental Covenant. Except as set forth in this Environmental Covenant, U.S. EPA's signature to this Environmental Covenant does not constitute a commitment, contract or obligation for future action on the part of U.S. EPA.

15. Severability. If any provision of this Environmental Covenant is found to be unenforceable in any respect, the validity, legality, and enforceability of the remaining provisions shall not in any way be affected or impaired.

16. Recordation. Within thirty (30) days after the date of the final required signature upon this Environmental Covenant, Owner shall record with the Hamilton County Recorder's Office, this Environmental Covenant, in the same manner as a deed to the Property, and pursuant to ORC §5301.88.

17. Effective Date. The effective date of this Environmental Covenant shall be the date upon which the fully executed Environmental Covenant has been recorded as a deed record for the Property with the Hamilton County Recorder.

18. Distribution of Environmental Covenant. Within sixty (60) days after the date of the final required signature the Owner shall mail or otherwise deliver a file and date-stamped copy of the recorded Environmental Covenant to:

A. U.S. EPA, Attention: Director, Land and Chemicals Division, 77 W. Jackson, Chicago, Illinois;

B. Ohio EPA, Division of Hazardous Waste Management, Attention: Division Chief, Lazarus Center, 50 West Town Street, Suite 700, Columbus, OH 43215;

C. Hamilton County, Ohio, Attention: County Administrator, 250 William Howard Taft Road, 1st Floor, Cincinnati, OH 45219;

D. City of Cincinnati, Ohio, Attention: City Manager, 801 Plum St. Room 152, Cincinnati, OH 45202-1979;

E. City of Norwood, Ohio, Attention: Office of Mayor, 4645 Montgomery Road, Norwood, Ohio 45212. The City of Norwood, Ohio is given notice in its capacity as the unit of local government in which a portion of the Property is located, and in its capacity as a person holding a recorded interest in the real property that is subject to the Environmental Covenant.

19. Notices. All other notices, requests, demands or other communications required or permitted under this Environmental Covenant shall be given to the U.S. EPA or the Ohio EPA at the addresses set forth herein. Any notices required to be given to EMD may be delivered via commercially acceptable means to the 2909 Highland Avenue, Cincinnati, Ohio address.

20. Governing Law. Except as provided herein, the laws of the State of Ohio shall be the governing law. Federal law shall govern issues related to environmental remediation, the Environmental Response Project, the adequacy of the institutional controls to protect human health and the environment, and issues involving or relating to the authority of U.S. EPA. The federal court for the appropriate judicial district shall have jurisdiction of any action involving the U.S. EPA.

21. Captions. All paragraph captions are for convenience of reference only and shall not affect the construction of any provision of this Environmental Covenant.

22. Time of the Essence. Time is of the essence of each and every performance obligation of Owner under this Environmental Covenant.

[SIGNATURE PAGE TO FOLLOW]

IN WITNESS WHEREOF, Owner, and U.S. EPA have executed and delivered this Environmental Covenant as of the date first above written.

OWNER

_____
EMD Chemicals Inc.

_____
Title

STATE OF_____)
) SS.
COUNTY OF _____)

The foregoing instrument was acknowledged before me this ____ day of _____, 201__, by EMD Chemicals Inc.

_____
Notary Public

United States Environmental Protection Agency

By: _____
Director, Land and Chemicals Division

STATE OF ILLINOIS)
) SS.
COUNTY OF COOK)

The foregoing instrument was acknowledged before me this ___ day of _____, 201__, by_____, Director, Land and Chemicals Division, Region 5 of the United States Environmental Protection Agency, on behalf of the United States of America.

_____
Notary Public

EXHIBIT A

Legal Description of the "Property"

"Property" comprising three parcels with Hamilton County Auditor Parcel ID as follows:
Parcel I - Parcel ID 651-0018-0007-00 (5.94 acres)
Parcel II - Parcel ID 052-0A07-0002-00 (2.458 acres)
Parcel III - Parcel ID 651-0018-0127-00 (0.307 acres)

Parcel I

All that tract of land in the Northwest Quarter of Section 28, Town 4, Fractional Range 2 of Townships in the Miami Purchase, now City of Norwood, Hamilton County, Ohio bounded and described as follows: Beginning on the south line of Highland Avenue, as the same was widened by condemnation in Case No. 95872, Hamilton County Common Pleas Court, at a point 255 feet East of the West line of Lot No. 9 of the Tunnis Van Middlesworth Estate, as shown on plat recorded in Plat Book 4, page 158, Hamilton County, Ohio, Records; thence eastwardly along the south line of Highland Avenue 682.05 feet to a point in the east line of said Lot No. 9, 495.26 feet to the Southeast corner of said lot; thence westwardly along the south line of said Lot No. 9 421.92 feet to a stake; thence northwardly, parallel with the west line of said Lot No. 9, 255.26 feet to the North line of the right of way of the C. L. & N R.R. Co.'s switch track; thence westwardly along said North Line, and parallel with the North line of said Lot No. 9 258.30 feet to a point 255 feet East of the West line of said Lot No. 9, 240 feet to the South line of Highland Avenue at the Place of beginning.

Parcel II.

Situated in Section 28, Town 4, Fractional Range 2, Columbia Township, Hamilton County, Ohio, as follows: Beginning at a point in the North line of the above mentioned Section 28, which point is the Northeast corner of Lot No. 9, of T. Van Middlesworth Estate as shown on plat recorded in Plat Book 4, page 158, of the Hamilton County, Ohio, Plat Records; thence southwardly along the East line of said Lot No. 9 and also along the East line of Lot No. 6 of said estate for a distance of 578.40 feet, more or less, to the westerly line of the land heretofore conveyed to the P. C. C. & St. L. Railroad, as recorded in Deed Book 1396, page 502, of the Hamilton County, Ohio, Deed records; thence along the West line of said land northeastwardly, and following the curvature of said Railroad Right of Way for a distance of 549 feet, more or less, to a point in the North line of the above mentioned Section 28; thence westwardly along said Section Line, 337 feet to the place of beginning.

EXCEPTING THEREFROM AND SUBJECT TO ALL LEGAL HIGHWAYS. Containing 2.50 acres, more or less, subject to easement of City of Norwood, Ohio, for sewer purposes.

[Parcel II legal description continued at next page]

EXHIBIT A

Legal Description of the "Property" (cont.)

ALSO EXCEPTING THE FOLLOWING DESCRIBED REAL ESTATE:

Situated in Section 28, Town 4, Fractional Range 2, Columbia Township, Hamilton County, Ohio, and being more particularly described as follows: Beginning at the intersection of the East line of Lot 6 of T. Van Middlesworth's Estate as recorded in Plat Book 4, page 158, Hamilton County Records (said easterly line being also the West line of the property conveyed to EM Industries, Inc. by deed recorded in Deed Book 4312, Page 1592, Hamilton County Records) and the northwesterly line of the property conveyed to the P. C. C. and St. L. Railroad (now the Norfolk Southern Railroad Company, formerly Philadelphia, Baltimore and Washington Railroad Company) by deed recorded in Deed Book 1396, page 522, Hamilton County Records; thence North 5° 46' 53" East, along the easterly line of said Lot 6, a distance of 43.13 feet; to the NE corner of said Lot thence South 73° 12' 45" East, a distance of 34.25 feet to the said northwesterly Railroad property line; thence southwestwardly along said northwesterly line, which is along a curve deflecting to the right with a radius of 1,448.16 feet for a distance of 49.70 feet (the chord of said curve bears South 48° 21' 11" West for 49.70 feet) to the easterly line of said Lot 9 and the place of beginning containing 741 square feet, more or less.

Together with the right and easement of access from and to the limited access highway known as "Northeast Expressway, HAM. 71-7.45" along the following course, to-wit: South 73° 12' 45" East - 34.25 feet. The description for this parcel is based on a centerline survey made by Vogt, Ivers and Associates under the direction of Robert C. Vogt. Excepted Real Estate granted by deed recorded at Deed Book 3603 Page 470 and corrected by Quit-Claim Deed filed in Hamilton County Ohio Records 6802 page 788.

ALSO LESS AND EXCEPTING a triangular piece along the East side, 35 feet irregular, dedicated from Will Ross, Inc., a Wisconsin corporation, for the widening of Highland Avenue, which strip was dedicated by Ordinance 395-1970, City of Cincinnati, and recorded in Deed Book 165, pages 54 and 55, Recorder's Office of Hamilton County, Ohio on March 26, 1971.

Parcel III

Situated in the City of Norwood, Hamilton County, Ohio and being parts of Lots #6 and #7 of T. Van Middlesworth's Estate Subdivision, recorded in Plat Book 4, page 158 of Hamilton County, Ohio Records, and more particularly described as follows: Beginning at a point in the North line of said Lot #7 which lies South 85° 26' East, 131.16 feet, as measured along said North line from the Northwest corner of said Lot #7, said Northwest corner of Lot #7 being also the Northeast corner of the premises described in Certificate of Title #29140; thence South 4° 24' West, 87.30 feet to the northerly right of way of Interstate #I-71 thence North 81° 44' 23" East (Highway) along said North line of I-71, 345.10 feet to the point of intersection of said North line of I-71 with the North line of said Lot #6, which point lies North 83° 43' 7" West (highway) 86.80 feet from the Northeast corner of said Lot #6, as measured along the North line of said Lot #6; thence westwardly, along the North line of said Lots #6 and #7, 335.12 feet, more or less, to the place of beginning.

EXHIBIT B

Hamilton County Auditor's Map With Property Boundaries Outlined

EXHIBIT C

Map With Restricted Areas Designated and Legal Descriptions

EXHIBIT D

Notice upon Conveyance of Restricted Areas or any Portion thereof

THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED _____, 201__ ("ENVIRONMENTAL COVENANT" AND AN ADMINISTRATIVE ORDER ON CONSENT ("AOC") DATED _____, 201__. THE ENVIRONMENTAL COVENANT WAS RECORDED IN _____ COUNTY RECORDER ON _____, 201___, IN [DOCUMENT _____OR BOOK _____, PAGE _____]. THE ENVIRONMENTAL COVENANT CONTAINS THE FOLLOWING ACTIVITY AND USE LIMITATIONS AND ACCESS RIGHTS:

1. The Environmental Covenant identifies a property, commonly known as 2909 Highland Avenue, Cincinnati, Ohio ("Property"), and three areas within the Property which contain special restrictions ("Restricted Areas"). The Restricted Areas shall not be used in any manner that would interfere with or adversely affect the integrity or protectiveness of the corrective measures which have been implemented or which will be implemented on the Property as reflected in the Environmental Covenant unless the written consent of the United State Environmental Protection Agency (U.S. EPA) to such use is first obtained. The Restricted Areas covered by this Notice are identified in Exhibit _____ with the legal description identified in Exhibit _____.

2. Perched Ground Water underlying the Property shall not be extracted or used for any purpose, potable or otherwise, except for investigation, monitoring or remediation of the Perched Ground Water or in conjunction with construction or excavation activities or maintenance of subsurface utilities. Perched groundwater shall only be extracted pursuant to the site-specific Health and Safety Plan.

3. Owner covenants that the Property may only be used for Commercial/Industrial Activities. The Property shall not be used for Residential and Other Prohibited Activities. Owner acknowledges and agrees that the Property has been remediated only for Commercial/Industrial Activities. "Commercial/Industrial Activities" means, but is not limited to: (a) wholesale and retail sales and service activities including, but not limited to retail stores, and automotive fuel, sales and service facilities; (b) governmental, administrative and general office activities, (c) manufacturing, processing, packaging, handling and warehousing activities, including, but not limited to, production, storage and sales of durable goods and other products; (d) research and development, including all ancillary and supporting activities incident thereto; (e) other office and warehousing activities, including but not limited to production, processing, storage and sales of chemicals, chemical intermediates, blendstocks, feedstocks and/or by-products, durable goods; (f) activities which are consistent with or similar to the above listed activities together with related parking areas and driveways, but excludes Residential and Other Prohibited Activities. "Residential and Other Prohibited Activities" means, but is not limited to: (a) single and multi-family dwellings and rental units; (b) day care centers and preschools; (c) educational and religious facilities (except as used in connection with an allowed commercial/industrial activity); (d) hospitals, assisted living facilities and other extended care medical facilities and medical and dental offices; (e) restaurants and other food and beverage services (except as used in connection with an allowed commercial/industrial activity); (f) indoor or outdoor

entertainment and recreational facilities; (g) hotel and motels; and (h) transient or other residential facilities.

4. Any future use of the Restricted Areas must be protective of human health and the environment and is the sole responsibility of the Owner and/or Transferee to ensure the use is solely and exclusively consistent with the implemented corrective measures for the Restricted Areas.

5. In the event that any activity by the holder of an encumbrance constitutes a violation of the Activity and Use Limitations Owner and/or Transferee shall notify U.S. EPA within thirty (30) days of becoming aware of the event, and shall remedy the breach of the covenant within sixty (60) days of becoming aware of the event, or such other time frame as may be agreed to by the Owner or Transferee and U.S. EPA.

6. Owner and every subsequent Transferee shall notify U.S. EPA within thirty (30) days after each conveyance of an interest in any portion of the Restricted Areas. The notice shall include the name, address, and telephone number of the Transferee, a copy of the deed or other documentation evidencing the conveyance, a legal description of the portion of the Restricted Areas being transferred, a survey map of the portion of the Restricted Areas being transferred; and the closing date of the transfer of ownership of the portion of the Restricted Areas.

7. No Owner or Transferee may make changes in the use of the Restricted Areas, or may make applications for building permits for, or proposals for any work in the Restricted Areas affecting contamination on the Restricted Areas without first providing notice to U. S. EPA and obtaining its approval or consent thereto.

8. U.S. EPA, Ohio EPA and Holder have the right of access to the Property for implementation or enforcement of this Environmental Covenant. The access rights granted herein do not limit any statutory authority of the Agencies nor do they provide any rights against the Agencies. The exercise of such right of access shall be made in compliance with all applicable laws and regulations, and in accordance with the AOC.

9. No Owner or Transferee in interest may make changes in the use of the Restricted Areas or may make applications for building permits for, or proposals for any work in the Restricted Areas affecting contamination on the Restricted Areas, without first providing notice to U. S. EPA and obtaining its approval thereto.

10. In the Restricted Areas, as applicable, Owner covenants:

Owner agrees and covenants, for itself and its successors in title, as follows:

A. The O&M Plan shall be implemented at the Property to ensure continued operation and maintenance of the corrective measures required by the NFDRC and AOC.

B. There shall be no use of the Restricted Areas of the Property in a manner that interferes with or impairs the integrity or protectiveness of the corrective measures which have

been implemented and are required by the NFDRC or the AOC. Specifically, there shall be no surface or subgrade (below ground surface) use of the Restricted Areas that: 1) causes a breach in, or increase in permeability of, the West Ravine cover system or the low permeability containment wall at the south end of the West Ravine, 2) prevents or reduces transport of ground water in the high permeability ground water collection trench that connects to the extraction sump, or 3) that reduces the ability of the French drain system to intercept and collect ground water migrating to the east and southeast of the West Ravine area through the Upper Sand Unit.

C. There shall be no subgrade construction or excavation work within any of the Restricted Areas without implementation of the site-specific Health and Safety Plan (HASP), maintained at the Property, to address potential construction worker exposures to contaminants in subsurface soils or Perched Ground Water.

D. If any surface or subgrade use of Restricted Area #1 increases the permeability of the cover system, the Owner or Transferee shall promptly repair the breach to prevent infiltration of precipitation and shall promptly report the breach to the Agency.

E. Any new buildings or structures located partially or completely within Restricted Areas 1 or 2, or within the footprint of the area currently occupied by Building 3, shall be designed and constructed with passive and/or active engineering controls (e.g., passive vapor barriers or active ventilation systems), as required, to mitigate potential vapor intrusion and indoor air exposures to acceptable levels, consistent with the NFDRC (i.e., where necessary to reduce excess lifetime cancer risk from indoor air inhalation maintained to less than 1×10^{-4} and noncarcinogenic hazard index from indoor air inhalation to less than 1.0).

11. U.S. EPA maintains an Administrative Record for the final selection of the corrective measures ("NFDRC Administrative Record) at U.S. EPA, Region 5; Land and Chemicals Division, RCRA Records Center, 7th Floor; 77 West Jackson Blvd.; Chicago, Illinois, 60604-3590 and at the Cincinnati Public Library, Norwood Branch; 4325 Montgomery Road; Cincinnati, Ohio.

EXHIBIT E

Notice upon Conveyance of any Portion of the Property other than a Restricted Area

THE INTEREST CONVEYED HEREBY IS SUBJECT TO AN ENVIRONMENTAL COVENANT, DATED _____, 201___, ("ENVIRONMENTAL COVENANT") AND AN ADMINISTRATIVE ORDER ON CONSENT ("AOC") DATED _____, 201__. THE ENVIRONMENTAL COVENANT WAS RECORDED IN THE HAMILTON COUNTY RECORDER ON _____, 201___, IN [DOCUMENT _____OR BOOK _____, PAGE _____]. THE ENVIRONMENTAL COVENANT CONTAINS THE FOLLOWING ACTIVITY AND USE LIMITATIONS AND ACCESS RIGHTS:

1. The Environmental Covenant identifies a property, commonly known as 2909 Highland Avenue, Cincinnati, Ohio ("Property"), and three areas within the Property which contain special restrictions ("Restricted Areas"). The Restricted Areas shall not be used in any manner that would interfere with or adversely affect the integrity or protectiveness of the corrective measures which have been implemented or which will be implemented on the Property as reflected in the Environmental Covenant unless the written consent of the United State Environmental Protection Agency (U.S. EPA) to such use is first obtained. The Restricted Areas covered by this Notice are identified in Exhibit _____ with the legal description identified in Exhibit _____.

2. Perched Ground Water underlying the Property shall not be extracted or used for any purpose, potable or otherwise, except for investigation, monitoring or remediation of the Perched Ground Water or in conjunction with construction or excavation activities or maintenance of subsurface utilities. Perched groundwater shall only be extracted pursuant to the site-specific Health and Safety Plan.

3. The O&M Plan shall be implemented at the Property, to the extent applicable to those portions of the Property conveyed, to ensure continued operation and maintenance of the corrective measures required by the NFDRC and AOC.

4. Owner covenants that the Property may only be used for Commercial/Industrial Activities. The Property shall not be used for Residential and Other Prohibited Activities. Owner acknowledges and agrees that the Property has been remediated only for Commercial/Industrial Activities. "Commercial/Industrial Activities" means, but is not limited to: (a) wholesale and retail sales and service activities including, but not limited to retail stores, and automotive fuel, sales and service facilities; (b) governmental, administrative and general office activities, (c) manufacturing, processing, packaging, handling and warehousing activities, including, but not limited to, production, storage and sales of durable goods and other products; (d) research and development, including all ancillary and supporting activities incident thereto; (e) other office and warehousing activities, including but not limited to production, processing, storage and sales of chemicals, chemical intermediates, blendstocks, feedstocks and/or by-products, durable goods; (f) activities which are consistent with or similar to the above listed activities together with related parking areas and driveways, but excludes Residential and Other Prohibited Activities. "Residential and Other Prohibited Activities" means,: (a) single and multi-family dwellings and rental units; (b) day care centers and preschools; (c) educational and religious facilities (except as used in connection with an allowed commercial/industrial activity); (d) hospitals, assisted living facilities and other extended care medical facilities and medical and

dental offices; (e) restaurants and other food and beverage services (except as used in connection with an allowed commercial/industrial activity); (f) indoor or outdoor entertainment and recreational facilities; (g) hotel and motels; and (h) transient or other residential facilities.

5. Any future use of the Property must be protective of human health and the environment and is the sole responsibility of the Owner and/or Transferee to ensure the use is solely and exclusively consistent with the implemented corrective measures for the Property.

6. In the event that any activity by the holder of an encumbrance constitutes a violation of the Activity and Use Limitations contained in this covenant, Owner and/or Transferee shall notify U.S. EPA within thirty (30) days of becoming aware of the event, and shall remedy the breach of the covenant within sixty (60) days of becoming aware of the event, or such other time frame as may be agreed to by the Owner and/or Transferee and U.S. EPA.

7. Owner and every subsequent Transferee shall notify U.S. EPA within thirty (30) days after each conveyance of an interest in any portion of the Property. The notice shall include the name, address, and telephone number of the Transferee, a copy of the deed or other documentation evidencing the conveyance, a legal description of the Property being transferred, a survey map of the Property being transferred; and the closing date of the transfer of ownership of the Property.

8. U.S. EPA, Ohio EPA, and EMD Chemicals Inc. have the right of access to the Property for implementation or enforcement of this Environmental Covenant. Specifically, the right of access is granted for the following purposes: a) monitoring the corrective measures, b) verifying any data or information submitted to the U.S. EPA, c) conducting investigations relating to contamination at or near the Property, d) obtaining samples, e) assessing Owner's compliance with the AOC, and f) determining whether the Property is being used in a manner that is prohibited or restricted pursuant to the AOC. The access rights granted herein do not limit any statutory authority of U.S. EPA or Ohio EPA nor do they provide any rights against the U.S. EPA or Ohio EPA. The exercise of such right of access shall be made in compliance with all applicable laws and regulations, and in accordance with the AOC.

9. U.S. EPA maintains an Administrative Record for the final selection of the corrective measures ("NFDRC Administrative Record) at U.S. EPA, Region 5; Land and Chemicals Division, RCRA Records Center, 7th Floor; 77 West Jackson Blvd.; Chicago, Illinois, 60604-3590 and at the Cincinnati Public Library, Norwood Branch; 4325 Montgomery Road; Cincinnati, Ohio.

EXHIBIT F

Encumbrances on the Property

Owner holds fee simple title to the Property which is free, clear and unencumbered except for the following encumbrances:

1) Easement of City of Norwood, for sewer purposes, recorded at D.B. 3474, page 648

APPENDIX C

Schedule for Work
West Ravine Remedy
EMD Chemicals Inc.

Construction	**Start Date**	**End Date**	**Milestone**
Start Construction	**7/6/2009**		*
Installation of Treatment System - Phase 1	2/15/2010	3/26/2010	
Installation of Retaining Wall	5/30/2010	12/11/2010	
Installation of Hydraulic Containment Trench	12/12/2010	6/26/2011	
Installation of Cover System	9/1/2011	1/16/2012	
Record Environmental Covenant	**1/16/2012**		*
Installation of Chemox Injection System	6/27/2011	9/18/2011	
Installation of Treatment system	5/27/2012	11/11/2012	
Complete Construction		**11/11/2012**	*
Submit Final Remedy Construction Completion Report	**1/10/2013**		*
EPA Comments on Final Remedy Construction Completion Report	3/11/2013		
Revised Final Remedy Construction Completion Report	5/10/2013		
EPA Approved Final Remedy Construction Completion Report	6/9/2013		
Performance Monitoring	**Start Date**	**End Date**	
Groundwater Monitoring Plan Implementation	6/9/2013	6/8/2018	
Interim O&M Plan Implementation	6/9/2013	6/8/2018	
Submit Chemox Treatment System Report	**9/16/2016**		*
EPA Comments on Chemox Treatment System Report	11/15/2016		
Revised Final Chemox Treatment System Report	12/15/2016		
EPA Approval of Final Chemox Treatment System Report	1/14/2017		
Submit Final Remedy Performance Monitoring Report	**6/8/2018**		*
EPA Comments on Final Remedy Performance Monitoring Report	8/7/2018		
Revised Final Remedy Performance Monitoring Report	10/6/2018		
EPA Approved Final Remedy Performance Monitoring Report	11/5/2018		
Revise and Record Environmental Covenant (if necessary)	12/5/2018		
Monitoring Well Abandonment – Phase I	1/4/2019		
Long Term Care			
Implement Reporting Under Environmental Covenant	12/5/2018		
Implement Final O&M Plan	6/8/2018		
Monitoring Well Abandonment - Phase II	TBD		