ENVIRONMENTAL PROTECTION AGENCY

STATEMENT OF BASIS

Great Lakes Chemical Company
Nitro, West Virginia
EPA ID No. WVD005005087

Prepared by

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I. INTRODUCTION

The Environmental Protection Agency (EPA) has prepared this Statement of Basis (SB) to solicit public comment on its proposed remedy for the facility owned by Great Lakes Chemical Company (GLCC), located in Nitro, Putnam County, West Virginia (Facility). EPA's proposed remedy for the Facility inlcudes the containment of white phosphorus-impacted soil with an enhanced concrete cover, monitored natural attenuation and institutional controls (ICs) to implement land and groundwater use restrictions.

This document explains EPA's basis for recommending the proposed remedies and the Administrative Record (AR) for the Facility contains all documents, including data and quality assurance information, on which EPA's proposed remedy is based. See Section XII, Public Participation, for information on how you may review the AR.

The Facility is subject to the Corrective Action (CA) Program under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. §§ 6901 et seq. (Corrective Action Program). The RCRA CA Program is designed to ensure that certain facilities subject to RCRA have investigated and cleaned up any releases of hazardous waste and hazardous constituents that have occurred at their property.

EPA is providing a thirty (30) day public comment period on this SB. EPA may modify its proposed remedy based on comments received during this period. EPA will announce its selection of a final remedy for the Facility in a Final Decision and Response to Comments (FDRTC) after the public comment period has ended.

Information on the CA program as well as a fact sheet for the Facility can be found by navigating to https://www.epa.gov/hwcorrectiveactionsites/hazardous-waste-cleanup-great-lakes-chemical-corporation-formerly-fmc.

II. FACILITY BACKGROUND

The Facility consists of two separate parcels, the Main Plant Area (14.7 acres) and the Lab/Warehouse Parcel (9.04 acres). The Facility has been used to produce a range of phosphorus-based specialty chemicals, including phosphorus chlorides and phosphate esters. FMC Corporation (FMC) owned and operated the Facility between 1950 and July 1999. GLCC operated the Facility from July 1999 until July 2002 when operations ceased. GLCC, a wholly-owned subsidiary of Chemtura Corporation (Chemtura), continues to own the Site.

The majority of the Facility buildings were demolished to grade in 2003. Three buildings remain on the Main Plant Area and two buildings remain on the Lab/Warehouse Parcel. The Facility is covered with concrete slabs and foundations, and asphalt pavement. Open concrete pits and former wastewater treatment lagoons are located on the Facility property. The majority of the soils at the Main Plant Area are covered by concrete and asphalt. Soils at the Lab/Warehouse Parcel are uncovered.

The Facility is currently inactive and zoned as industrial. Businesses and residences in the Nitro area are provided with potable water by the West Virginia American Water Company, which obtains its water from the Elk River. Land use in the area surrounding the Facility is also industrial, and the Kanawha River bounds the Facility on the west side. The nearest residences are located approximately one-half mile east of the Facility.

Geology

The geology underlying the Facility is characterized by fill and alluvial deposits overlying bedrock. The alluvial deposits are 50 to 60 feet thick, and consist of clay, silt, and gravel. The bedrock is comprised of the Conemaugh Group sandy shale and sandstone. The stratigraphy of the alluvial deposits underlying the Facility consists of the following two zones:

1. Fill material, consisting of fine and coarse gravel and fine to coarse sand, slag, concrete, and brick fragments, is encountered at depths up to 18 feet below ground surface (bgs). Fine grained alluvium, consisting of clay and silt with lenses of fine to medium sand is encountered from 10 to 34 feet bgs. These materials are referred to as the "shallow zone" in the RCRA Facility Investigation (RFI).

2. Fine to medium sands with small amounts of fine to coarse gravel are encountered from 34 to 55 feet bgs, or to a depth of 60 feet bgs where the top of bedrock is encountered. These materials are referred to as the "deep zone" in the RFI.

Based on literature information presented in Section 3.0 of the RFI report (ARCADIS BBL, 2007, #11), the upper portion of the bedrock consists of weathered silty to sandy shale; however, no bedrock drilling has been conducted on-site.

Hydrogeology

Groundwater was encountered at depths ranging from 15 to 25 feet below ground surface (bgs) across most of the Facility, with the exception of the vicinity of wells MW-5S and 8S where it was encountered at shallower depths, and is present in two distinct water-bearing zones within the alluvium:

1. The water table was encountered within the shallow zone beneath the central and western portions of the Facility. Groundwater within the shallow zone flows west to the Kanawha River where it discharges.

2. The surface of the deep zone rises on the eastern portion of the Facility, and is where the water table was encountered on that portion of the Facility. Groundwater within the deep zone flows west to the Kanawha River at a relatively flat gradient. Additionally, there is a slightly upward gradient from the deep zone to the shallow zone.

III. AREAS OF INTEREST

Information regarding potential sources of chemical releases was obtained during preparation of the Description of Current Conditions Report (DOCC) (BBL, 2003, #4) and, prior to preparation of the RFI Work Plan (RFIWP) (BBL, 2004, #5), and from a memorandum from the West Virginia Department of Environmental Protection (WVDEP) dated October 30, 2002. A total of 32 Areas of Interest (AOIs) were identified in the DOCC (BBL, 2003, #4), while six additional AOIs were identified in the WVDEP's October 30, 2002 memorandum and one was identified by EPA during a January 2006 meeting. A description of each of these 39 AOIs is provided below.

Area of Interest (AOI)		Description	Unit Status
AOI-1	Former Hazardous Waste Container Storage Area	From September 1984 to September 1994, the Container Storage Area was permitted for storage of hazardous waste in containers (drums) under a RCRA Part B permit. The area measures approximately 50 feet by 200 feet and had the capacity to store approximately one thousand 55-gallon drums. Prior to 1984, drums were stored on the concrete floor of the former Still House Building that once occupied this location, and stormwater runoff and any spills or leaks in this area were contained in a 15,000 gallon sump lined with acid-resistant bricks. In 1984, the area was renovated to include new paving and two new 5,800-gallon collection sumps lined with an acid-resistant coating. Use of the Hazardous Waste Container Storage Area ceased in early September 1994 and the area was closed between 1996 and 1998.	The closure process included soil sampling and analysis that identified arsenic and lead at concentrations in excess of the EPA's soil screening values for residential use that the EPA and the WVDEP determined should be met to achieve clean closure. Arsenic was subsequently delineated and determined to meet the criteria set forth by the agencies for clean closure under RCRA. Soils that contained lead at concentrations above 400 milligrams per kilogram (mg/kg) were identified in an isolated area near a crack in the pavement and were excavated and disposed off-site. Post-excavation samples showed the remaining soils to contain less than 20 mg/kg of lead, well below the agencies' criteria for clean closure. In January 1999, the WVDEP and the EPA accepted the clean closure demonstration for this area. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007); 2004 Phase I RFI Work Plan (BBL, 2004)*

Area of Interest (AOI)		Description	Unit Status
AOI-2	Waste Collection Sumps S-106 (East and West)	Waste Collection Sumps S-106 consisted of two adjacent sumps located in the vicinity of the Building 72 Filter House. The eastern sump had an approximate 15,000-gallon capacity, and the western sump had an approximate 7,000-gallon capacity. The sumps were initially constructed of reinforced concrete with acid-brick liners, but both were completely relined with polypropylene during the rehabilitation work performed around 1990. The units were used to collect process wastewater from the production areas, spills and leaks, wash waters, and scrubber waters.	Soils in the vicinity of these sumps were sampled during Phase I of the investigation to evaluate whether releases have occurred. No supplemental samples were required during Phase II of the investigation in this AOI, as no delineation issues were noted was determined to be complete. April 2007 RFI Report (Arcadis, 2007). Arsenic and iron exceedances of direct contact criteria were below WV background levels.
AOI-3	Neutralization Tank T-107	Neutralization Tank T-107 is constructed of fiberglass, has a capacity of 12,000 gallons, and is surrounded by a concrete dike. The tank was placed into service in 1967 and was an active unit in the Facility's Waste Water Treatment System (WWTS). The tank received and neutralized process wastewater from Waste Collection Sumps S-106 with magnesium hydroxide. Prior to the use of magnesium hydroxide, other caustics and acids were used to achieve neutralization.	Soils in the vicinity of the tank were sampled during Phase I to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of the soil exceedances in AOI-3 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic and iron exceedances of direct contact criteria were below WV background levels. The bis(2-ethylhexyl)phthalate exceedance of the direct contact criterion was delineated by surrounding samples, and determined in the risk assessment to warrant no further action.
AOI-4	Diversion Basin	The Diversion Basin is a 300,000-gallon capacity, open-top, reinforced concrete structure that was placed into service in 1977 as part of the Facility's WWTS. Initially, wastewater was directed to the Diversion Basin in the event of a spill, pH	Soil samples were collected during Phase I in the vicinity of the Diversion Basin to evaluate whether any releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of soil exceedances in AOI-4 has been

Area of Interest (AOI)		Description	Unit Status
AOI-4	Diversion Basin (cont.)	malfunction, power outage, or excessive hydraulic load. Since 1990, the Diversion Basin served as a Sequencing Batch Reactor (SBR) as part of the WWTS.	achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic and iron exceedances of the direct contact criteria were below WV background levels, with the exception of one location. The arsenic and bis(2-ethylhexyl)phthalate exceedances of direct contact criteria were delineated by surrounding samples, and determined in the risk assessment to warrant no further action.
AOI-5	Equalization Basin	The Equalization Basin is a 300,000-gallon capacity, open-top, reinforced concrete structure that was placed into service in 1973 as part of the Facility's WWTS. Most of the biological treatment for the WWTS took place in this basin. The Equalization Basin received process waters, wastewaters, sewer wastewaters and scrubber wastes from throughout the Facility. Prior to cessation of manufacturing at the Facility, the Equalization Basin served as an SBR.	Soil samples in the vicinity of the Equalization Basin were collected during Phase I of the investigation to evaluate whether releases have occurred. No facility-related contaminants were found to exceed their respective RSL. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* One arsenic exceedance of the direct contact criterion was below the WV background level. One benzo(a)pyrene (BAP) exceedance of the direct contact criterion was delineated by surrounding samples and was determined in the risk assessment to warrant no further action.
AOI-6	South Lagoon	The South Lagoon was a 350,000-gallon storage capacity that was part of the WWTS. The South Lagoon received varying types of waste loads for biological treatment using activated sludge.	Soil samples in the vicinity of the South Lagoon were collected during Phase I of the investigation to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of soil exceedances in AOI-6 has been achieved. AOI-6 was also included in the geophysical survey work that was performed to attempt to determine whether drums alleged to have been buried beneath the lagoons are present. No significant

Area of Interest (AOI)		Description	Unit Status
AOI-6	South Lagoon (cont.)		metal objects that could represent drums were identified beneath the South Lagoon. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Seven arsenic exceedances of the direct contact criterion were below the WV background level. The BAP exceedance of the direct contact criterion was delineated, and was determined in the risk assessment to warrant no further action.
AOI-7	North Lagoon	The North Lagoon was a 300,000-gallon capacity structure that was part of the WWTS. The North Lagoon received varying types of waste loads for biological treatment using activated sludge. According to the WVDEP, a former Facility employee alleged that an unspecified number of drums were buried beneath the lagoons prior to the installation of the reinforced concrete liner.	Soils in the vicinity of the North Lagoon were sampled during Phase I of the investigation to evaluate whether releases have occurred. Delineation of soil exceedances in AOI-7 has been achieved. To evaluate the alleged drums buried beneath the lagoons, a geophysical survey was performed in this area as part of the RFI in addition to the soil and groundwater investigations completed during Phase I to evaluate whether releases occurred. No supplemental samples were required during Phase II of the investigation in this AOI as no delineation issues were noted. No significant metal objects that could represent drums were identified beneath the North Lagoon. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Five arsenic exceedances of the direct contact criterion were below the WV background level.

Area of Interest (AOI)		Description	Unit Status
AOI-8	Former Settling Basin	The Former Settling Basin was located immediately north of the North Lagoon and was part of the Facility's WWTS. Placed into service in 1967, the basin was constructed of reinforced concrete with a dual inverted pyramid design and a 10,000-gallon storage capacity. The treated wastes were allowed to settle to separate the sludge from clear water. The sludge was then recycled, and the clarified water was discharged to the Kanawha River. This unit was removed in 1990 as part of the latest WWTS upgrade.	Soils in the vicinity of the Former Settling Basin were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of soil exceedances in AOI-8 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Two arsenic exceedances of the direct contact criterion were below the WV background level.
AOI-9	Former Settling Tanks	The Former Settling Tanks included three aboveground tanks that ranged from 1,000- to 5,000-gallon capacity. The tanks were used for phase separation and recycling process wastes. The Former Settling Tanks were located in the western portion of the former Hazardous Waste Container Storage Area (AOI-1), but were removed prior to 1984 and the renovation of the area for hazardous waste storage.	Soil samples were collected in the vicinity of the tanks during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of soil exceedances in AOI-9 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic exceedances of the direct contact criterion were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action. Bis(2-ethylhexyl)phthalate and di-n-octyl phthalate exceedances of direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.

Area of Interest (AOI)	Description	Unit Status
AOI-10 Calgon System	The Calgon System consisted of two steel-lined aboveground tanks situated in a concrete dike. This unit managed a wastewater stream from the Specialty Esters Area that contained organic compounds in salty water. The wastewater stream was then treated by the Calgon System, which used granular activated carbon to remove any remaining high-boiling point organic compounds that had not been removed during steam distillation. The Calgon System was removed from service and dismantled in 1991, after which time the wastewater stream from the Specialty Esters Area was directed to the WWTS.	Soil samples in the vicinity of the former Calgon System were sampled during Phase I of the investigation to evaluate whether releases have occurred. No supplemental samples were required with respect to this AOI during Phase II of the investigation. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* One arsenic exceedance of the direct contact criterion was below the WV background level. Benzene, bis(2-ethylhexyl)phthalate, and benzo(a)pyrene exceedances of direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.
AOI-11 Sump and Trench	The Sump and Trench unit was used to contain stormwater within the phosphorus trichloride/phosphorus oxychloride (PCl3/POCl3) process area, as well as to collect and contain any spills or acidic water associated with PCl3 reactor cleanout. In the early 1980s, spills could also have contained 1,1,1-trichloroethane. The unit was built in 1977 as part of a NPDES project and was constructed of reinforced concrete lined with acid brick. This was an active unit composed of the PCl3 clean-out sump and PCl3/POC13 process area trench.	Soils in the vicinity of the Sump and Trench unit were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate any conditions observed in Phase I. Elemental phosphorus was observed in the vicinity of this AOI and the area of investigation of elemental phosphorus in soil completed during the Phase II RFI extended to this AOI. Institutional and engineering controls are needed in order to be protective of human health and the environment. *April 2007 RFI Report (Arcadis, 2007).* Based on the findings in the risk assessment, future potential risk to elemental phosphorus in AOI 11 was mitigated by the placement of a concrete cover as part of an interim measure.

Area of Interest (AOI)		Description	Unit Status
AOI-12	Former Phosphorus Unloading Area	The Former Phosphorus Unloading Area was located near the north edge of the Facility. Phosphorus unloading was accomplished by pumping from rail tank cars via overhead lines to the phosphorus storage tank. This unit was replaced in 2000 with new unloading equipment at a different location, and the area has not been used since the start-up of the new equipment. The access platform and most of the overhead piping remained but had been cleaned out and were not in use. The area is mostly underlain by concrete, except for the ballast on the railroad tracks.	Phosphorus is inherently unstable in an open environment and spontaneously ignites upon contact with air. Institutional and engineering controls are needed in order to be protective of human health and the environment. *April 2007 RFI Report (Arcadis, 2007).* Based on the findings in the risk assessment, future potential risk to elemental phosphorus in AOI-12 was mitigated by the placement of a concrete cover as part of an interim measure.
AOI-13	Former Phosphorus Storage Tank	The Former Phosphorus Storage Tank was located along the north edge of the Facility near the POCl3 area and the Former Phosphorus Unloading Area. The tank was constructed below grade to a depth of 12 feet, and measured approximately 25 by 50 feet in area. The tank was used to store elemental phosphorus under water. The tank was taken out of service in 2000 and closure was completed in 2001.	Soil borings advanced beneath the base of the tank identified phosphorus in the soils. WVDEP informed GLCC/FMC that former Facility employees reported that phosphorus was present in the subsurface soils. Since elemental phosphorus is already known to exist in this area, no sampling was proposed as part of the Phase I RFI. Soil samples were collected as part of the Phase II RFI, in conjunction with AOI-11 soil samples, to delineate elemental phosphorus presence in the immediate area. Institutional and engineering controls are needed to be protective of human health and the environment. *April 2007 RFI Report (Arcadis, 2007).* Based on the findings in the risk assessment, future potential risk to elemental phosphorus in AOI 13 was mitigated by the placement of a concrete cover as part of an interim measure.

Area of Interest (AOI)		Description	Unit Status
AOI-14	Former Alkylate Air Compressor	The Former Alkylate Air Compressor was located just east of the Diversion Basin near the southern edge of the Facility. The air compressor supplied air for the Alkylate Area, but was taken out of service and removed in approximately 1990. Some soil staining near the unit (possibly from compressor oil) was noted during a site visit in 2001. The composition of the oil used in this compressor is not documented.	Soil samples were collected in the vicinity of this compressor during the Phase I RFI to evaluate whether releases have occurred. No supplemental samples were required during Phase II of the investigation in this AOI as no delineation issues were noted. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Two arsenic exceedances of the direct contact criterion were below the WV background level.
AOI-15	Fill Areas	Between 1950 and 1964, residue from the aluminum chloride production area was used as fill material along the north central portion of the Kanawha riverbank area on the west edge of the Facility (alongside the old aluminum chloride production unit). This material was also used, together with other materials, such as rubble and soil, to fill in a former basement area located north of the J-Pit Tank area. The composition of the residue was the unreacted material (a dry, solid powder) left from the reaction of aluminum and chlorine, and may have contained traces of aluminum chloride. However, any traces of aluminum chloride would have reacted quickly with moisture to form a very weak hydrochloric acid. The residue would now be expected to be inert. The former basement was located north of the J-Pit Tank area and is now paved and supports the PCl3/POCl3 storage tanks.	The riverbank area was inspected byin 1983 and concluded to require no further action. Delineation of the soil exceedances in AOI-15 has been achieved with chemical analytical data to the north, east, and south and by physical limitations of the riverbank to the west. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Aluminum, arsenic and manganese exceedances of the direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.

Area of Interest (AOI)		Description	Unit Status
AOI-16	RCRA 90-Day Generator Storage Area	This paved area located immediately west of Building 71 was used since 1994 to store drums of hazardous wastes for periods of less than 90 days. This area may have been used on occasion for temporary drum storage prior to 1994. The area measured approximately 50 by 40 feet and sloped into a containment curb to collect spills or runoff. The area was managed under generator accumulation standards and was routinely inspected under 40 Code of Federal Regulations (CFR) Section 265.174. Inspection reports and interviews revealed no releases in this area.	Based on the use of the area to store hazardous wastes, soils beneath this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate any conditions observed in Phase I. Delineation of the soil exceedances in AOI-16 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Benzene, bis(2-ethylhexyl)phthalate, benzo(a)pyrene, arsenic, iron, and chromium exceedances of direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.
AOI-17	Drum Storage Area for Nonhazardous Wastes	This area along the south-central property line was used to store nonhazardous wastes in drums after 1980 and to store drummed wastes prior to 1980. This was originally a graveled area that was gradually paved and is now entirely paved. Available documentation identifies no incidents involving reportable releases in this area. However, Facility personnel recall that the ground surface in this area was inspected for stained soils prior to each episode of paving, and that some stained soils were removed and disposed of off-site prior to paving.	Soils beneath the pavement in this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate any conditions observed in Phase I. Delineation of soil exceedances in AOI-17 has been achieved, except for tributyl phosphate in sample in SO-17 to the eastern GLCC facility boundary and benzo(a)pyrene in sample SO-12 to the southern GLCC facility boundary. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Benzene, bis(2-ethylhexyl) phthalate, BAP, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and arsenic exceedances of direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.

Area of Interest (AOI)		Description	Unit Status
AOI-18	Residue Drumming, Reofos	This area was part of the Reofos production area, where distillation residue was drummed for off-site disposal. The distillation residue drummed here was not normally a hazardous waste. Occasionally, a product was made that used cresol as a raw material, which rendered any distillation residue generated a D026 hazardous waste because it might have contained cresol. Such hazardous wastes were staged in the RCRA 90-day Generator Storage Area. The paved area of this AOI-18 measured approximately 15 feet square just inside the north edge of the process structure. Curbing was installed in the 1990s in the paved roadway just outside the structure to contain any splashing or spillage.	Soils beneath this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate any conditions observed in Phase I. Complete delineation of AOI-18 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Two arsenic exceedances of direct contact criterion were below the WV background level. Chlorobenzene and 1,2,4-trichlorobenzene exceedances of direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.
AOI-19	Rail Car Loading/Unloading, "C" Track	The Rail Car Loading/Unloading, "C" Track is the graveled roadbed "C" Track for the railroad track next to former B IE. Rail cars containing raw materials and products associated with Facility operations in areas other than the Chlorides Area were unloaded and loaded at several spots along this track. Containment pans were placed under the rail cars and led to a collector sewer trench running along the tracks to collect pan drainage and runoff. The track bed gravel (ballast) was removed and replaced in the 1990s. According to reports, some of the gravel that was removed showed evidence of staining. Organic vapors and stained soils were noted by field personnel during field sampling, and soil results	Soils beneath this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Complete delineation of AOI-19 has been achieved except for vertical delineation of soil exceedances. However, the deepest samples are within the water table. Therefore, vertical delineation of soil exceedances is not needed in AOI-19. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Four VOCs, seven SVOCs, and lead exceedances of direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action. Arsenic, chromium, iron, and manganese

Area of Interest (AOI)		Description	Unit Status
AOI-19	Rail Car Loading/Unloading, "C" Track (continued)	yielded higher organic concentrations in the soil around this area and in the underlying groundwater.	concentrations were below their respective WV background levels.
AOI-20	Stormwater Diversion Tanks (Old CBS Tanks)	The two stormwater diversion tanks are partially underground tanks that were originally built to store and reship carbon bisulfide (CBS), which was produced at another facility. CBS was not used at the Facility. The tanks each had a capacity of 300,000 gallons. The storage of CBS at the Facility ended by the late 1980s. In 1990, the tanks underwent a change in service to become part of the Facility's WWTS. As part of this change in service, the tanks were emptied, thoroughly cleaned and inspected, and determined to be in satisfactory condition with no evidence of leaks. Documentation of these activities was provided to the WVDEP along with a notice of the change in service in 1990. From the 1990s until the closure of the Facility, one tank was used to hold stormwater from nearby process areas and the S-106 sumps, and the other to hold process wastewaters primarily from the Multipurpose facility. Water from both tanks was directed through the WWTS and discharged to the Kanawha River via outfall 001. Based on the results of the 1990 inspection, it	Soils beneath this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of soil exceedances in AOI-20 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Seven arsenic exceedances and one iron exceedance of the direct contact criteria were below the WV background level. The BAP exceedance of direct contact criterion was delineated, and was determined in the risk assessment to warrant no further action.

Area of Interest (AOI)		Description	Unit Status
AOI-20	Stormwater Diversion Tanks (Old CBS Tanks) (continued)	is not considered likely that releases have occurred from these tanks.	
AOI-21	Northwest Former Drum Storage Area	The Northwest Former Drum Storage Area was used routinely to store dirt that was excavated during construction work at the Facility, pending off-site disposal. From approximately 1970 to 1984, full and empty drums were also stored there. No information regarding the contents of these drums was found. During the 1990s, this area was covered with geotextile fabric and gravel to reduce soil erosion during rainstorms. In addition, the WVDEP informed GLCC/FMC that former employees have alleged that a "reactor" was buried in this area of the Facility during the RFIWP preparation process in 2003. The RFIWP was unclear as to whether this allegation may have been related to AOI-15, but the WVDEP clarified that the allegation is associated with AOI-21. Information regarding the alleged buried reactor is entirely anecdotal. It is presumed that the term "reactor" refers to some sort of chemical reactor, such as those utilized in the Facility processes.	Soil samples were collected in this area during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Complete delineation of AOI-21 has been achieved except for vertical delineation of soil exceedances. However, samples in AOI-21 were primarily collected near the water table. Therefore, vertical delineation of soil exceedances is not needed in AOI-21. *April 2007 RFI Report (Arcadis, 2007).* Seven arsenic exceedances and one iron exceedance of the direct contact criteria were below the WV background level. The BAP exceedance of direct contact criterion was delineated, and was determined in the risk assessment to warrant no further action. A geophysical survey was performed in this area to evaluate the presence of the alleged buried reactor. As requested by the EPA in a January 19, 2006 meeting, test trenches were dug during the Phase II RPI to evaluate subsurface conditions. Based on the geophysical survey and excavation results, there appears to be no evidence to substantiate the allegation that a reactor was buried in this area. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*

Area of Interest (AOI)		Description	Unit Status
AOI-22	Former Waste Oil Container Storage Area	The Former Waste Oil Container Storage Area formerly occupied approximately 400 square feet in a paved and curbed area against the south wall of Building 1 and east of Building 17. The area was used from approximately 1985 to 1990 to store drums of waste oil from air compressors, the hydraulic crane, and other sources.	Soils beneath the pavement in this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Complete delineation of AOI-22 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic exceedances of the direct contact criterion were below the WV background level. SVOC exceedances of direct contact criteria were delineated, and were determined in the risk assessment to warrant no further action.
AOI-23	Phosphorus Rail Car Unloading Area	The Phosphorus Rail Car Unloading Area was constructed in 2000 to replace the Former Phosphorus Unloading Area (AOI-12). This area was located east of the former unloading area, just north of Building 52. This area exhibited no signs of soil impacts.	Given that unloading activities in this area had always been above grade and the fact that phosphorus combusts on contact with air, the absence of observable impacts to area soils supported the conclusion that environmental impacts have not occurred. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*
AOI-24	Chlorine Rail Car Unloading Area	The Chlorine Rail Car Unloading Area was located west of the Former Phosphorus Unloading Area. Tank cars of chlorine were parked in this area, and their contents were unloaded under pressure via overhead pipelines directly to process units, with no intermediate on-site storage. This area experienced one reportable quantity release in August 1996. This release was to air only.	Due to the fact that chlorine is a gas at standard temperature and pressure, the potential for environmental impacts to soil and groundwater in this area is considered to have no potential to pose an unacceptable risk. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*
AOI-25	Drum Cleaning/Crushing Area	The Drum Cleaning/Crushing Area was a small paved and curbed area constructed of reinforced concrete and located adjacent to the Waste Collection Sumps S-106 (east) (AOI-2). Steel	Soils beneath this area were sampled during the Phase I RFI to evaluate whether releases have occurred and during the Phase II RFI to delineate conditions observed in Phase I. Delineation of

Area of Interest (AOI)		Description	Unit Status
AOI-25	Drum Cleaning/Crushing Area (continued)	drums that contained raw materials or reworked products were steam cleaned at this location before being crushed and sold as scrap metal. Wash water from the area was collected in the curbed area and flowed into the Waste Collection Sumps S-106 (east) for treatment in the WWTS. Cleaned drums were crushed in the drum crusher located in a paved and diked area approximately 20 feet northeast of the Drum Cleaning Area. Drums were transported to the Drum Crushing Area either manually or by forklift.	soil exceedances in AOI-25 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*
AOI-26	Control Laboratories and Bottle Wash Room	Drainage through the sinks in the Control Laboratories and Bottle Wash Room was collected and sent to the WWTS through double-walled underground piping that runs along Pickens Road. According to former Facility personnel, prior to 1990, the drainage ran due west into a manhole and then into a drain that ran west under Flexsys Road to a WWTS on the adjacent former Monsanto property. Sanitary sewage was sent to the Nitro municipal treatment system. Rainfall runoff around the building was sent to the Nitro storm sewer system. No evidence of releases was identified for this area during the site inspections, document reviews or employee interviews. This area was not considered to be a potential source area, but was included as an AOI because it was identified in the WVDEP's September 29, 1993 letter to the EPA responding to a EPA Region III Corrective Action Questionnaire.	For the Phase II RFI, soil samples were collected in AOI-26 based on a request made by EPA during a meeting between the EPA and the GLCC/FMC on January 19, 2006. Samples related to the discharge piping were collected beginning at depths at the base of the piping of the older drain leading to the former Monsanto property, as well as the lab building's drainage piping to attempt to characterize whether releases had occurred. Step-out samples were collected in August 2006 to delineate conditions observed in samples collected in this AOI in June 2006. Vertical and horizontal delineation was achieved for all compounds in AOI-26. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*

Area of Interest (AOI)		Description	Unit Status
AOI-27	HCL Storage Tanks	The HCL Storage Tanks were situated in a paved and curbed area. Water collected within the dike was sent to the Facility WWTS. These tanks were part of Facility production operations and were not related to waste handling.	No evidence of releases was identified for this area during the site inspections, document reviews or employee interviews. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007); 2004 Phase I RFI Work Plan (BBL, 2004)*
AOI-28	New Kronitex HCL Area	The New Kronitex HCL Area was part of the active production process at the Facility. The area was curbed, and stormwater was collected and sent to the Facility WWTS. This area was not related to waste handling.	No evidence of releases was identified for this area during the site inspections, document reviews or employee interviews. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007); 2004 Phase I RFI Work Plan (BBL, 2004)*
AOI-29	Alkylate Tank Farm	The Alkylate Tank Farm contained product storage tanks. The area was built in 1969 and was diked and curbed. Rainwater was collected and sent to the WWTS. These tanks were part of Facility production operations and were not related to waste handling.	No evidence of releases was identified for this area during the site inspections, document reviews or employee interviews. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007); 2004 Phase I RFI Work Plan (BBL, 2004).*
AOI-30	PCl3 Tank	The PCl3 Tank was a finished product storage tank. The PCl3 production area was paved and curbed, and rainwater was collected and sent to the Facility WWTS. The PCl3 Tank was part of Facility production operations and was not related to waste handling.	No evidence of release was identified for this area during the site inspections, document reviews or employee interviews. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007); 2004 Phase I RFI Work Plan (BBL, 2004)*
AOI-31	Dowtherm Heater and Boiler (31A and 316)	The Dowtherm Heater and Boiler were separate units. The Dowtherm Heater (which more recently used Therminol as the heat transfer fluid, rather than Dowtherm) was natural gas fired and provided a recirculating hot oil stream for process use. The boiler was natural gas fired and produced steam for process and heating uses. The air permits allowed for either unit to burn	At the WVDEP's specific request during the RFIWP development, soil samples were collected during the Phase II RFI to verify that these areas are not potential sources of contamination. Complete delineation of AOI-31 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic and iron exceedances of the direct

Area of Interest (AOI)		Description	Unit Status
AOI-31	Dowtherm Heater and Boiler (31A and 316)	either gas or oil, but only the boiler burned oil for a brief period. The units had emissions to the air, but no evidence of releases to the ground surface was identified during the site inspections, document reviews or employee interviews. These boilers were not part of the waste management operations at the Facility.	contact criteria were below the WV background levels.
AOI-32	PCl3/POCl3 Scrubbers	The PCl3 and POCl3 Scrubbers were two process scrubbers that each recirculated a working fluid to absorb acid vapors from the process. The circulating fluid was normally acidic water. Some of the fluid was routinely purged to the WWTS for neutralization; city water was used as makeup. Interviews with Facility personnel indicate that historical leaks may have occurred from these units. These two scrubber systems were replaced in early 2002 with new units at an adjacent location.	Soil samples were collected in the vicinity of these scrubbers during the Phase I RFI to evaluate whether releases have occurred and during Phase II to delineate conditions observed during Phase I. Delineation of soil exceedances in AOI-32 has been achieved. Institutional and engineering controls are needed in order to be protective of human health and the environment. *April 2007 RFI Report (Arcadis, 2007).* Based on the findings in the risk assessment, future potential risk to elemental phosphorus in AOI 32 was mitigated by the placement of a concrete cover as part of an interim measure.
AOI-33	F-Tank Area	Former Facility employees have alleged to the WVDEP that the soils underlying the F-Tank Area contain elemental phosphorus.	Soil samples were collected in this area during the Phase II RFI to evaluate whether elemental phosphorus releases have occurred. Delineation of soil exceedances in AOI-33 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic exceedances of the direct contact criterion were below the WV background level. BAP, benzo(a)anthracene, benzo(b)fluoranthene, and bis(2-ethylhexyl)phthalate exceedances of the direct contact criteria were

Area of Interest (AOI)	Description	Unit Status
AOI-33 F-Tank Area		delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.
AOI-34 M-Tank Area	According to the WVDEP, former Facility employees have alleged that soils were affected by leaks and spills from tanks in the M-Tank Area, where Kronitex was reportedly stored. The area was reportedly paved and diked.	Soil samples were collected in this area during the Phase I RFI to evaluate whether releases have occurred and during Phase II to delineate conditions observed in Phase I. Delineation of soil exceedances in AOI-34 has been achieved. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic and iron exceedances of the direct contact criteria were below the WV background levels. Benzene and tris(dimethylphenyl)phosphate exceedances of the direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.
AOI-35 Tank Yard Sump	During a site inspection on July 11, 2002, the WVDEP observed groundwater with a sheen and odor to be seeping through cracks in the concrete in the vicinity of the Tank Yard Sump. As a result, the WVDEP expressed concerns regarding groundwater quality in this area.	Soils in this area were sampled during the Phase I RFI to evaluate whether releases have occurred. Soil samples were collected in this area during Phase II to delineate conditions found during the Phase I investigation with respect to AOI-19 and AOI-35. The evaluation and additional delineation for AOI-35 was combined with AOI-19 due to the similar nature of constituents detected above screening criteria and the relative proximity of this AOI to AOI-19. No additional delineation was conducted specific to AOI-35. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*

Area of Interest (AOI)		Description	Unit Status
AOI-36	Alleged Spent Carbon Area	According to the WVDEP, former Facility employees have alleged that spent carbon was buried in an area near the present WWTS. The location of this Alleged Spent Carbon Area was hand drawn on a map that was provided to GLCC/FMC by the WVDEP. No further information is available regarding this Alleged Spent Carbon Area.	Soil samples were collected in the area during the Phase I RFI to evaluate whether releases have occurred. No supplemental samples were required during Phase II of the investigation in this AOI as no delineation issues were noted. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* One arsenic exceedance of the direct contact criterion was below the WV background level.
AOI-37	Former Pond	A pond-like feature ("Former Pond") is visible on historical aerial photographs in the area most recently occupied by the Kronitex production area. According to the WVDEP, former Facility employees alleged that acidic wastewater from a former methyl diphenyl phosphate process was routed to the Former Pond for 2 to 3 years in the late 1960s. No further information is available regarding this Former Pond.	Soils within the footprint of this former area were sampled during the Phase I RFI to evaluate whether releases have occurred. No supplemental samples were required during Phase II of the investigation in this AOI as no delineation issues were noted. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).* Arsenic, chromium and iron exceedances of the direct contact criteria were below the respective WV background levels. 3-methylphenol and 4-methylphenol exceedances of the direct contact criteria were delineated by surrounding samples, and were determined in the risk assessment to warrant no further action.
AOI-38	Former Gasoline Underground Storage Tank	As described in the DOCC (BBL, 2003b), a 1,000-gallon steel gasoline underground storage tank was installed in the grassy area south of the gatehouse (Building 62) in the 1960s and removed in 1987. Notice of the removal was provided to the WVDNR Division of Waste Management on June 4, 1987. No soil samples were collected when this Former Gasoline Tank was	Soil samples were collected in this area during the Phase I RFI to evaluate whether releases have occurred. There were no exceedances of direct contact standards, thus no supplemental samples were required during Phase II of the investigation in this AOI as no delineation issues were noted. No further action is required for this AOI. *April 2007 RFI Report (Arcadis, 2007).*

Area of Interest (AOI)		Description	Unit Status
AOI-38	Former Gasoline Underground Storage Tank (continued)	removed. However, the tank and excavation were visually inspected at the time of tank removal and reportedly exhibited no signs of leaks or release of petroleum products to soils. Based on these observations, the excavation was backfilled.	
AOI-39	Lab/Warehouse Parcel	Historic aerial photographic evidence provided by the EPA suggested that drums of unknown origin may have been stored in the northern area of the Lab/Warehouse Parcel. Therefore, during the Phase II RFI, soil samples were collected in the Lab/Warehouse Parcel area surrounding AOI-26.	The RFIWP did not consider this AOI as a source area and proposed no sampling for Phase I. However, several surface soil samples were collected and temporary wells installed in the Lab/Warehouse Parcel during the Phase II. Step-out samples were collected in August 2006 to delineate conditions observed in samples collected in this AOI in June 2006. Delineation of AOI-39 has been achieved. *April 2007 RFI Report (Arcadis, 2007)*. Based on the findings in the risk assessment, future potential risk to dioxin-impacted soil on the Lab/Warehouse Parcel was mitigated by excavation during implementation of an interim measure.

IV. SUMMARY OF ENVIRONMENTAL INVESTIGATIONS

In accordance with the AOC, the RFI was conducted for the Facility between May 2003 and August 2006, and an EPA approved RFI Report was issued in November 2007 (ARCADIS BBL, 2007, #11). The RFI focused on soil and ground water at the Facility and within the surrounding areas. A supplemental RFI was conducted in 2009, which focused on the sampling and analysis of pore water and sediment samples from the Kanawha River. EPA approved an RFI Report Addendum detailing the results of this sampling on June 11, 2011 (ARCADIS, 2011, #16). Because the results of the supplemental RFI demonstrated that the Facility is not adversely impacting the Kanawha River, the Human Health Risk Assessment (HHRA) focused on soil and ground water associated with the Facility.

The HHRA Report was submitted to EPA in August 2014 (ARCADIS, 2014, #22). The HHRA was prepared in accordance to the approach described in the risk assessment interim deliverable (ARCADIS, 2012, #17) and took into consideration the EPA comments received on

the risk assessment approach (USACE, 2015, #23). After responding to EPA's February 2015 comments to the HHRA, EPA approved the HHRA on August 21, 2015. (EPA, 2015, #25)

The RFI included collection and analysis of soil and ground water on the Facility and from Fike/Artel wells and piezometers located on the adjacent Par and Solutia properties, and sampling and analysis of pore water and sediment samples from the Kanawha River. The selection of the AOI were based on a review of historical facility processes, chemicals used, stored or manufactured at the Facility, and waste manifests (ARCADIS, 2007, #11). In addition, soil and ground water samples were collected from the Lab/Warehouse Parcel in locations not designated as an AOI. The results of the investigations are summarized below.

Soil Quality

Soil data were collected from the 38 AOIs on the Main Plant Area and non-AOI locations on the Lab/Warehouse Parcel during implementation of the RFI between May 2003 and August 2006 (**Appendix B**). Soil samples collected on the Main Plant Area were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals with the inclusion of white phosphorus for AOIs 11, 12, 13, 15, and 32. Soil samples collected from the Lab/Warehouse Parcel were analyzed for VOCs, SVOCs, metals, polychlorinated biphenyls (PCBs), pesticides, and dioxins. Dioxin/furan data were presented in the HHRA as 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) toxic equivalent quotients (TEQs), which were based on World Health Organization toxicity equivalency factors (TEFs) (ARCADIS, 2014, #22).

Based on the results of the soil samples collected on the Main Plant Area and Lab/Warehouse Parcel, multiple constituents detected in soil were identified as Contaminants of Potential Concern (COPCs) when screened against the EPA regional screening levels in the HHRA. In surface and subsurface soil on the Main Plant Area, benzene, 1,2,4,5-tetrachlorobenzene, select SVOCs (including PAHs), select metals, PCBs (Aroclor 1254), kepone (organochlorine pesticide), and dioxins/furans were identified as COPCs. Benzo(a)pyrene, arsenic, and dioxins/furans were identified as COPCs in surface and subsurface soil on the Lab/Warehouse Parcel.

Human Health Risk Assessment

Based on the HHRA, EPA determined that the presence of certain COPCs, namely pesticides, PCBs, and dioxins, are not Facility-related due to the lack of activities at the Facility involving the use, storage, or production of these chemicals and the known existence of off-site sources in the Kanawha River valley (ARCADIS, 2014, #22). The HHRA presented a statistical analysis to determine if there were statistically significant differences between on-site and off-site soil concentrations of arsenic, PCBs, pesticides, and dioxins/furans. The statistical analysis concluded there were no significant differences between Facility and background concentrations of arsenic, PCBs, pesticides, or dioxins/furans in soil.

Overall, the results of the HHRA indicate there are two areas of soil impacts that create an unacceptable risk to future Facility workers and construction workers. These two areas are:

1. Potential exposure to the presence of white phosphorus creates an unacceptable risk to Facility workers and future Facility construction workers. There is no risk to Facility trespassers due to the existing concrete slabs and foundations over the areas.

2. Potential exposure to the presence of dioxin-impacted surface soils on the Lab/Warehouse Parcel creates an unacceptable risk to future outdoor commercial/industrial workers. Although dioxins are not considered to be Facility-related impacts, the risk to future workers must still be addressed as part of the RCRA Corrective Action process.

No other areas representing an unacceptable risk were identified and EPA concurred that delineation of soil conditions at the Facility is complete. However, there is the potential to encounter soil contamination not previously identified during removal of slabs and foundation during future redevelopment.

Groundwater Quality

Five groundwater sampling events were conducted at the Facility between 2003 and 2009. (**Appendix C**). The sampling events included sampling of on and off-site monitoring wells screened in both the shallow and deep zones. Comparison of the results across the sampling events indicates that concentrations of groundwater COPCs have shown relatively similar or slightly decreasing trends. The findings of the groundwater sampling events for the Main Plant Area are summarized as follows:

VOCs consisting of benzene, carbon tetrachloride, chlorobenzene, chloroform, cis-1,2-dichloroethene (DCE), trichloroethene (TCE), and vinyl chloride, have concentrations detected above MCLs in the shallow zone in on-site wells. Benzene, carbon tetrachloride, chloroform, and TCE are the most prevalent of the seven VOCs beneath the former Facility footprint. No VOCs were detected above the EPA screening values in the deep zone.

Seven SVOCs, 1,4-dioxane, 2,4-dimethylphenol, 3-methylphenol, 4-methylphenol, bis(2-chloroethyl) ether, phenol, and tributyl phosphate, have been detected in one or more on-site wells above MCLs, or EPA Region III Screening Levels for Tap Water (Tap Water RSLs) for chemicals for which there are no applicable MCLs. The data indicate that 1,4-dioxane is likely migrating on-site from the east and south in the deep zone.

Arsenic, barium, cadmium, iron, manganese, and thallium were detected in one or more on-site wells at concentrations above the applicable screening criteria. However, iron, manganese, and thallium were the only metals detected at concentrations above MCLs or Tap Water RSLs in a majority of the on-site wells, and EPA has determined that detections are indicative of regional baseline conditions (ARCADIS, 2007, #11).

The data indicate that COPCs in the shallow zone are not migrating vertically into the deep zone, and there is a slight upward gradient from the deep zone to the shallow zone. No COPCs were identified in groundwater samples collected by the GLCC/FMC from the Lab/Warehouse Parcel.

Natural Attenuation

Natural attenuation entails a variety of physical, chemical and/or biological processes that reduce the mass, toxicity, mobility, volume or concentration of constituents of concern. These processes are classified as degradation (biological or chemical), sorption (chemical) and dispersion, diffusion, dilution, and volatilization (physical). Facility conditions were evaluated in a manner consistent with the Technical Protocol for Monitored Natural Attenuation of Chlorinated Solvents in Groundwater by Todd Weidemeier (September 1998) for the purpose of understanding the fate and transport of Main Plant Area source contaminants.

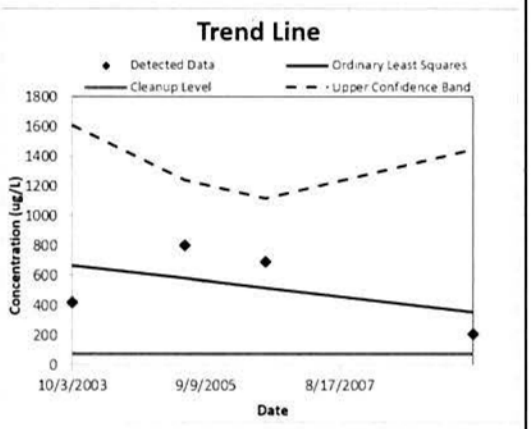
The primary COPCs are VOCs and SVOCs related to the phosphorus-based chemical manufacturing processes, which took place in the Main Plant Area. Monitoring at the Facility has shown that the contaminants are effectively being addressed by natural attenuation. Specifically, the extent of contamination in groundwater is not increasing and concentrations of contaminants are declining over time. EPA's Groundwater Statistics Tool was use to evaluate groundwater data trends for a given constituent at a single monitoring well. Results are shown in **Figure 1**, **Figure 2** and **Figure 3**.

Figure 1

Groundwater Statistics Tool

UCL calculations and summary statistics for data sets that are normally distributed

Site Name	GLCC Nitro
Operating Unit (OU)	Main Plant
Type of Evaluation	Remediation
Date of Evaluation	7/5/2017
Person performing analysis	J. Hopkins
Chemical of Concern	Chloroform
Well Name/Number	EW-8
Date Units	Date
Concentration Units	ug/L
Confidence Level	95%
Number of results	4
Number < cleanup level	0
Are any potential outliers present?	No
Mean of concentration	530
Standard deviation of concentration	266
t-value for UCL calculation	2.353



95% Upper Confidence Limit (UCL)	843
Method for calculating UCL	Student's t UCL
Value of 95% Upper Confidence Band value at final sampling event	1450
Trend calculation method	Ordinary Least Squares
Cleanup level	80
Source of cleanup level	MCL
Is the trend decreasing or statistically insignificant?	Yes

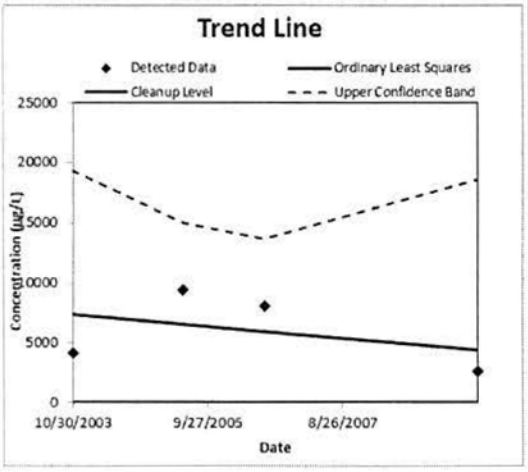
When is the concentration predicted to exceed the MCL?	Not applicable - slope is not statistically increasing
Message: None.	

Figure 2

Groundwater Statistics Tool

UCL calculations and summary statistics for data sets that are normally distributed

Site Name	GLCC Nitro
Operating Unit (OU)	Main Plant
Type of Evaluation	Remediation
Date of Evaluation	7/5/2017
Person performing analysis	J. Hopkins
Chemical of Concern	Carbon Tetrachloride
Well Name/Number	EW-3
Date Units	Date
Concentration Units	ug/L
Confidence Level	95%
Number of results	4
Number < cleanup level	0
Are any potential outliers present?	No
Mean of concentration	6050
Standard deviation of concentration	3220
t-value for UCL calculation	2.353



95% Upper Confidence Limit (UCL)	9840
Method for calculating UCL	Student's t UCL
Value of 95% Upper Confidence Band value at final sampling event	18600
Trend calculation method	Ordinary Least Squares
Cleanup level	5
Source of cleanup level	MCL
Is the trend decreasing or statistically insignificant?	Yes

When is the concentration predicted to exceed the MCL?	Not applicable - slope is not statistically increasing

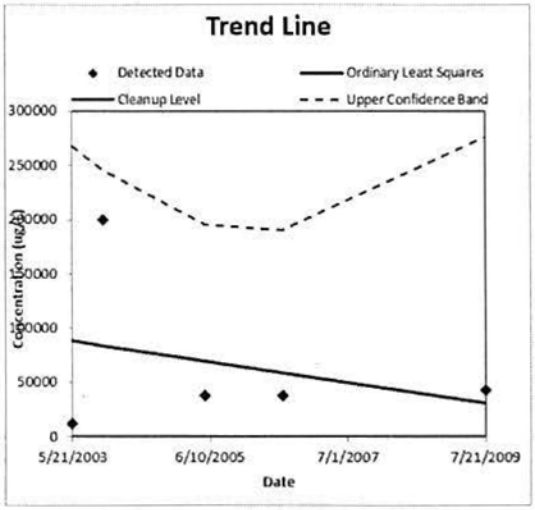
Message: None.

Figure 3

Groundwater Statistics Tool

UCL calculations and summary statistics for nonparametric data sets

Site Name	GLCC Nitro
Operating Unit (OU)	Main Plant Area
Type of Evaluation	Remediation
Date of Evaluation	7/5/2017
Person performing analysis	J. Hopkins
Chemical of Concern	2,4-Dimethylphenol
Well Name/Number	MW-4S
Date Units	Date
Concentration Units	ug/L
Confidence Level	95%
Number of results	5
Number < cleanup level	0
Are any potential outliers present?	Yes
Mean of concentration	66200
Standard deviation of concentration	75800



95% Upper Confidence Limit (UCL)	214000
Method for calculating UCL	Chebyshev UCL
Value of 95% Upper Confidence Band value at final sampling event	277000
Trend calculation method	Ordinary Least Squares
Cleanup level	6.1
Source of cleanup level	Region 3 RBC Tapwater
Is the trend decreasing or statistically insignificant?	Yes

When is the concentration predicted to exceed the MCL?	Not applicable - slope is not statistically increasing
Random Seed Used	0

Message: None.

Vapor Intrusion

The presence of VOCs in groundwater presents the potential for vapor intrusion (VI) from groundwater. The HHRA identified the potential exposure of future indoor commercial/industrial workers to vapors emanating from groundwater as an unacceptable risk. The remaining buildings currently on-site are inactive and are located along the eastern edge of the Facility where VOC concentrations in groundwater do not present a concern for vapor intrusion. The HHRA demonstrates a potential cancer risk within the EPA acceptable risk range of 1×10^{-4} to 1×10^{-6}[BS29][gp30][HJ31]. Therefore, no corrective measures to mitigate exposure to VOCs in indoor air in existing buildings are necessary.

There is the potential for vapor intrusion from groundwater to indoor air if future buildings are placed in areas where VOC-impacted groundwater is present. Specifically, the results of the HHRA indicate that there is the potential for unacceptable risk to future indoor commercial/industrial workers if future buildings are placed within 100-foot of wells MW-11S[BS32][gp33][HJ34], MW-12S or MW-16S due to the presence of carbon tetrachloride and TCE in shallow groundwater (ARCADIS, 2014, #11). TCE concentrations in groundwater are highest off-site, on an adjacent property to the North. Specifically, the "footprint" of the shallow groundwater plume demonstrates that the source area of TCE is off-site.

GLCC and FMC prepared a Soil Gas Sampling and Analysis Plan (SAP) for collection of empirical soil gas data, and submitted the SAP to EPA on February 22, 2016 as a pre-design study for the Corrective Measures Implementation (CMI) Work Plan (ERM, 2016, #30). EPA approved the SAP in a letter dated March 15, 2016 (EPA, 2016, #31)[BS35][HJ36], and the SAP was implemented in April 2016. The results of the soil gas sampling were described in the May 2016 report titled Soil Gas Investigation (SGI) (ERM, 2016, #35). The SGI results indicate an unacceptable human health non-cancer risk to a future indoor commercial/industrial worker due to the presence of VOCs in groundwater (ERM, 2016, #35). Thus, vapor mitigation would[BS37][gp38][HJ39] be warranted in future buildings constructed on the Main Plant Area as shown in **Figure 1**, unless groundwater quality conditions improve over time.

Surface Water and Sediment Quality

The Kanawha River, which is used for commercial shipping and recreational boating and fishing, is located hydraulically downgradient of the Facility in terms of groundwater flow. Based on the surface water and sediment evaluation conducted as part of the 2003 Phase I RFI, EPA determined that the discharge of groundwater constituents from the shallow zone to the Kanawha River does not impact sediments or surface water above EPA screening levels. Pore-water and sediment samples were collected as part of the supplement RFI activities supporting EPA's determination are available in the AR.
[gp40]

EPA determined that there are no unacceptable risks to aquatic biota based on the acceptance of the RFI Addendum. Further, the conclusion that the Facility does not pose an unacceptable risk to aquatic biota in the Kanawha River was restated in Section 1.3 of the August 2014 HHRA Report (ARCADIS, 2014, #11). EPA approved the HHRA in a letter dated August 21, 2015.

Subsurface Piping

Subsurface Piping

Underground piping including utilities, sanitary sewer, and storm sewers are present at the Facility. These underground features are located above the shallow zone water table and do not represent a source of contamination to groundwater. A network of storm sewers that formerly conveyed water from non-process areas to the Kanawha River also appears to be above the water table.

The storm sewers originate from areas beyond the Facility boundary and therefore also convey stormwater generated from the adjacent properties. Monthly storm water data collected between October 2010 and February 2016, as a condition of West Virginia NPDES Permit No. WV0116459, indicate that benzene, arsenic, and organic phosphorus are the only constituents detected in storm water on a routine basis and the concentrations of these constituents in storm water are less than the concentrations found in groundwater. Additionally, selected VOCs present in groundwater, including trichloroethylene, carbon tetrachloride, and vinyl chloride, were not detected in 65 monthly storm water monitoring results. The storm water monitoring results indicate that the sewers do not represent an on-going source of contamination to groundwater.

V. INTERIM REMEDIAL MEASURES

Removal of Non-Site Related Dioxin Contaminated Soil

Analytical results from the RFI revealed that the presence of dioxin-impacted surface soils on the Lab/Warehouse Parcel creates an unacceptable risk to future outdoor commercial/industrial workers. Although dioxins are not considered to be Facility-related impacts, the risk to future workers must still be addressed as part of the RCRA Corrective Action process.

GLCC and FMC prepared a CMS that included a task to conduct an Interim Measure (IM) to address the dioxin contamination. The initial version of the CMS that was submitted to EPA on 31 March 2016 identified the three potential corrective measure alternatives. The Excavation and Placement on Solutia Facility Under a Protective Soil Cover alternative was implemented as an IM in June 2016.

GLCC and FMC implemented the first part of the IM Work Plan on 31 March 2016, which consisted of soil sampling around previous sample points LW-1 and LW-2 to delineate the excavation areas. The results of the soil sampling indicated that the estimated excavation area was reduced to 3,100 square feet. Based on the configuration of the excavation area an estimated 230 cubic yards of soil was proposed for excavation. Excavation of the soil, placement of the excavated soil on the Solutia Facility, backfilling the excavations, and restoring the Facility occurred on 21 and 22 June 2016 and 27 through 29 June 2016.

The interim measure is complete and no further action is proposed for the Lab/Warehouse Parcel. The implementation of the IM is documented in the report titled *Interim Measure Final Report for the Dioxin-Impacted Soil on the Lab/Warehouse Parcel* (ERM, 2016, #37).

Enhanced Concrete Cover Over the White Phosphorus Area

The white phosphorus area, which includes AOIs 11, 12, 13 and 32, is currently beneath existing concrete slabs or a gravel-covered soil surface. The corrective measure identified and evaluated in the CMS included placement of a six-inch thick concrete cover on top of the existing concrete slab over an approximate 8,000 square foot area. This enhancement to the existing concrete slab will be implemented in a manner that the integrity of the existing concrete slab will be protected over time. The enhanced concrete cover, coupled with a land use covenant preventing disturbance of the cover, will prevent contact with the underlying phosphorus-impacted soil, and effectively mitigate human health risk.

EPA indicated in an August 24, 2016 telephone conference with GLCC and FMC that the cover can be constructed as an interim measure, and the interim measure will be the final action for the white phosphorus area. The November 29, 2016 document titled *Interim Measure Work Plan for the White Phosphorous Area* (IM Work Plan) was submitted to EPA and WVDEP. The IM Work Plan described the scope of an interim measure to place a concrete cover over the existing concrete in the area where the white phosphorus was managed on the Main Plant Area, and represents the 50 percent design elements for the interim measure implementation. The location and size of the concrete cover was adjusted in the IM Work Plan from the initial conceptual design presented in the CMS to a larger, more conservative design covering an area of approximately 100 feet by 108 feet (10,800 square feet). EPA and WVDEP approved this IM Work Plan in letters dated 15 December 2016 and 21 December 2016, respectively.

The IM Work Plan was implemented between June 5th and June 6th, 2017.

V. CORRECTIVE ACTION OBJECTIVES

EPA's Corrective Action Objectives (CAOs) for the specific environmental media at the Facility are the following:

1. Soils

EPA's COA for soils is to attain RSLs for Industrial Soils and to control exposure to the hazardous constituents remaining in soils to contaminants concentrations within the EPA allowable risk range of 1x10-4 to 1x10-6

2. Groundwater

EPA expects final remedies to return groundwater to its maximum beneficial use within a timeframe that is reasonable given the particular circumstances. EPA's Corrective Action Objectives for Facility groundwater are 1) to restore the groundwater to drinking water standards, otherwise known as MCLs, or to the relevant RSL for tap water for each contaminant that does not have an MCL and, 2) until such time as drinking water standards are restored, to control exposure to the hazardous constituents remaining in the groundwater.

3. Vapor Intrusion

The CAO for potential vapor intrusion for occupied buildings is to control human exposure and attain EPA's acceptable cancer risk range of 10^{-4} to 10^{-6} and the non-cancer risk (hazard quotient) of 1 or less within 100-foot of wells MW-11S, MW-12S and MW-16S.

VII. PROPOSED REMEDY

EPA's proposed remedy for the Facility is a combination of No Further Action for the majority of the AOIs and Engineering and Institutional Controls. Under this proposed remedy, contaminants remain in the soil and groundwater at specific areas within the Facility above levels appropriate for residential use. EPA's proposed remedy requires the compliance with and maintenance of soil and groundwater use restrictions that will prohibit residential use. EPA proposes to implement the land and groundwater restrictions necessary to prevent human exposure to contaminants at the Facility through an enforceable mechanism such as a permit, order, or environmental covenant. The elements of the proposed remedy are described below:

A. Based on the RFI, EPA has determined there are no unacceptable risks to human health and the environment for the following areas:

AOI 1 – Former Hazardous Waste Container Storage Area
AOI 2 – Waste Collection Sumps S-106 (East and West)
AOI 3 – Neutralization Tank T-107
AOI 4 – Diversion Basin
AOI 5 – Equalization Basin
AOI 6 – South Lagoon
AOI 7 – North Lagoon
AOI 8 – Former Settling basin
AOI 9 – Former Settling Tanks
AOI 10 – Calgon System
AOI 14 – Former Alkylate Air Compressor
AOI 15 – Fill Areas
AOI 16 – RCRA 90-Day Generator Storage Area
AOI 17 – Drum Storage Area for Nonhazardous Waste
AOI 18 – Residue Drumming, Reofos
AOI 19 – Rail Car Loading/Unloading, "C" Track
AOI 20 – Stormwater Diversion Tanks (Old CBS Tanks)
AOI 21 – Northwest Former Drum Storage Area
AOI 22 – Former Waste Oil Container Storage Area
AOI 23 – Phosphorus Rail Car Unloading Area
AOI 24 – Chlorine Rail Car Unloading Area
AOI 25 – Drum Cleaning/Crushing Area
AOI 26 – Control Laboratories and Bottle Wash Room
AOI 27 – HCL Storage Tanks

AOI 28 – New Kronitex HCL Area
AOI 29 – Alkylate Tank Farm
AOI 30 – PCL3 Tank
AOI 31 – Dowtherm Heater and Boiler (31A and 316)
AOI 33 – F-Tank Area
AOI 34 – M-Tank Area
AOI 35 – Tank Yard Sump
AOI 36 – Alleged Spent Carbon Aare
AOI 37 – Former Pond
AOI 38 – Former Gasoline Underground Storage Tank

B. Engineering Controls – Soils

EPA is proposing that the enhanced concrete cover that was constructed as an interim measure, be the final remedy for the following AOIs:

- AOI 11 – Sump and Trench
- AOI 12 – Former Phosphorous Unloading Area
- AOI 13 – Former Phosphorus Storage Tank
- AOI 32 – PCl3/POCl3 Scrubbers.

EPA is also proposing that he following plans be developed and implemented:

1. Soil and Groundwater Management Plan (S&GMP)

   The S&GMP will address all earth moving activities, including excavation, drilling and construction activities in known contaminated areas at the Facility where any contaminants remain in soils above EPA Region Ill's Screening levels for Industrial Soils or groundwater above MCLs or Region III's Tap Water RSLs, shall be conducted in accordance with an EPA approved S&GMP. A Health and Safety Plan will be incorporated into the S&GMP.

   The S&GMP will also detail how soil and groundwater will be managed during any future subsurface activities conducted at the Facility. The S&GMP will detail how all excavated soils will be handled and disposed. All soils that are to be disposed of shall be sampled and disposed of in accordance with applicable State and Federal regulations. The SMP will require analysis of site-related VOCs, SVOCs, and metals.

   Soil remediation cleanup standards will be EPA's RSL for industrial soil. In addition, the S&GMP will include soil stabilization requirements to minimize contact between storm water runoff and the parcel soils during construction. Soil stabilization measures may include the construction of berms to prevent storm water from flowing onto certain areas as well as the construction of sumps with pumps to remove ponded water from low lying areas.

2. Operation and Maintenance Plan (O&M Plan)

   The O&M Plan will be specific to the enhanced concrete cover at AOCs 11, 12, 13 and 32. The O&M Plan shall be submitted for EPA and WVDEP review and approval and, at a minimum must include the following: the procedures to maintain the cover over the impacted soil; a schedule for inspections to be performed as part of cover maintenance, no less frequent than once a year; physical maintenance requirements of the covered areas to prevent degradation of the cover and unacceptable exposure to the underlying soil.

C. Groundwater Monitoring

Monitoring and site characterization has identified several sources which have historically degraded groundwater. These include contaminated soils within the White Phosphorus Area and the Lab/Warehouse Parcel. EPA anticipates that, because soils which were a source to groundwater contamination were removed or capped, the remaining contamination in groundwater will naturally attenuate, and groundwater cleanup levels (drinking water standards) will be achieved without engineering controls.

The proposed remedy for groundwater is monitored natural attenuation pursuant to an EPA approved Groundwater Monitoring Plan combined with the compliance with and maintenance of groundwater use restrictions listed below, to be implemented through institutional controls, at the Facility to prevent exposure to contaminants while levels remain above drinking water standards. The point of compliance shall be throughout the plume or the downgradient property boundary.

D. Institutional Controls

Under this proposed remedy, some contaminants remain in the groundwater and soil at the Facility above levels appropriate for residential uses. Because some contaminants remain in the soil and groundwater at the Facility at levels that exceed residential use, EPA's proposed remedy requires the compliance with and maintenance of land and groundwater use restrictions. EPA proposes to implement the land and groundwater use restrictions necessary to prevent human exposure to contaminants at the Facility through enforceable ICs, in the form of an Environmental Covenant, pursuant to the West Virginia Uniform Environmental Covenants Act to be recorded with the deed for the Facility property. The process to develop and record the land use covenants will be conducted under the direction of EPA and WVDEP.

EPA is proposing the following land and groundwater use restrictions be implemented through institutional controls at the Main Plant Area as shown in **Figure 1**:

1. Groundwater will not be used for potable purposes, while monitoring indicates that groundwater contaminant concentrations remain above MCLs, unless it is demonstrated to EPA that such use will not pose a threat to human health or the

environment or adversely affect or interfere with the final remedy and EPA provides prior written-approval for such use;

2. No new wells will be installed on the Main Plant Area unless it is demonstrated to EPA that such wells are necessary to implement the final remedy and EPA provides prior written approval to install such wells;

3. The Main Plant Area will not be used for any residential purpose unless it is demonstrated to EPA that such use will not pose a threat to human health or the environment or adversely affect or interfere with the selected remedy and EPA provides prior written approval for such use;

4. Excavation of the area beneath the engineered concrete cover at AOCs 11, 12, 13 and 32 is prohibited, unless it is demonstrated to EPA that such use will not pose a threat to human health or the environment or adversely affect or interfere with the selected remedy and EPA provides prior written approval for such use;

5. A vapor mitigation system will be installed and maintained in any new structures constructed within 100-foot of wells MW-11S, MW-12S or MW-16S, unless is demonstrated to EPA that vapor intrusion does not pose unacceptable risk to human health and EPA provides written approval that no vapor mitigation system is needed. See **Figure 2**. The vapor intrusion system shall be operated until it is demonstrated to EPA that vapor intrusion of contaminants at the Facility does not pose a threat to human health. For the relatively small area of the 100-foot VI buffer zone located beyond the Facility property boundary, since construction of a building there is unlikely, the proposed remedy shall require notification of the adjacent property owner of the potential risks due to vapor intrusion and recommendations for safely using the property;

6. Compliance with the EPA-approved groundwater monitoring program while contaminant concentrations remain above drinking water standards, otherwise known as MCLs;

7. Compliance with the EPA-approved Soil and Groundwater Management Plan (S&GMP);

8. Compliance with an EPA-approved an Operation and Maintenance Plan (O&M Plan) specific to the enhanced concrete cover at AOCs 11, 12, 13 and 32.

EPA is proposing the following land and groundwater use restrictions be implemented through institutional controls at the Lab/Warehouse Parcel shown in **Figure 1**:

1. Groundwater will not be used for potable unless it is demonstrated to EPA that such use will not pose a threat to human health or the environment or adversely affect or interfere with the final remedy and EPA provides prior written-approval for such use;

2. The Lab/Warehouse Parcel will not be used for any residential purpose unless it is demonstrated to EPA that such use will not pose a threat to human health or the environment or adversely affect or interfere with the selected remedy and EPA provides prior written approval for such use.

E. Additional Requirements

EPA notes that there is an ordinance in the Nitro Industrial District that prevents well drilling for any purpose other than monitoring, a land use covenant should also be applied to the deed to layer the use controls and provide a higher likelihood that a future owner will comply with the well drilling and groundwater use restriction[gp49].

1. On an annual basis and whenever requested by WVDEP and EPA, the then current owner shall submit to WVDEP and EPA a written certification stating whether or not the groundwater and land use restrictions are in place and being complied with.

2. Within one month after any of the following events, the then current owner of the Facility shall submit, to WVDEP and EPA written documentation describing the following: observed noncompliance with the groundwater use restrictions; transfer of the Facility; changes in use of the Facility.

3. The Facility shall not be used in a way that will adversely affect or interfere with the integrity and protectiveness of the final remedy.

4. Include in the enforceable mechanism which implements the final remedy a coordinate survey, as well as a metes and bounds as follows:

    a. The boundary of the Facility and each engineering control, land and groundwater use restriction shall be defined as a polygon; and

    b. The longitude and latitude of each polygon vertex shall be established as follows:

        i. Decimal degrees format;
        ii. At least seven decimal places;
        iii. Negative sign for west longitude; and
        iv. World Geodetic System (WGS) 1984 datum.

Mapping the extent of the engineering controls land and groundwater use restrictions will allow for presentation in a publicly accessible mapping program such as Google Earth or Google Maps.

VIII. EVALUATION OF EPA's PROPOSED REMEDY

This section provides a description of the criteria used to evaluate the proposed remedy

consistent with EPA guidance, "Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule," 61 Fed. Reg. 19431, May 1, 1996. The criteria are applied in two phases. In the first phase, EPA evaluated three decision threshold criteria as general goals. In the second phase, for those remedies that meet the threshold criteria, EPA then evaluated seven balancing criteria.

1. **Threshold Criteria**

- **Protect Human Health and the Environment**

  Overall protection of human health and the environment addresses the ability of an alternative to eliminate, reduce or control threats to public health or the environment through institutional controls, engineering controls, removal or treatment.

  The placement of an enhanced concrete cover of the white phosphorus-impacted soil has prevented contact with the impacted soil, and effectively eliminate the risk to human health for outdoor commercial/industrial workers and construction workers.

  Groundwater analytical results for the Facility indicate that there could be future concerns regarding soil vapor intrusion if the Facility undergoes new construction. Vapor mitigation may be necessary in future buildings constructed on the Facility unless groundwater quality conditions improve over time. The need to install vapor mitigation will be assessed at the time the Facility is planned for redevelopment, and be based on a combination of soil gas data, updated groundwater quality data, and the Facility-specific development plan for placing buildings on the Facility.

  With respect to groundwater, the contaminants are contained in the aquifer and decreasing through attenuation at the Facility[s50] as shown by groundwater monitoring. That monitoring will continue until groundwater clean-up standards are met. In addition, groundwater is not used in the surrounding area and a local ordinance prohibits the installation of wells for purposes other than monitoring throughout the Nitro industrial district where the Facility is located. Furthermore, the HHRA concluded that there is limited potential for human exposure to impacted groundwater in the future. The discharge of groundwater constituents from the shallow zone to the Kanawha River is adequately protective of the receiving water. Pore-water and sediment samples were collected as part of the supplemental RFI activities to affirm this conclusion, and no Facility-related impacts were identified.

- **Achieve Media Cleanup Objectives**

  EPA's proposed remedies meet the media cleanup objectives based on assumptions regarding current and reasonably anticipated land and water

resource use(s). The remedy proposed in this SB is based on the current and future anticipated land use at the Facility as commercial or industrial.

To manage groundwater impacted from AOC-related releases of contaminants and to ensure the ongoing protectiveness of human health and the environment, under EPA's proposed remedy the Facility is required to maintain a groundwater monitoring program to demonstrate that the contamination is being reduced through natural attenuation so that MCLs are being achieved and there is no impact on the Kanawha River.

- **Remediating the Source of Releases**

  In all proposed remedies, EPA seeks to eliminate or reduce further releases of hazardous wastes and hazardous constituents that may pose a threat to human health and the environment. Placement of the enhanced concrete cover over the white phosphorus-impacted soil has reduced potential human contact with the impacted soil.

  Through natural attenuation, the levels of VOCs should be lowered through time and therefore the potential for future vapor intrusion problems should be reduced or eliminated.

2. Balancing/Evaluation Criteria

- **Long-Term Effectiveness**

  The potential for human exposure through direct contact with white phosphorus-impacted soil has been controlled by the placement of the enhanced concrete cover. In addition, EPA proposes to implement land and groundwater use restrictions necessary to prevent human exposure to contaminants at the Facility through enforceable ICs, such as a permit, order and/or an Environmental Covenant.

  To manage groundwater impacted from AOI-related releases, the groundwater monitoring program will be performed to ensure contaminant concentrations are decreasing over time through natural attenuation.

- **Reduction of Toxicity, Mobility, or Volume of the Hazardous Constituents**

  The reduction of toxicity, mobility and volume of hazardous constituents will continue by natural attenuation at the Facility. Reduction of contaminant mobility has been accomplished by the installation of an enhanced concrete cover over the white phosphorous area which has prevented water from infiltrating the contaminated soil.

Short-Term Effectiveness

The proposed remedy does not involve any activities, such as construction or excavation that would pose short-term risks to workers, residents, and the environment. EPA anticipates that the land use restrictions and the on-going groundwater monitoring program will continue after the issuance of the FDRTC. EPA approved groundwater monitoring plan will be implemented and updated as necessary based on monitoring results.

Vapor mitigation could be necessary in future buildings constructed on the Facility unless groundwater quality conditions improve over time. The need to install vapor mitigation should be assessed at the time the Facility is planned for redevelopment.

- **Implementation**

The proposed remedy is readily implementable. Groundwater monitoring wells are already in place and operational. EPA proposes that the ICs be implemented through an enforceable mechanism such as an order and/or an Environmental Covenant pursuant to the West Virginia Uniform Environmental Covenants Act. Therefore, EPA does not anticipate any regulatory constraints in implementing its proposed remedy.

- **Cost**

The proposed remedy is cost effective. The significant costs associated with this proposed remedy, including the removal of dioxin contaminated soils from the Lab/Warehouse Parcel that was completed in 2016 and the installation of the enhanced concrete cover for the white phosphorous area that was completed in 2017, have already been expended. Groundwater monitoring is estimated to cost approximately $45,000, annually.

- **Community Acceptance**

EPA will evaluate Community acceptance of the proposed remedy during the public comment period, and it will be described in the FDRTC.

- **State Support/Agency Acceptance**

WVDEP has reviewed and concurred with the proposed remedy for the Facility. Furthermore, EPA has solicited WVDEP input and involvement throughout the investigation process at the Facility.

IX. FINANCIAL ASSURANCE

EPA will evaluate the need for Financial Assurance during the negotiation of the Remedy Implementation mechanism. If EPA determines that Financial Assurance is required, FMC would need to demonstrate and maintain the appropriate financial assurance for completion of the remedy pursuant to the standards contained in Federal regulations 40 C.F.R. § 264.145 and 40 CFR § 264.143.

X. PUBLIC PARTICIPATION

Interested persons are invited to comment on EPA's proposed remedy. The public comment period will last thirty (30) calendar days from the date that notice is published in a local newspaper. Comments may be submitted by mail, fax, or electronic mail to Mr. John Hopkins at the contact information listed below.

A public meeting will be held upon request. Requests for a public meeting should be submitted to Mr. John Hopkins in writing at the contact information listed below. A meeting will not be scheduled unless one is requested.

The Administrative Record contains all the information considered by EPA for the proposed remedy at this Facility. The Administrative Record is available at the following location:

U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103
Contact Mr. John Hopkins
Phone: 215-814-3437
E-mail: hopkins.john@epa.gov

All persons who comment on this proposed remedy receive a copy of the FDRTC. Others may obtain a copy by contacting the RCRA Corrective Action Program Manager at the address listed above.

7-25-17
Date:

Catherine A. Libertz, Acting Director
Land and Chemicals Division
US EPA, Region III

Attachments:

Figure 1	Site Plan Map
Figure 2	Vapor Intrusion Boundary
Appendix A	Administrative Record Index
Appendix B	Historical and Recent Groundwater Analytical Results
Appendix C	Surface and Subsurface Soils Data for Lab/Warehouse Parcel

Figure 1

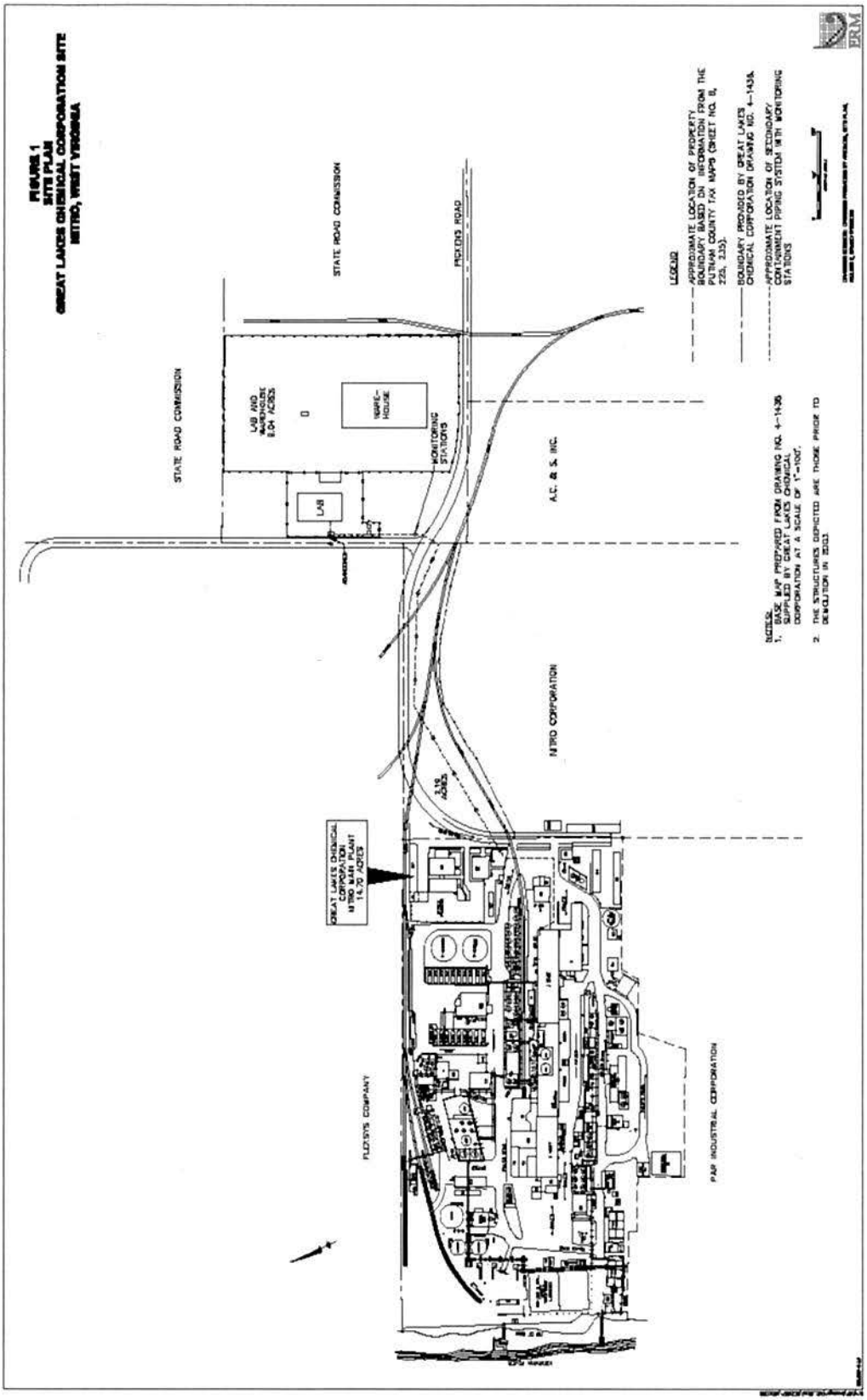
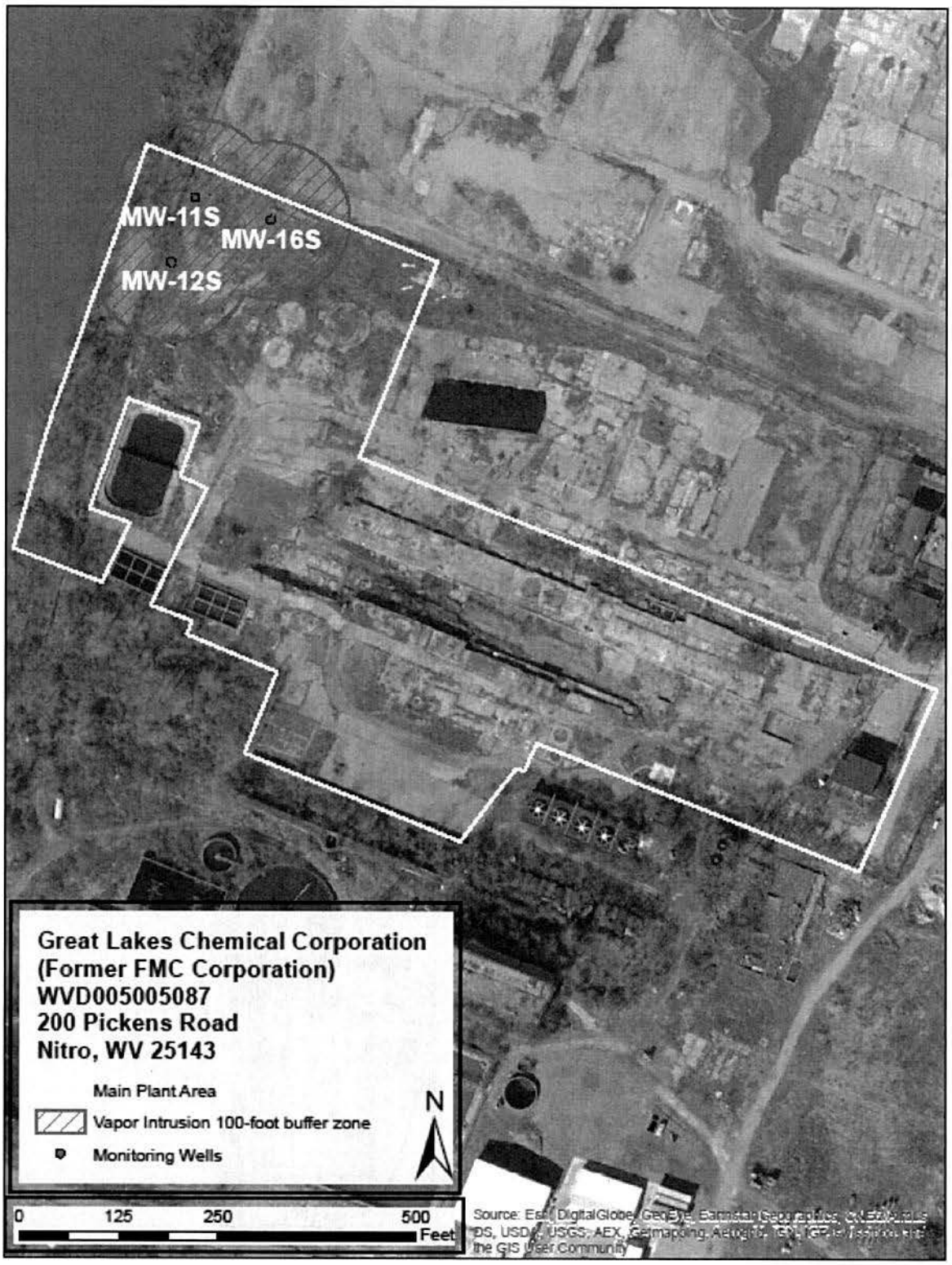


FIGURE 1
SITE PLAN
GREAT LAKES CHEMICAL CORPORATION SITE
NITRO, WEST VIRGINIA
STATE ROAD COMMISSION
PATRIOT ROAD
LAB AND WAREHOUSE 8.04 ACRES
WARE-HOUSE
LAB
MONITORING STATIONS
A.C. & S. INC.
NITRO CORPORATION
GREAT LAKES CHEMICAL CORPORATION NITRO MAIN PLANT 14.70 ACRES
FLEXSYS COMPANY
PAR INDUSTRIAL CORPORATION
LEGEND
APPROXIMATE LOCATION OF PROPERTY BOUNDARY BASED ON INFORMATION FROM THE PUTNAM COUNTY TAX MAPS (SHEET NO. 8, 220, 235).
BOUNDARY PROVIDED BY GREAT LAKES CHEMICAL CORPORATION DRAWING NO. 4-1436.
APPROXIMATE LOCATION OF SECONDARY CONTAINMENT PIPING SYSTEM WITH MONITORING STATIONS
NOTES:
1. BASE MAP PREPARED FROM DRAWING NO. 4-1436 SUPPLIED BY GREAT LAKES CHEMICAL CORPORATION AT A SCALE OF 1"=100'.
2. THE STRUCTURES DEPICTED ARE THOSE PRIOR TO DEMOLITION IN 2003.
FRM

Figure 2


MW-11S
MW-16S
MW-12S
Great Lakes Chemical Corporation
(Former FMC Corporation)
WVD005005087
200 Pickens Road
Nitro, WV 25143
Main Plant Area
Vapor Intrusion 100-foot buffer zone
Monitoring Wells
N
0
125
250
500
Feet
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

APPENDIX A

Administrative Record Index

Nitro GLCC Administrative Record Index

June 2017

1. U.S. Environmental Protection Agency (USEPA) 2002. Final Administrative Order on Consent U.S. EPA Docket No.: RCRA-3-022-AM, 11 June 2002.
2. Blasland, Bouck & Lee, Inc. (BBL) 2003. Expedited Phase I RFI Sampling and Analysis Plan. Prepared for Great Lakes Chemical Corporation and FMC Corporation. Nitro, West Virginia Facility. USEPA ID No. WVD005005087. (April 2003).
3. USEPA. 2003. Current Human Exposure Under Control. Environmental Indicator Worksheet (CA750). Great Lakes Chemical Corporation Site, Nitro, West Virginia. September, 2003.
4. BBL 2003. RCRA Facility Investigation Task 1 - Description of Current Conditions. Prepared for Great Lakes Chemical Corporation and FMC Corporation. Nitro, West Virginia Facility. USEPA ID No. WVD005005087. (November 2003).
5. BBL. 2004. RCRA Facility Investigation Task 2- Phase I RFI Work Plan. Prepared for Great Lakes Chemical Corporation and FMC Corporation. Nitro, West Virginia Facility. USEPA ID No. WVD005005087. (July 2004, with updates through November 2004).
6. USEPA. 2004. Groundwater Migration Under Control Environmental Indicator Worksheet (CA750). Great Lakes Chemical Corporation Site, Nitro, West Virginia. September 2004.
7. BBL. 2005. Quality Assurance Project Plan. RCRA Facility Investigation - Task 2, Phase I Work Plan (Appendix 1). Prepared July 2003. Final revision January 2005.
8. BBL. 2005. Phase I RFI Data Report. Prepared for Great Lakes Chemical Corporation and FMC Corporation. Nitro, West Virginia Facility. USEPA ID No. WVD005005087. (October 2005).
9. BBL. 2006. Phase II RFI Sampling and Analysis Plan. Prepared for Great Lakes Chemical Corporation and FMC Corporation. Nitro, West Virginia Facility. USEPA ID No. WVD005005087. (March 2006).
10. USEPA. 2007. Letter to FMC providing comments to the ARACDIS Draft RFI Report. 6 November 2007.
11. ARCADIS. 2008. RCRA Facility Investigation Report- Task 3, RF/ Report. Great Lakes Chemical Corporation and FMC Corporation, Nitro, West Virginia Facility, USEPA ID No. WVD005005087. Prepared April 2007 by Blasland, Bouck and Lee, Inc. Revised September 2008.
12. FMC. 2009. Responses to November 28, 2008, January 13, and 15, 2009 Comments to the October 2008 Sediment Sampling and Analysis Plan, 12 March 2009.
13. ARCADIS. 2009. Sediment Sampling and Analysis Plan. Prepared for Great Lakes Chemical Corporation and FMC Corporation. Nitro, West Virginia Facility. USEPA ID No. WVD005005087. (March 2009).
14. USEPA. 2011. Letter with comments to the March 2010 RFI Addendum Report. 2 February 2011.
15. FMC. 2011. Letter to USEPA providing responses to USEPA's 2 February 2011 comments to the March 2010 RFI Addendum Report. 7 March 2011.
16. ARCADIS. 2011. RFI Report Addendum. Great Lakes Chemical Corporation, Nitro, West Virginia Facility. Great Lakes Chemical Corporation and FMC Corporation. USEPA ID No. WVD005005087. 3 June 2011.
17. ARCADIS. 2012. Human Health Risk Assessment Interim Deliverable. Great Lakes Chemical Corporation, Nitro, West Virginia Facility. Great Lakes Chemical Corporation and FMC Corporation. USEPA ID No. WVD005005087. 16 October 2012.

18. USEPA. 2013. Letter with Comments to the Human Health Risk Assessment Interim Deliverable. 3 April 2013.
19. FMC. 2013. Letter with FMC Response to USEPA's 3 April Comments to the Human Health Risk Assessment Interim Deliverable. 18 April 2013.
20. USEPA. 2013. Letter with Comments to FMC's 18 April 2013 Response to Comments to the Human Health Risk Assessment Interim Deliverable. 22 May 2013.
21. FMC. 2013. Letter with FMC's Acknowledgement of Receipt of USEPA's 22 May 2013 Comments FMC's 18 April Response to Comments to the Human Health Risk Assessment Interim Deliverable. 23 May 2013.
22. ARCADIS. 2014. Human Health Risk Assessment. Great Lakes Chemical Corporation, Nitro, West Virginia Facility. Great Lakes Chemical Corporation and FMC Corporation. USEPA ID No. WVD005005087. 6 August 2014.
23. U.S. Army Corps of Engineers (USACE). 2015. FMC Corporation Human Health Risk Assessment (HHRA) Review. Transmitted in a 5 February 2015 email from Mr. William Wentworth, USEPA to Mr. Michael Shannon, FMC.
24. FMC. 2015. Letter to USEPA providing responses to USEPA's 5 February 2015 comments to the Human Health Risk Assessment. 13 May 2015.
25. United States Environmental Protection Agency (USEPA). 2015. Letter to FMC approving the May 2015 response to comment letter and August 2014 Human Health Risk Assessment. 21 August 2015.
26. FMC and GLCC. 2016. Letter to USEPA requesting acceptance of the approach to place dioxin-impacted soil on the Solutia site as an interim measure. 12 February 2016.
27. ERM. 2016. Soil Gas Sampling and Analysis Plan. Great Lakes Chemical Corporation, Nitro, West Virginia Facility. Prepared for FMC Corporation. 22 February 2016.
28. USEPA. 2016. Email from Mr. William Wentworth, USEPA to Mr. Nicholas Schapman, FMC accepting the proposed approach to manage dioxin-impacted soil on the Lab/Warehouse Parcel as an interim measure. 7 March 2016.
29. USEPA. 2016. Letter from Mr. William Wentworth, USEPA to Mr. Nicholas Schapman, FMC approving the 22 February 2016 Soil Gas Sampling and Analysis Plan. 15 March 2016.
30. ERM. 2016. Interim Measure Work Plan. Great Lakes Chemical Corporation, Nitro, West Virginia Facility. Prepared for FMC Corporation. 16 March 2016.
31. USEPA. 2016. Letter from Mr. William Wentworth, USEPA to Mr. Nicholas Schapman, FMC approving the 16 March 2016 Interim Measure Work Plan. 23 March 2016.
32. West Virginia Department of Environmental Protection (WVDEP). 2016. Letter from Ms. Tracy Jeffries, WVDEP to Mr. Nicholas Schapman, FMC approving the 16 March 2016 Interim Measure Work Plan. 24 March 2016.
33. ERM. 2016. Corrective Measures Study Report. 31 March 2016.
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35. ERM. 2016. Soil Gas Investigation. Great Lakes Chemical Corporation, Nitro, West Virginia Facility. Prepared for FMC Corporation. 24 May 2016.
36. ERM. 2016. Final Corrective Measures Study Report. 12 October 2016.
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38. USEPA. 2016. Letter from Mr. William Wentworth, USEPA to Mr. Nicholas Schapman, FMC approving the 29 November 2016 Interim Measure Work Plan. 15 December 2016.

39. WVDEP. 2016. Letter from Mr. John Meeks, WVDEP to Mr. Nicholas Schapman, FMC approving the 29 November 2016 Interim Measure Work Plan. 21 December 2016
40. USEPA. 2017. Letter from Mr. William Wentworth, USEPA to Mr. Nicholas Schapman, FMC approving the October 2016 CMS Report. 6 March 2017.

APPENDIX B

Historical and Recent Groundwater Analytical Results

APPENDIX C

Surface and Subsurface Soils Data for Lab/Warehouse Parcel