Remediation Cost Estimate Summary

Delphi - Moraine
MLC ID 1317

October 30, 2009

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Background Information

For the purposes of this summary, the GM Moraine Site consists of approximately 465 acres that include the GM Truck Group Moraine Truck Assembly Plant (Moraine Assembly), the GM Powertrain Group Moraine Engine Plant (Moraine Engine), and the Delphi Harrison Thermal Systems Moraine Plant (Delphi Thermal Moraine).

GM acquired the property from the World War I Wright Airplane Company in the mid-1920s. Frigidaire, a division of GM, produced appliances on the property from the late 1920s until 1979. The oldest structure on the property, designated as Building 1, was constructed in 1916 and served as a powerhouse for Frigidaire operations. Refrigerators, air conditioners, electric ranges, and electric water heaters were manufactured at the former Frigidaire Plant 2 throughout this period except for 1942 to 1945 when GM built disposable, auxiliary gas tanks for airplanes and propeller parts to support Word War II. Plant 3 was used as a manufacturing facility for ranges, dryers, wall ovens, drop-in cook tops, and dishwashers.[1] All Frigidaire operations, which included metal stamping, machining, metal plating, painting, and porcelain coating, ceased in February 1979.[2]

During 1980 and 1981, a majority of the former Frigidaire Plant 2 was converted to the Moraine Engine facility and the former Frigidaire Plant 3 and the northeast corner of former Frigidaire Plant 2 were converted to the Moraine Assembly facility. Moraine Engine operations ceased in the fall of 2000. The Moraine Engine facility and former Delphi Thermal Building 14 have been demolished. The majority of this portion of the property is now covered with a parking surface.

In 1998, at the time of the GM/Delphi separation, Delphi leased the Delphi Thermal Moraine facility. Delphi terminated its operations at this facility in 2003.

Surrounding Area

Moraine and the surrounding region are drained by the Great Miami River, which is located as close as 700 feet at the southern end of the Site.[3] Beneath the Site, three hydrogeologic units have been characterized as follows:

- An upper sand-and-gravel unit; 30-70 feet thick in which the unconfined water table has a saturated thickness of approximately 10-40 feet.
- A clay till zone; varied thickness and continuity, ranging up to more than 50-feet thick.
- A lower sand-and-gravel unit; at least 50 feet thick, fully saturated semi-confined aquifer.

[1] "Supplemental DOCC for General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant (Moraine, Ohio)", Geraghty & Miller, Inc. (G&M), July 1997.
[2] "Region 5 Amendment to Unilateral Administrative Order (RCRA) [EPA Docket No. V-W-R-002-91]", U.S. Environmental Protection Agency (EPA), April 1997. ("1997 AO Amendment")
[3] "Resource Conservation and Recovery Act Facility Investigation Final Report, Volume I (Methodologies and Results), Delphi Harrison Thermal Systems (Moraine, Ohio)", Arcadis Geraghty & Miller (Arcadis), April 2000.

Numerous pumping wells in the lower hydrogeologic unit have been utilized at locations near the Site, including existing municipal well fields two miles south of the Site, former municipal well fields within one-half mile south (downgradient) of the Site that still have the potential for use as an emergency supply of drinking water, and industrial pumping wells on-site (formerly) and east of the Site.[4,5]

Current Operational Status or Land Use of Site

The Moraine Engine facility and former Delphi Thermal Building 14 have been demolished down to the slab. The approximately 4.458 million square foot Moraine Assembly building still exists at the facility. In June 2008, GM announced plans to shut down the Moraine Assembly plant. Closure of the plant occurred in December 2008. GM staged new vehicles on a portion of the site now referred to as the Vehicle Distribution Center, these operations also ceased when Moraine Assembly closed.

Background information is provided below:

- Site Location

  Delphi – Moraine
  3600 Dryden Road
  Moraine, Ohio

  Moraine Assembly
  2601 West Stroop Road
  Moraine, Ohio

  Moraine Engine
  4100 Springboro Road
  Moraine, Ohio

- EPA ID Numbers

  Delphi - Moraine OHD000817577
  Moraine Assembly OHD041063074
  Moraine Engine OHD980569388

- MLC Project Manager

  Pam Barnett

[4] "Supplemental RFI, Volume II (Supplemental Baseline Risk Assessment), General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant (Moraine, Ohio)", ENVIRON Corporation (ENVIRON), April 2000.
[5] "Region 5 Unilateral Administrative Order In the Matter of Harrison Radiator Division (OHD 000817577), Proceeding under Section 3008(h) of the Resource Conservation and Recovery Act, as Amended (RCRA) [EPA Docket No. V-W-R-002-91]", U.S. Environmental Protection Agency (EPA), December 1990. ("1991 AO")

- Regulatory Agencies & Contacts

  EPA Region V, Mirtha Capiro; Ohio EPA, Harold O'Connell

- Principal Consultant(s)

  ARCADIS

- LFR ARCADIS Lead Site Analysts

  Nancy Gillotti

- Current Phase of Site

  Corrective Measures Proposal, Operation, Monitoring and Maintenance (OMM)

Real Estate Information

The following is a summary of the real estate information for the site:

- Current Land Use & Zoning/Permitted Use – Industrial
- Zoning – General Industry
- Building & Improvements – Concrete slabs, paved parking, Moraine Assembly building
- Size, age, condition – 4.458 million square-feet, 1920s
- Infrastructure – Water, sewer and power
- Demo Cost (as necessary for remediation) – None

Environmental History

- Delphi Thermal Moraine, formerly Harrison Radiator Division, received a unilateral Administrative Order, pursuant to RCRA Section 3008(h), from the U.S. Environmental Protection Agency (EPA) Region 5, which became effective January 30, 1991 (the 1991 AO). The 1991 AO requires GM to implement a RCRA Corrective Action program at the Site, consisting of:

  (1) Implementation of Interim Measures as needed to protect human health and the environment;

  (2) A RCRA Facility Investigation (RFI) to determine the nature and extent of any release of hazardous wastes and hazardous constituents at or from the Site; and,

  (3) A RCRA Corrective Measures Study (CMS) to identify and evaluate alternatives for corrective action to address migration or releases at or from the Site.

- In April 1991, PRC Environmental Management Inc. conducted a Preliminary Assessment/Visual Site Inspection (PA/VSI) of the Site on behalf of the EPA. As a result of this investigation a number of areas of concern were identified.[6]

- In accordance with the 1991 AO, GM submitted the Description of Current Conditions Report in 1991 and the RFI Work Plan in 1992 for Delphi Thermal to EPA.

- Subsequent to the PA/VSI reports and as a result of extensive discussions between GM and the EPA, the EPA issued an Amendment to the 1991 AO, effective April 24, 1997, that added the Moraine Assembly and Moraine Engine facilities to the RCRA Corrective Action program (1997 AO Amendment).

- In July 1995, the EPA approved the capture zone Interim Measures design.[7]

- In accordance with the 1997 AO Amendment, GM submitted the Supplemental Description of Current Conditions and the Supplemental RFI Work Plan to the EPA in July 1997.

- In 1999, the EPA approved Interim Measures proposed in AOI 7, which represented a combination of *in situ* technologies.

- GM submitted a final RFI report for the Moraine Assembly and Moraine Engine facilities to EPA in April 2000.

- In March 2000, GM submitted a draft Site-wide Ground Water Monitoring Plan to evaluate the effectiveness of the interim measures and monitoring results associated with the AOIs and lagoon monitoring.[8]

- GM submitted a draft, Site-wide Interim Measures/Corrective Measures Report to the EPA in March 2001 that addressed the groundwater contamination downgradient of the source area and the associated off-site plume.

- EPA and OEPA agreed to the Site-wide Groundwater Monitoring Plan in December 2003, which covers both the closed lagoons (OEPA) and the RCRA Corrective Action (EPA) monitoring aspects.

- A Correction Measures Proposal (CMP) was submitted to EPA in August 2008. The specific elements of the CMP are:
  1. Upper Aquifer Reactive Zone Corrective Measures: operation of in-situ remediation barriers in the upper aquifer downgradient and sidegradient of the

[6] "Region 5 Amendment to Unilateral Administrative Order (RCRA) [EPA Docket No. V-W-R-002-91]", U.S. Environmental Protection Agency (EPA), April 1997. ("1997 AO Amendment")
[7] "Final Interim Measures, Design Plans, Harrison Division- GMC (Moraine, Ohio)", Geraghty & Miller, Inc. (G&M), April 1995.
[8] *Ibid.*

Former Oil House Area and downgradient of the Moraine Assembly Process Waste Collection Systems (RZ-1, proposed relocated RZ-2, RZ-3, RZ-4) for treatment.

2. Upper Aquifer Capture Zone Corrective Measures: operation of an upper aquifer recovery well at the downgradient property boundary (TW-2) for hydraulic control.
3. Lower Aquifer Corrective Measures: operation of two lower aquifer recovery wells, one located downgradient of wells GM-68D/GM-75D for lower aquifer source containment and one downgradient of the Site property boundary (DN-13) for hydraulic control.
4. Corrective Measures Groundwater Monitoring: completion of monitoring groundwater quality associated with land-based units, performance monitoring for corrective measures, and the point of compliance wells.
5. Engineering/Institutional Controls: implementation of land and groundwater use restrictions via environmental covenants for the entire facility.

Past Remedial Actions

Several areas of environmental concern were identified at Delphi Moraine, including a former oil house, drum storage area, storage tanks and systems and surface impoundments (lagoons).

- The Former Oil House Area (AOI 7) consists of Building #7, a tank farm, which included three underground storage tanks (USTs), 17 aboveground storage tanks (ASTs) and a drum storage area. Virgin paints and chemicals, including oils, thinners, solvents, and acids, were stored and mixed in Building #7 and pumped or transferred to various production areas. The drummed waste storage area was located north of Building #7 and was used to store drummed waste oils, thinners, alcohols, and still bottoms from Building 7 and sludges containing chromium, nickel and phosphorus. The tanks were located in a tank farm north of Building #7 and stored various chemicals necessary for production. All tanks were removed from service in 1979. An aerial photograph dated November 1979 showed that Building 7 had been demolished. AOI 7 was identified as a potentially significant source of soil and groundwater contamination by tetrachloroethene (PCE).[9]

- Several surface impoundments managed industrial wastewater, storm water, and/or non-contact cooling water at the Site during various operating periods.[10] Three impoundments in the southwestern portion of the property (collectively, the South Lagoon) were constructed in 1965 and were taken off-line in October 1989. GM has conducted groundwater monitoring in this area and closed the impoundments under Ohio EPA RCRA closure. Additional samples of the sludge in the lagoons were taken during the RFI.

[9] "Supplemental DOCC for General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant (Moraine, Ohio)", Geraghty & Miller, Inc. (G&M), July 1997.
[10] "Region 5 Unilateral Administrative Order In the Matter of Harrison Radiator Division (OHD 000817577), Proceeding under Section 3008(h) of the Resource Conservation and Recovery Act, as Amended (RCRA) [EPA Docket No. V-W-R-002-91]", U.S. Environmental Protection Agency (EPA), December 1990. ("1991 AO")

- Several underground storage tanks (USTs) were located in the two tank farms at the Delphi Thermal Moraine facility, which were designated as the West and South Tank Farms.[11] Twelve of these USTs were identified by the EPA in the 1991 AO. These USTs contained various petroleum-based materials (e.g., oils, Stoddard solvent), detergents, and chlorinated solvents to support operations.

- Based upon the findings of the RFI, certain chlorinated volatile organic compounds (VOCs) (predominantly PCE, trichloroethylene (TCE), trans- and cis-1,2-dichloroethylene (1,2-DCE), 1,1-dichloroethylene (1,1-DCE), and vinyl chloride) are present in groundwater as a result of historic releases.[12] The initial and on-going Interim Measures consist of addressing the migration of VOCs at the southern (downgradient) Site boundary by pumping groundwater in the upper hydrogeologic unit at well TW-2 and in the lower hydrogeologic unit at well DN-13.[13,14] The groundwater recovered by well TW-2 is treated through an air stripper tower and is discharged to the Great Miami River through GM's permitted outfall.

- Waste Pile Staging Area (WSPA), which encompasses approximately two acres south of the former Delphi Thermal Building 14, and is contaminated with oily material and other constituents, including antimony, cadmium, PCBs and chromium. GM completed supplemental delineation for soil and groundwater and an interim measure that consisted of hot spot soil excavation. GM submitted the WPSA Interim Measures Report to EPA in 2006.

- GM completed a supplemental groundwater investigation based on monitoring data from the Site-wide groundwater monitoring program. This ongoing program monitors the groundwater quality to evaluate the effectiveness of the corrective action and determine when corrective measures have attained the remedial objectives. The supplemental investigation included installation of additional monitoring wells in the upper and lower hydrogeologic units from 2006 to 2008. This data was used to support development of the final remedy presented in the Corrective Measures Proposal.

- An investigation of soil and groundwater was completed beneath the floor of the Delphi Thermal Building 14. GM submitted the Building 14 Investigation Summary Report to EPA in 2005.

[11] "Description of Current Conditions, Task 1 of the RCRA Facility Investigation for Harrison Radiator Division- GMC (Moraine, Ohio)", Geraghty & Miller, Inc. (G&M), January 1991.
[12] "Resource Conservation and Recovery Act Facility Investigation Final Report, Volume I (Methodologies and Results), Delphi Harrison Thermal Systems (Moraine, Ohio)", Arcadis Geraghty & Miller (Arcadis), April 2000.
[13] "Documentation of Environmental Indicator Determination, Migration of Contaminated Ground Water Under Control (RCRIS Code CA750), Delphi Harrison Thermal Systems, General Motors Powertrain Group Moraine Engine Plant, and General Motors Truck Group Moraine Assembly Plant", ENVIRON Corporation (ENVIRON), February 5, 1999.
[14] Well DN-13 is a deep well that is used to protect Montgomery County's downgradient well field, which represents a contingent source of drinking water for the county. DN-13 has operated as a hydraulic barrier well since March 1990, with GM assuming full responsibility for operation as part of an EPA approved interim measure.

A supplemental RFI for the Moraine Engine and Moraine Assembly facilities identified that the primary source of VOCs in shallow groundwater beneath the Site is located in AOI 7 and that dense non-aqueous phase liquid (DNAPL) materials may be present in the shallow saturated zone above the upper clay till layer.[15] The highest concentrations of VOCs in groundwater are present in monitoring well GM-23, beneath AOI 7. Two remedial technologies, combined, were selected to achieve compliance with the Interim Measures objectives for AOI 7:

1) Chemical oxidation of the VOCs in situ via injection of hydrogen peroxide and creation of Fenton's reagent for contaminated areas within AOI 7 and above the clay till.

2) Enhanced bioremediation for downgradient areas with lower VOC concentrations.

In July 1999, EPA approved a work plan to implement these two technologies.[16] Field activities, including the installation of injection wells and new monitoring wells, began in August 1999 and technology testing was completed in May 2000. Based upon preliminary testing data, GM concluded that both technologies were effective in reducing VOC concentrations and that both Interim Measures should be continued.

GM completed the first annual Site-wide groundwater monitoring event in September 2000 to assess the effectiveness of the Interim Measures and evaluate the continuing contribution of the lagoons to groundwater quality degradation. Based upon the annual monitoring data from 2000 and 2001, GM concluded:

- The capture zone Interim Measures continue to be effective at maintaining hydraulic control in both the lower and upper hydrogeologic units at the southern Site boundary.

- VOC concentrations in monitoring wells downgradient of the Site have decreased compared to RFI data and the 1999 baseline groundwater sampling data.

- Introduction of a carbon source (molasses) into the upper hydrogeologic unit has generally been effective at developing highly anaerobic conditions therein, which has enhanced biodegradation rates of the VOCs in the vicinity of certain monitoring wells.

- The North and South lagoons were closed as RCRA Interim Units and the Certification of Lagoon Closure was submitted to OEPA in 2001.

[15] "Supplemental RFI, Volume I (Methodologies and Results), General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant (Moraine, Ohio)", Arcadis Geraghty & Miller (Arcadis), April 2000b.
[16] *Ibid.*

Current Environmental Issues and Future Remedial Actions

VOCs at concentrations exceeding the respective Maximum Contaminant Level (MCL) under the Federal Safe Drinking Water Act continue to be present in the upper and lower hydrogeologic units.[17] The lower hydrogeologic unit is used as an industrial water supply and has the potential for use as a drinking water source downgradient of the Site.[18,19] GM is currently implementing the following final corrective measures for the Site:

- Continued operation of the capture zone Interim Measures (i.e., pumping at TW-2 and DN-13);
- Continued operation of enhanced bioremediation (the reactive zone Interim Measures) at locations RZ-1, RZ-3, and RZ-4;
- Lagoon post closure care; and
- Site-Wide groundwater monitoring and reporting.

Future remedial actions include expanding the reactive zone barriers and adding another pump and treat system as presented in the Corrective Measures Proposal. The EPA has not officially approved the Final Corrective Measures Proposal, including the proposed long-term and short-term remedial objectives.

Remediation Cost Estimate

The remedial cost estimate is provided below:

- Remedial Activities
  Negotiate the CMP, complete the environmental covenant, pre-design investigation, CMP design plans and implementation, remediation system OMM, lagoon OMM, long-term groundwater monitoring and reporting, Landfill L1 investigation and capping, source treatment for Oil House and sump with OMM, and vapor intrusion investigation.

- Regulatory Drivers
  Negotiate final remedy with agency. Define closure strategy.

[17] "Documentation of Environmental Indicator Determination, Migration of Contaminated Ground Water Under Control (RCRIS Code CA750), Delphi Harrison Thermal Systems, General Motors Powertrain Group Moraine Engine Plant, and General Motors Truck Group Moraine Assembly Plant", ENVIRON Corporation (ENVIRON), February 5, 1999.
[18] *Ibid.*
[19] "Supplemental RFI, Volume II (Supplemental Baseline Risk Assessment), General Motors Powertrain Group Moraine Engine Plant and General Motors Truck Group Moraine Assembly Plant (Moraine, Ohio)", ENVIRON Corporation (ENVIRON), April 2000.

- Key Assumptions
  The final remedy will be implemented as defined in the CMP with source treatment and landfill capping added. Treatment timeframes are achievable. The southwest corner of the Moraine Assembly plant is accessible to address the sump. Off-site vapor mitigation is not required.

The remediation cost estimate for this site in current dollars (2009) is $27,818,298. Refer to the Remediation Budget Summary Spreadsheet below for more details.

		Remediation Cost Estimate Summary															
Year	No.	Negotiate CMP, Environmental Covenant	Contingency	Pre-Design Investigation, CMP Design, System Installation	Contingency	OMM IRZ Barriers and Pump and Treat Systems	Contingency	OMM Lagoons, Landfills, Groundwater Monitoring, Reporting	Contingency	Landfill L1	Contingency	Source Treatment for Oil House and Sump	Contingency	Vapor Intrusion Investigation	Contingency	Agency Oversight
2009	1	$ 50,000	0%	$ 40,000	0%	$ 197,250	0%	$ 90,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2010	2	$ 75,000	0%	$ 1,775,941	0%	$ 344,500	0%	$ 100,000	0%	$ 279,840	0%	$ 1,864,500	0%	$ 1,023,000	0%	$ -
2011	3	$ 20,000	0%	$ 1,646,680	5%	$ 582,500	0%	$ 100,000	0%	$ 2,816,974	5%	$ 2,343,000	0%	$ 229,680	0%	$ -
2012	4	$ -	0%	$ -	0%	$ 582,500	0%	$ 100,000	0%	$ -	0%	$ 1,044,000	0%	$ -	0%	$ -
2013	5	$ -	0%	$ -	0%	$ 582,500	0%	$ 105,000	0%	$ -	0%	$ 1,044,000	0%	$ -	0%	$ -
2014	6	$ -	0%	$ -	0%	$ 582,500	0%	$ 100,000	0%	$ -	0%	$ 703,000	0%	$ -	0%	$ -
2015	7	$ -	0%	$ -	0%	$ 429,000	0%	$ 100,000	0%	$ -	0%	$ 408,000	0%	$ -	0%	$ -
2016	8	$ -	0%	$ -	0%	$ 429,000	0%	$ 100,000	0%	$ -	0%	$ 408,000	0%	$ -	0%	$ -
2017	9	$ -	0%	$ -	0%	$ 429,000	0%	$ 100,000	0%	$ -	0%	$ 408,000	0%	$ -	0%	$ -
2018	10	$ -	0%	$ -	0%	$ 429,000	0%	$ 105,000	0%	$ -	0%	$ 408,000	0%	$ -	0%	$ -
2019	11	$ -	0%	$ -	0%	$ 429,000	0%	$ 100,000	0%	$ -	0%	$ 408,000	0%	$ -	0%	$ -
2020	12	$ -	0%	$ -	0%	$ 429,000	0%	$ 100,000	0%	$ -	0%	$ 408,000	0%	$ -	0%	$ -
2021	13	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ 204,000	0%	$ -	0%	$ -
2022	14	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2023	15	$ -	0%	$ -	0%	$ 82,000	0%	$ 105,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2024	16	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2025	17	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2026	18	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2027	19	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2028	20	$ -	0%	$ -	0%	$ 82,000	0%	$ 105,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2029	21	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2030	22	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2031	23	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2032	24	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2033	25	$ -	0%	$ -	0%	$ 82,000	0%	$ 105,000	0%	$ -	0%	$ -	0%	$ -	0%	$ -
2034	26	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ 9,100
2035	27	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ 9,100
2036	28	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ 9,100
2037	29	$ -	0%	$ -	0%	$ 82,000	0%	$ 100,000	0%	$ -	0%	$ -	0%	$ -	0%	$ 9,100
2038	30	$ -	0%	$ -	0%	$ 82,000	0%	$ 105,000	0%	$ -	0%	$ -	0%	$ -	0%	$ 9,350