Cleanup and Disposal of PCB Remediation Waste

Building 40 Tunnel and Basement

General Motors Corporation
NAO Flint Operations Site
Flint, Michigan

January 7, 2004

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BLASLAND, BOUCK & LEE, INC.
engineers & scientists

TECHNICAL REPORT

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1. Introduction

This *Cleanup of PCB Remediation Waste* report was prepared by Blasland, Bouck & Lee, Inc. (BBL), with risk assessment assistance from ENVIRON International Corporation (ENVIRON), to present items outlined in 40 CFR 761.61(c) under the Toxic Substances Control Act (TSCA) for a risk-based cleanup of polychlorinated biphenyl (PCB) remediation waste in the tunnel connecting former Buildings 16 and 40 and the adjacent basement of former Building 40 at the General Motors Corporation (GM) North American Operations (NAO) Flint Operations Site in Flint, Michigan (the Site). The proposed cleanup and disposal is also consistent with EPA's risk reduction goal for RCRA corrective action. In summary, GM has characterized and addressed PCB-containing water and floating oil within the tunnel and basement, and proposes to fill portions of the former basement and tunnel with crushed concrete resulting from recent demolition of above-grade structures at the Site.

1.1 Background

As a component of the ongoing activities at the Site concerning a Resource Conservation and Recovery Act (RCRA) Section 3008(h) Administrative Order on Consent (R8H-5-00-02) (Consent Order), signed by GM and the United States Environmental Protection Agency (USEPA) (effective March 1, 2000), the *Description of Current Conditions for Areas South of Leith Street, General Motors Corporation, NAO-Flint Operations, Flint, Michigan* (BBL, May 30, 2000) (DOCC) identified the Building 40 tunnel and basement as an Area of Interest (AOI), AOI 40-12. As part of the RCRA Program, AOIs are evaluated to determine if a release into the environment may have occurred. The evaluation of AOIs documents that waste constituents were removed and/or immobilized from the AOI before demolition of the adjacent buildings. Analytical sampling is performed, as appropriate, to provide supporting information. On-going RCRA Facility Investigation (RFI) activities have included sampling in the vicinity of the Building 40 tunnel and basement, and a site-wide evaluation of PCBs. The Site is being addressed under the Consent Order for a risk-based closure.

The objective of this report is to provide documentation of items required under 40 CFR 761.61(a) for self-implementing on-site cleanup and disposal of PCB remediation waste to facilitate cleanup and final demolition of the former Building 40 tunnel and basement. This report presents a description and background of the Building 40 tunnel and basement area (Section 1), presents characterization data (Section 2), describes the cleanup approach (Section 3), and provides the verification required under 40CFR761(a)(3)(E) (Section 4).

1.2 Site History

The Site began operations as an automobile parts producer in 1903, and since that time various automotive production activities have been conducted. Figures 1 and 2 include a Site location map and current Site plan, respectively. Building 40 was constructed in 1920, and was primarily used for wheel and tire assembly, as well as the storage of blemished vehicle body parts. In 1920, a tunnel was constructed that connected the new Building 40 to Building 06, an assembly building constructed in 1907.

Building 06 was demolished and replaced by Building 16 in 1946. Buildings 16A and 16B were constructed as additions between 1972 and 1985. Buildings 16, 16A, and 16B were primarily used for chassis assembly. Sumps, pits, storage tanks, drums, trenches, and oils are known to have been used in Buildings 16 and 40. Both Building 40 and Building 06 had basements and elevators that provided access to the tunnel. To construct Building 16, the basement of Building 06 was filled. Building 16 did not have a basement. The elevator access to the tunnel from Building 06 was blocked with an 8-inch concrete slab during the construction of Building 16. A stairway just outside of the building wall was also indicated on engineering drawings for Building 16.

In 2002, as part of an extensive program of building demolition in the southern portion of the Site, Building 40 (except for its basement, which is now exposed to the ground surface) and Building 16 were demolished along with the surrounding area.

1.3 Tunnel and Basement Description

Building 40 occupied approximately 82,000 square feet on the south end of Division Street (see Figure 2), and Building 16 occupied approximately 194,000 square feet between Leith Street and Hamilton Avenue, and west of the CSX Railroad prior to the demolition in 2002 of the above grade portions of the buildings. The Building 40 basement is approximately 1,900 square feet. The Building 40 tunnel served to convey materials, personnel, and equipment between Building 40 and Building 06/16 assembly areas. Figure 3 illustrates a plan view and cross sections of the Building 40 tunnel and basement.

Both Building 40 and Building 06 had basements and elevators that were used to access the tunnel. The tunnel is oriented in the east-west direction and is approximately 260 feet long by 15 feet wide and 8.5 feet high. The top of the tunnel roof is approximately 8 feet below grade. The tunnel contains an 18-inch diameter sump, 7.5 feet deep, that collected water from tunnel floor drains. Engineering drawings indicate a pump with no details on its capacity. Drawings also show a small-diameter discharge pipe leading from the pump chamber to an adjacent storm sewer manhole equipped with a check valve. This pump chamber kept the tunnel dry while it was in service. In the 1980s, the use of this tunnel was discontinued, and the tunnel became flooded with water.

The tunnel, which is under the basement, is submerged with water, and the water level is approximately 2 feet above the floor of the exposed basement. In 1991, floating oil was observed on the floor of the basement and floating on the surface of the water flooding the tunnel below the basement. The basement of Building 40 has been flooded with water from the tunnel.

2. Tunnel and Basement Characterization

The water flooding the tunnel, oil floating on the surface of water in the tunnel, and other material from the basement have been sampled by GM and submitted for laboratory analysis, as summarized in Table 1. In addition, soil, groundwater, and free product have been investigated outside the tunnel as part of RFI activities.

2.1 Nature of the Contamination

The source of the PCB-containing oil in the tunnel and basement is unknown. No known PCB-containing items were located in the tunnel. Building 40 investigations conducted in 1991 and 1992 identified varying concentrations of PCBs in oil (from below detectable levels to 127 parts per million [ppm]) and water (from below detectable levels to 290 parts per billion [ppb]). Additional sampling and analysis of oil, water, sludge, and wipe samples were conducted, with the results of the analyses confirming the presence of PCBs at varying concentrations. Copies of historical analytical data were submitted to USEPA with the DOCC, Appendix L (BBL, May 30, 2000). Copies of data collected as part of the Site-wide RFI were submitted to USEPA with the *RCRA Facility Investigation Phase I Report* (BBL, 2002).

Samples have indicated detectable levels of PCBs in water flooding the tunnel and basement, oil floating on the surface of water in the tunnel, sludge collected from the basement, and the concrete basement floor. Soil and groundwater samples collected outside the tunnel in 1993 did not contain detectable levels of PCBs. Filtered groundwater samples collected outside the tunnel in 2001 and 2002, and a free product sample collected outside the tunnel, did not contain detectable levels of PCB. The maximum PCB concentration detected in sludge from the tunnel or basement was 75 ppm (1991), and the maximum concentration of PCB detected in a wipe sample from the basement was 811.4 micrograms (ug) per 100 cm^2 (1992).

2.2 Sampling and Analysis of Water from Building 40 Tunnel and Basement

Table 1 lists the available results of laboratory analysis of samples of water from the Building 40 tunnel and basement. Results vary from below detectable levels to 290 parts per billing (ppb). Of the 22 available samples, 13 samples contained no concentrations of PCBs above detectable levels, two samples contained concentrations of PCBs between 0.17 and 1.8 ppb, six samples contained concentrations of PCBs between 20 and 113 ppb, and one sample contained concentrations of PCBs above 200 ppb (290 ppb, sampled from the water surface on 4/28/92). The most recent sampling was conducted in September 2002. Analytical results of these samples indicate detectable levels of 0.17 and 1.8 micrograms per liter (ug/L) Aroclor 1254 in unfiltered water samples from the basement, and non-detectable levels of all Aroclors in filtered water samples from the basement and tunnel.

2.3 Sampling and Analysis of Oil from Building 40 Tunnel and Basement

Table 1 lists the available results of analysis of samples of oil floating on water in the tunnel and basement. Results vary from below detectable levels to 127 ppm PCBs. Of the nine available results, one sample contained no concentration of PCBs above detectable levels, two samples contained concentrations of PCBs below 50 ppm, seven samples contained between 50 and 100 ppm PCBs, and one sample contained greater than 100 pm PCBs (127 ppm, sampled 8/18/92). There is no oil currently floating on water in either the tunnel or basement.

2.4 Sampling and Analysis of Sludge from Building 40 Tunnel and Basement

Table 1 lists the available results of analysis of samples of sludge found in the tunnel and basement. Results vary from 0.4 ppm PCBs to 75 ppm PCBs. Of the five available results, three samples contained concentrations of PCBs less than 10 ppm, and four samples contained concentrations of PCBs between 33 and 75 ppm (basement only). The sampled sludge was removed from the basement in August 1992 (see Section 3.1). The highest concentration of PCBs detected in a sludge sample collected from the tunnel is 6.87 ppm (collected 12/19/91).

2.5 Wipe Sampling of Basement Floor

Wipe samples were taken on the floor of the basement in April of 1992, prior to any remedial action in the area. Table 1 lists the available results of the wipe samples. Of the 32 samples analyzed, 27 samples contained <10 microgram per 100 cm^2 (ug/100 cm^2) sample of all Aroclors. Five wipe samples contained 35.7, 56.4, 57.9, 112.8, and 811.4 ug/100 cm^2 Aroclor 1254 was the only Aroclor detected in the wipe samples.

2.6 Historic (or Pre-RFI) Soil and Groundwater Sampling and Analysis outside Tunnel

In December 1993, five soil borings were completed near Building 40, and monitoring wells were installed in these borings. The 2-inch wells, with 5-foot screens intersecting the water table, were sampled once in 1993 and twice in 1994. Table 1 lists results of these soil sample and groundwater sample analyses. No detectable levels of PCBs were found to be present in any soil or groundwater samples collected in these five locations. These five wells (MW-1, -2, -3, -4, and -5) were later re-named (40-301, -302, -303/303R, -304, and -305, respectively) as part of the RFI, and have not been sampled for PCBs since 1994 (see Figure 5).

2.7 Tunnel Inspection, 1993

On June 7, 1993, Commercial Diving & Marine Services, Inc. of Port Huron, Michigan inspected the interior of the tunnel by sending a scuba diver into the flooded tunnel. A videotape was recorded to document conditions within the

tunnel; however, the video tape is not available. The diver noted observations in a written report, included in Appendix A, which included small pockets of oil floating on the water in the tunnel, areas of the tunnel floor covered with sediment from 0.5 to 12 inches deep, pockets of air, a streak of "orange stringy material" (possibly paint), and debris including a gondola, wood debris, and insulation falling off a pipe. Noted tunnel features included 6-inch and 12-inch floor drains, an electrical junction box, several overhead doors, a stairway, 6-inch pipe through the ceiling, pipe crossing the tunnel, 12-inch-square opening in the ceiling, 10-foot-wide door, manhole-type steps, and a manhole grate.

2.8 Tunnel Inspection, 2003

On June 20, 2003, Solomon Diving Inc. inspected the interior of the tunnel by sending a scuba diver into the flooded tunnel. A video tape was recorded to document conditions within the tunnel, and is included as Appendix B. Sediment, with no visible oil or oil sheen present, was noted to be present on the basement floor under approximately 2 feet of water. Absorbent pads were placed on the basement water surface to collect an oil sheen that was present prior to the dive. Observations in the tunnel included two gondolas near the east end, hand tools (shovels), wood, and pallets. Some oil globules were observed to be floating on the water in the tunnel. This oil was directed using air bubbles to the former stairwell area on the west end of the tunnel basement and against the east wall of the basement. Oil booms and absorbent pads were used to gather and absorb the oil, and remove it from the water surface. The quantity of oil discovered and absorbed was estimated to be less than one quart. The pads and booms were placed in drums with personal protective equipment. No signs of oil stains on the concrete tunnel walls or ceiling were observed during the inspection. A boom was left floating on the water surface after the inspection to absorb any residual oil that may float to the surface. After two weeks, no oil was observed and the booms appeared to be clean.

2.9 RFI Data in the Vicinity of the Tunnel and Basement

Based on soil borings conducted during the RFI, portions of the Site contain several feet of fill that were necessary to construct some of the more than 5 million square feet of industrial facilities. Groundwater beneath the Site typically ranges from a few feet below ground surface (bgs) to 15 or 20 feet bgs. Groundwater tends to flow predominantly to the east toward the Flint River. While the permeability at the Site varies significantly due to the deposited fill, in general much of the Site has a relatively low permeability with pumping tests capturing only a few gallons per minute.

Soil borings conducted near the tunnel by Advanced Environmental, Inc. in 1993 confirm this general description, indicating sand and gravel, sandy clay, mixed fill, silty clay, and clay to depths of 17 feet bgs, with groundwater encountered within 10 feet of ground surface. The water level in nearby wells is similar to the water level noted in the tunnel and basement.

More recent site investigation conducted as part of on-going RFI activities indicate the presence of PCBs (Aroclors 1254 and 1260) in soil samples from three boring locations within approximately 40 feet of the tunnel at depths ranging from just below ground surface to 29 feet below ground surface. The detected concentrations at these locations are below pertinent Michigan Department of Environmental Quality (MDEQ) Part 201 generic risk-based criteria. PCBs (Aroclors 1248 and 1254) were also detected in two of the unfiltered groundwater samples nearby; however, the detected PCB concentrations are below pertinent MDEQ Part 201 generic criteria, and all filtered groundwater samples collected near the tunnel were found to contain no detectable concentrations of PCBs.

Free product has been documented to be present floating on the groundwater in five monitoring wells near the tunnel (40-302, RFI-16-04, RFI-16-07, RFI-16-08, and RFI-16-10). This material has been linked to upgradient releases from an underground storage tank which was subsequently removed. A sample of free product from well RFI-16-10 did not have detectable concentrations of PCBs.

RFI soil and groundwater data in the vicinity of the tunnel is summarized on Figures 4 and 5, respectively.

3. Tunnel and Basement Cleanup

To address the PCB-impacted media in the Building 40 tunnel and basement, GM conducted a series of remedial actions, as described below.

3.1 Basement Floor Cleanup

In August of 1992, GM contracted MPC Environmental (MPC) of Detroit, Michigan to clean the basement. On August 3 through August 7, 1992, MPC drummed debris, removed water and sludge from the basement, and cleaned PCB-containing oil from the concrete floor with a foam-applied aqueous-based solvent to extract PCBs from the concrete floor and the lower 2 feet of the basement walls. Twenty-two drums of solid material and five drums of liquid were removed from the basement. Daily worksheets, daily field notes, daily safety meeting forms, daily area access logs, and the GM purchase order are included as Appendix C.

3.2 Verification of Oil Removal

GM visually inspected the tunnel to ascertain if oil still remained in the tunnel in June 2003. SCUBA divers visually observed and removed approximately one quart of oil from the tunnel, and oil sheens observed on the water surface in the basement were removed. No oil staining on the concrete tunnel walls or ceiling was observed by the SCUBA divers during the inspection. Less than one quart of oil is estimated to have been collected with absorbent pads and booms on the surface of the water at the tunnel access point during the inspection. Less than one drum of waste was generated as a result of the underwater inspection (personal protective equipment, absorbent pads, booms), and the waste is currently in a drum on site awaiting characterization and off-site disposal.

3.3 Demolition of Tunnel and Basement

GM is proposing to remove the basement floor at former Building 40. The basement floor will be broken and allowed to collapse to the floor of the tunnel. Crushed concrete, generated as part of demolition activities at the Site, will then be dumped into the basement and tunnel until the fill is level with the surrounding ground. The water level will be monitored during filling activities to avoid flooding of the surrounding area from the displacement of the water with the fill. If necessary, filling activities will be suspended temporarily while the water is absorbed into the fill material. This approach is consistent with demolition activities conducted Site-wide.

3.4 RFI Monitoring Activities

Routine sampling of Site-wide groundwater, as well as monitoring of LNAPL areas and evaluation of any oil observed in sewers indicate that the groundwater in the vicinity of the basement is not impacted by the conditions associated with the tunnel. These monitoring activities will continue to be performed routinely as part of RFI activities, as required by USEPA.

3.5 Risk Evaluation

Currently, the only potential exposure pathway in the Building 40 basement and tunnel area is occasional contact of water and residual oil (if any) in the basement and tunnel during construction and/or maintenance activities, including the filling of the tunnel and basement with demolition debris. The detected concentrations in water samples collected from the tunnel and the basement are below MDEQ generic, risk-based groundwater contact criteria that are protective of utility workers who occasionally contact groundwater, except for several samples that were collected beneath the floating oil layers existing prior to 1993. The detected concentrations of several constituents in these "groundwater" samples are higher than their respective solubilities, indicating that these samples likely included oil and would not be representative of dissolved phase concentrations. As discussed in Sections 2.8, 3.1, and 3.2, oil was subsequently removed from the basement and tunnel. The most recent water sampling data collected from the basement and tunnel as part of on-going RFI activities shows that all constituents are either non-detect or below MDEQ Part 201 groundwater contact criteria.

In addition, any residual oil that is still present in the tunnel or basement would not pose significant exposures to workers during construction activities. This can be demonstrated by calculating upper-bound cancer risks and noncancer hazard quotients that are conservatively based on the highest detected concentrations of the constituents in the oil and "groundwater" samples collected from the tunnel and basement. The calculations are presented in Appendix D, and the resulting cumulative cancer risk and noncancer hazard index are no more than 10^{-7} and 0.05, respectively. These upper-bound estimates are well below the risk reduction goal of 10^{-6} to 10^{-4} for the cancer risk and of 1 for the noncancer HI that EPA considers protective of human health for RCRA corrective action (EPA 1996). Since EPA uses the same goal for other federal cleanup programs (EPA 1991), PCB soil cleanup levels that achieve this goal also would satisfy the TSCA goal of no unreasonable risk of injury under 40 CFR 761.61(c). Therefore, remedies that achieve the soil cleanup level would be considered protective of human health under both RCRA corrective action and TSCA.

Following the filling of the tunnel and basement, no future operations or construction activities are planned or expected in the Building 40 area. Therefore, there is no human exposure pathway in the future.

3.6 Schedule

Oil removal from the tunnel has already been completed, as has cleanup of the basement floor. GM plans to break the basement floor and begin filling the tunnel in spring 2004. The schedule for Site-wide groundwater and LNAPL monitoring is to be determined with USEPA as part of RFI activities.

3.7 Options and Contingencies

GM evaluated options for response actions at the tunnel and basement area in 2001. Other options considered included tremie flowable fill into the flooded tunnel, dewatering the tunnel and filling it with flowable fill, or dewatering the tunnel and filling it with demolition debris. These options are very costly and not warranted based on the Site conditions.

4. Certification

Measures have been implemented to cleanup and dispose of PCBs from the Building 40 tunnel and basement located at the General Motors Corporation North American Operations Flint Operations Site in Flint, Michigan, as described in this *Cleanup of PCB Remediation Waste, Building 40 Tunnel and Basement* report. The available sampling plans, sample collection procedures, sample preparation procedures, extraction procedures, and instrumental/chemical analysis procedures used to assess or characterize the PCB contamination at the cleanup site, and all other documentation related to activities conducted in the Building 40 tunnel and basement, are on file at the General Motors Corporation offices located at 902 East Leith Street, MC 485-118-230, Flint, Michigan, and are available for inspection.

Robert S. Metcalf, P.E.

Project Manager, General Motors Corporation

1/8/04

Date

Derek Kaiding

Project Manager, Blasland, Bouck & Lee, Inc.

Jan. 8, 2004

Date

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Tables

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TABLE 1
GENERAL MOTORS COPORATION
CHARACTERIZATION DATA SUMMARY
NAO FLINT OPERATIONS, SITE - FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

Sample Description	Date Collected	Laboratory Analytical Results Summary
Water		
1 Water West	8/30/1991	0.023 ppm Aroclors 1254, 1260
WHRBI Water	8/30/1991	<0.002 ppm total PCBs
Water, Blind Sump	10/31/1991	<0.001 ppm total PCBs
Water in Stairwell	10/31/1991	0.023 ppm Aroclors 1254, 1260
Manhole liquid	10/31/1991	<0.027 ppm total PCBs
Stairwell Basement 40	11/20/1991	<0.0002 ppm PCBs
Water	12/16/1991	0.113 ppm Aroclor 1254
Catch Basin, base of stairs, water	2/7/1992	<0.00005 ppm all Aroclors
Catch Basin, 6.0 foot depth, water	3/6/1992	<0.00005 ppm all Aroclors 5-10% solids
Catch Basin, 12.0 foot depth, water	3/6/1992	<0.00005 ppm all Aroclors 50-75% solids
Water-Top	4/28/1992	0.29 ppm Arochlor 1254
Water-Middle	4/28/1992	<0.01 ppm all PCB Arochlors
Water-Bottom	4/28/1992	0.02 ppm Arochlor 1254
Water-EWB	4/28/1992	<0.01 ppm all PCB Arochlors
Tunnel water below basement, EWM (middle)	8/20/1992	0.0032 ppm 1,1-dichloroethane <0.010 ppm PNAs, all parameters <0.01 ppm PCBs, all Aroclors
Tunnel water below basement, EWB (bottom)	8/20/1992	8010/8020 Scan, all parameters <0.005 ppm Benzo(a)anthracene, 0.2089 ppm Chrysene 0.2712 ppm Naphthalene 0.3528 ppm Pyrene 0.1150 ppm 0.05 ppm Aroclor 1254 0.01 ppm Aroclor 1260
Tunnel water below basement, WWM (middle)	8/20/1992	0.0033 ppm 1,1-dichloroethane PNAs all parameters <0.010 ppm PCBs all Aroclors <0.01 ppm
Tunnel water below basement, WWB (bottom)	8/20/1992	8010/8020 Scan, all parameters <0.005 ppm Benzo(a)anthracene, 0.1418 ppm 0.06 ppm Aroclor 1254 0.01 ppm Aroclor 1260
Original Bldg 40 Basement Water	9/6/2002	0.0018 ppm Aroclor 1254
Unfiltered Bldg 40 Basement Water	9/24/2002	0.00017 ppm Aroclor 1254
Filtered Bldg 40 Basement Water	9/24/2002	<0.00010 ppm all Aroclors
Filtered Bldg 40 Tunnel Water	9/24/2002	<0.00011 ppm all Aroclors
Oil		
Oil/Water, Sump	7/23/1991	20 - 30 ppm Aroclor 1254
Depression Corner 2Southeast, water/oil	8/30/1991	80 ppm Aroclors 1254, 1260
Water/oil, Stairs	8/30/1991	25 ppm Aroclors 1254, 1260
Surface Oil, Stairwell	10/31/1991	25 ppm Aroclors 1254, 1260
Oil in Basement	10/31/1991	80 ppm Aroclors 1254, 1260
Oil	12/16/1991	77.8 ppm Aroclor 1254
Oil floating on water, tunnel	8/11/1992	100 ppm Aroclor 1254 (viscosity consistent with LK-402 hydraulic oil)
Oil floating on water, tunnel	8/17/1992	127 ppm Aroclor 1254
Oil, Tunnel Bldg 40	6/7/1993	23 ppm Aroclor 1254 (23 ppm)
Sludge		
East Oil Sludge - Basement (pre-cleaning)	8/30/1991	75 ppm Aroclors 1254, 1260
West Oil Sludge - Basement (pre-cleaning)	8/30/1991	33 ppm Aroclors 1254, 1260
Manhole sludge (pre-cleaning)	10/31/1991	1.4 ppm Aroclors 1254, 1260
Sludge - Basement (pre-cleaning)	12/16/1991	6.87 ppm Aroclor 1254
Silt Sludge, Tunnel Bldg 40	6/7/1993	0.4 ppm Aroclor 1254

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NAO FLINT OPERATIONS, SITE - FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

Wipe Sample Designation (Pre-Cleaning)	Date Collected	Laboratory Analytical Results Summary
W1	4/23/1992	<10 ug/100 cm^2, all Aroclors
W2	4/23/1992	<10 ug/100 cm^2, all Aroclors
W3	4/23/1992	<10 ug/100 cm^2, all Aroclors
W4	4/23/1992	<10 ug/100 cm^2, all Aroclors
W5	4/23/1992	112.8 ug/100 cm^2 Aroclor 1254
W6	4/23/1992	<10 ug/100 cm^2, all Aroclors
W8	4/23/1992	<10 ug/100 cm^2, all Aroclors
W9	4/23/1992	<10 ug/100 cm^2, all Aroclors
W10	4/23/1992	<10 ug/100 cm^2, all Aroclors
W11	4/23/1992	<10 ug/100 cm^2, all Aroclors
W12	4/23/1992	<10 ug/100 cm^2, all Aroclors
W13	4/23/1992	<10 ug/100 cm^2, all Aroclors
W14	4/23/1992	<10 ug/100 cm^2, all Aroclors
W15	4/23/1992	<10 ug/100 cm^2, all Aroclors
W16	4/23/1992	<10 ug/100 cm^2, all Aroclors
W17	4/23/1992	<10 ug/100 cm^2, all Aroclors
W18	4/23/1992	<10 ug/100 cm^2, all Aroclors
W23	4/23/1992	<10 ug/100 cm^2, all Aroclors
W24	4/23/1992	<10 ug/100 cm^2, all Aroclors
W25	4/23/1992	56.4 ug/100 cm^2 Aroclor 1254
W26	4/23/1992	57.9 ug/100 cm^2 Aroclor 1254
W27	4/23/1992	811.4 ug/100 cm^2 Aroclor 1254
W28	4/23/1992	<10 ug/100 cm^2, all Aroclors
W29	4/23/1992	<10 ug/100 cm^2, all Aroclors
W30	4/23/1992	<10 ug/100 cm^2, all Aroclors
W31	4/23/1992	<10 ug/100 cm^2, all Aroclors
W32	4/23/1992	<10 ug/100 cm^2, all Aroclors
W33	4/23/1992	<10 ug/100 cm^2, all Aroclors
W38	4/23/1992	<10 ug/100 cm^2, all Aroclors
W39	4/23/1992	35.7 ug/100 cm^2, Aroclor 1254
W40	4/23/1992	<10 ug/100 cm^2, all Aroclors
W41	4/23/1992	<10 ug/100 cm^2, all Aroclors

TABLE 1
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CHARACTERIZATION DATA SUMMARY
NAO FLINT OPERATIONS, SITE - FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

Soil Boring/Monitoring Well Designation, Sample Interval	Date Collected	Laboratory Analytical Results Summary
B1 (9 - 11')	12/16/1993	< 0.330 ppm PCB
B1 (14 - 16')	12/16/1993	< 0.330 ppm PCB
B2 (9 - 11')	12/16/1993	< 0.330 ppm PCB
B2 (11.5 - 13.5')	12/16/1993	< 0.330 ppm PCB
B3 (8 - 10')	12/17/1993	< 0.330 ppm PCB
B3 (11.5 - 13.5')	12/17/1993	< 0.330 ppm PCB
B4 (6.5 - 8.5')	12/17/1993	< 0.330 ppm PCB
B4 (9 - 11')	12/17/1993	< 0.330 ppm PCB
B5 (1 - 2')	12/17/1993	< 0.330 ppm PCB
B5 (11.5 - 13.5')	12/17/1993	< 0.330 ppm PCB
MW-1	12/22/1993	< 0.0002 - 0.0004 ppm all Aroclors
MW-2	12/22/1993	< 0.0002 - 0.0004 ppm all Aroclors
MW-3	12/22/1993	< 0.0002 - 0.0004 ppm all Aroclors
MW-4	12/22/1993	< 0.0002 - 0.0004 ppm all Aroclors
MW-5	12/22/1993	< 0.0002 - 0.0004 ppm all Aroclors
MW-1	6/3/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-2	6/3/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-3	6/3/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-4	6/3/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-5	6/3/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-1	9/1/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-2	9/1/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-3	9/1/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-4	9/1/1994	< 0.0002 - 0.0004 ppm all Aroclors
MW-5	9/1/1994	< 0.0002 - 0.0004 ppm all Aroclors

Abbreviations:
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
PCB = polychlorinated biphenyl
PNA = polynuclear aromatic hydrocarbon
ppb = parts per billion
ppm = parts per million
ug/g = microgram per gram
ug/L = micrograms per liter

Reference:

Appendix L, "Description of Current Conditions for Areas South of Leith Street, General Motors Corporation, NAO-Flint Operations, Flint, Michigan, May 30, 2000," BBL.

Figures

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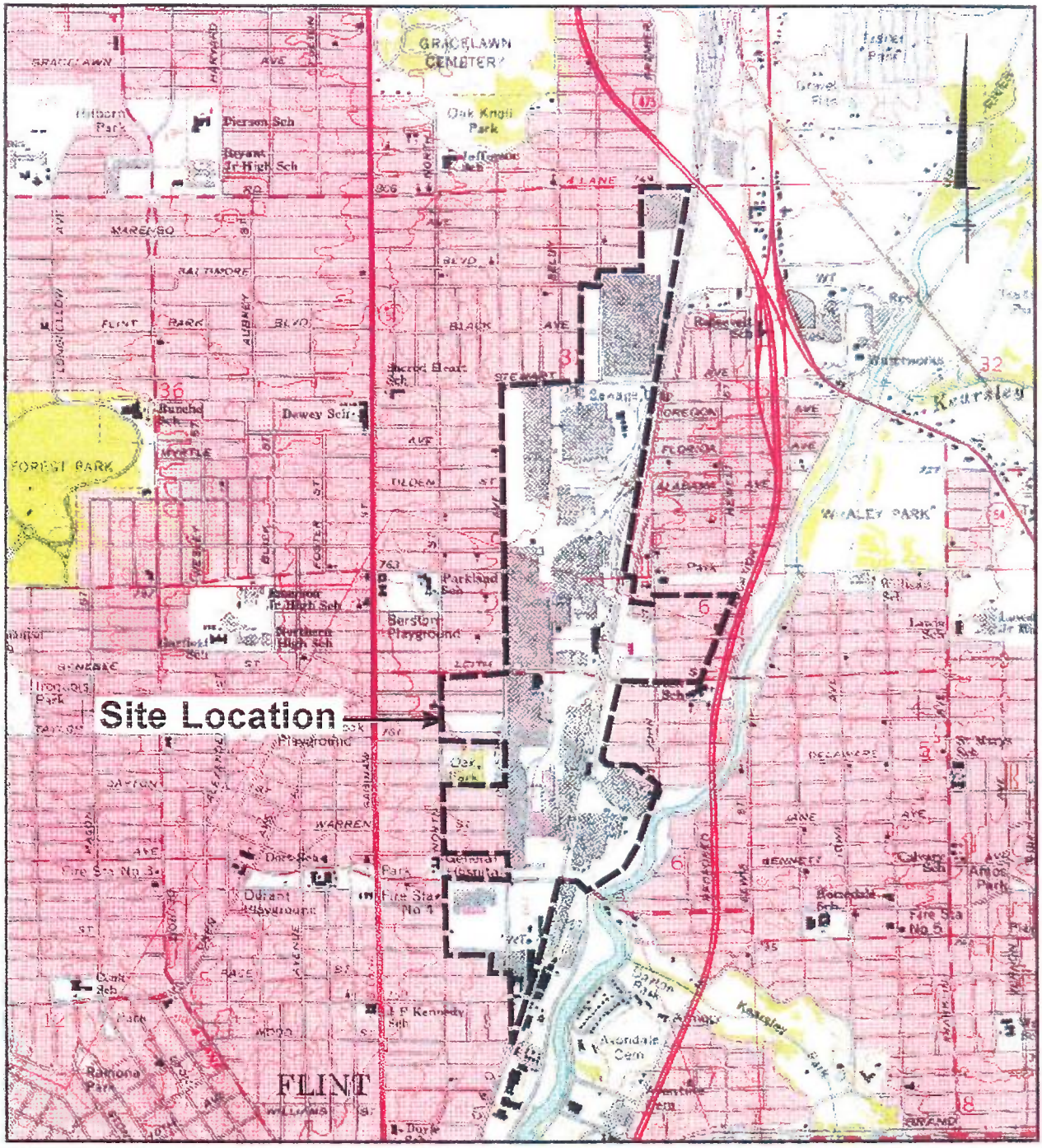
BLASLAND, BOUCK & LEE, INC.
engineers & scientists



REFERENCE: Base Map Source: USGS 7.5 Min. Topo. Quad., Flint North, Mich. (1969, Photorevised 1975).

2,000' 0 2,000'

APPROX. SCALE 1" = 2,000'

Area Enlargement

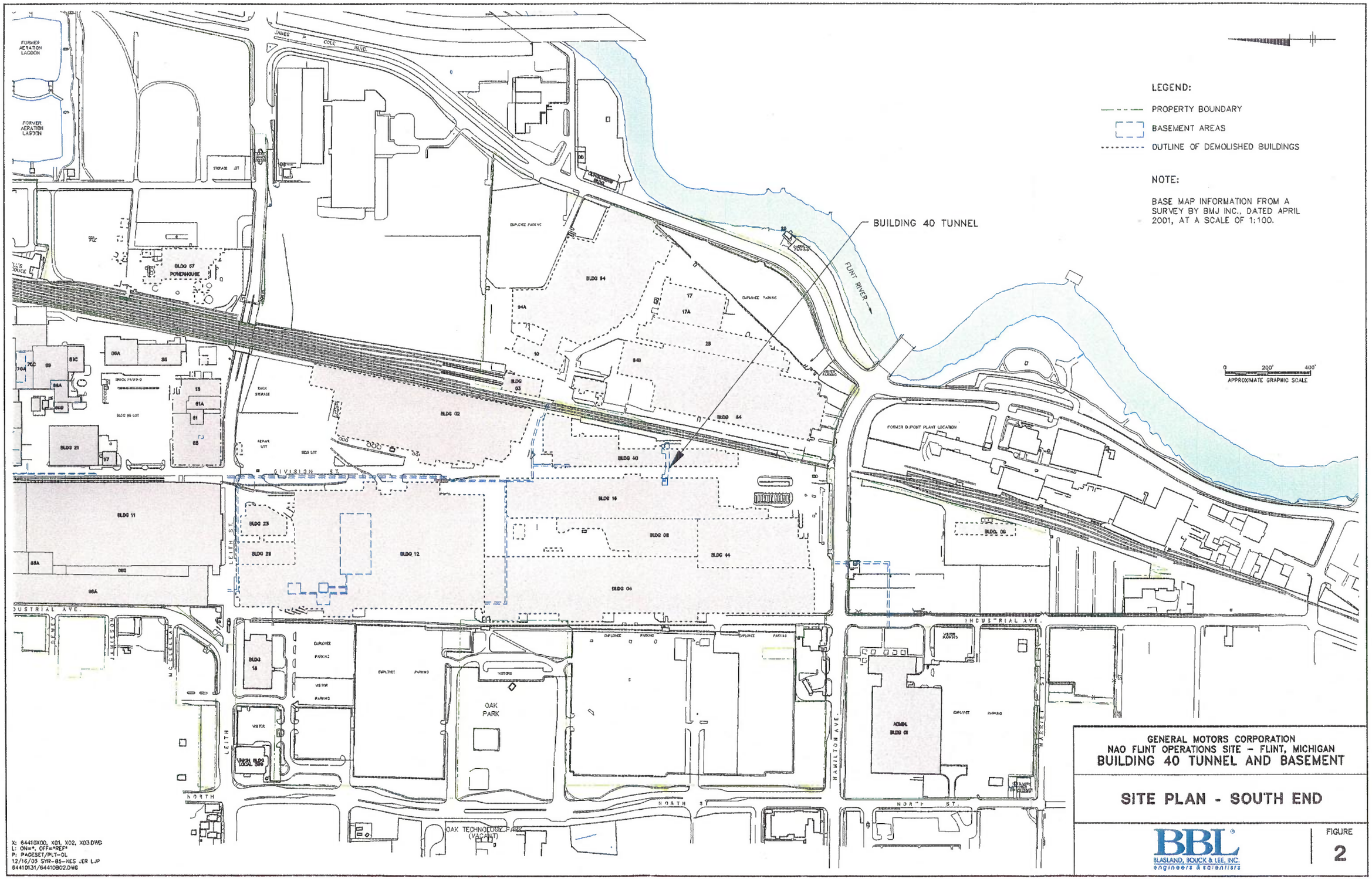
07/07/03 SYR-D85-DJH YCC LAS MRC LBR
64410131/64410n01.CDR

GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

SITE LOCATION MAP

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 1



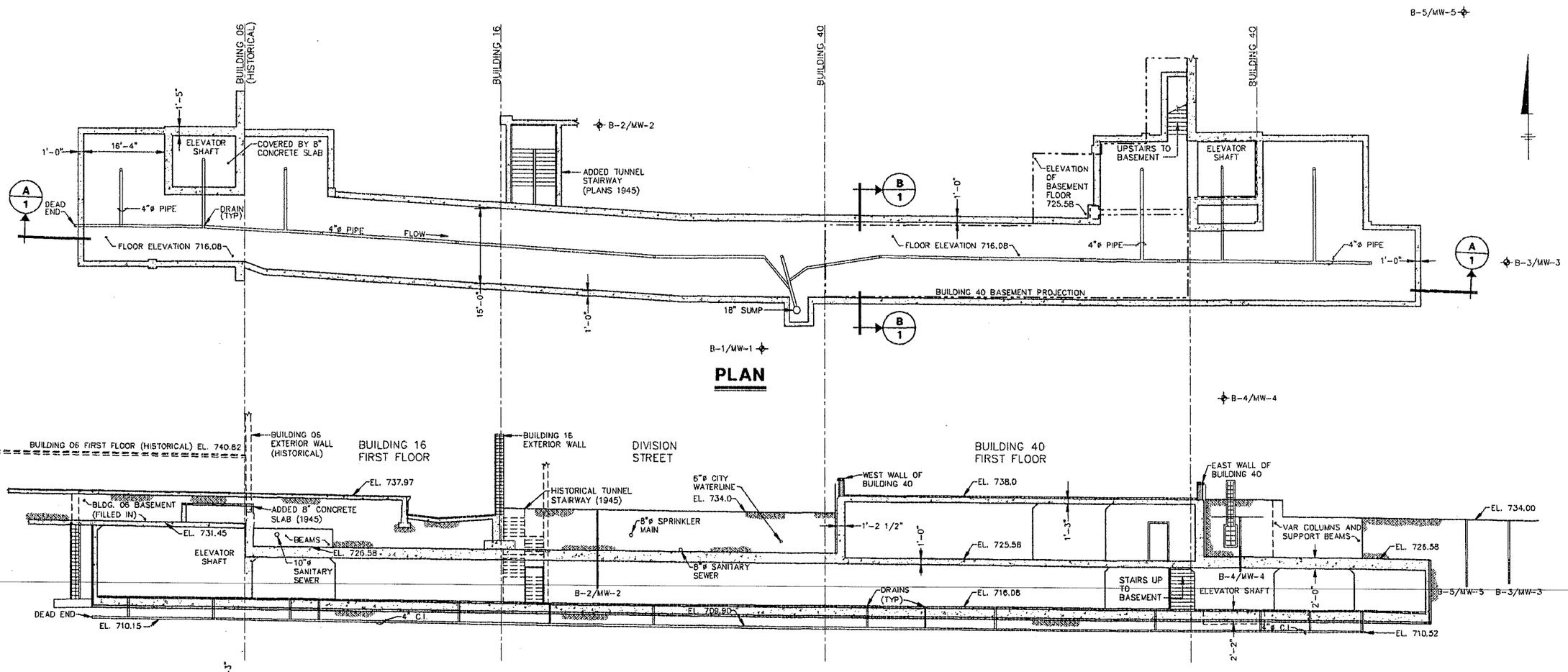
X: 64410X00, X01, X02, X03.DWG
L: ON=*, OFF=*REF*
P: PAGESET/PLT-DL
12/16/03 SYR-85-NES JER LJP
64410131/64410902.DWG

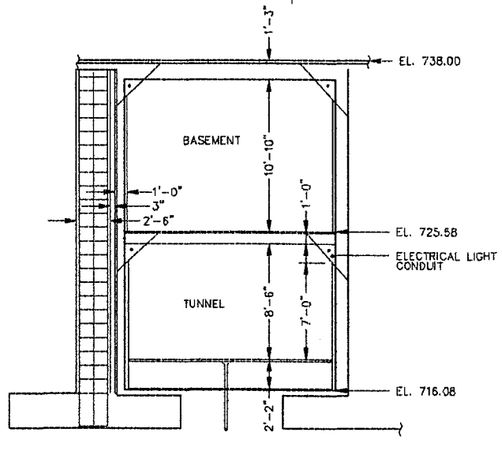
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE – FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

SITE PLAN - SOUTH END

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 2





SECTION B-B

3/16"=1'-0" 4' 0 6' 12'
APPROXIMATE SCALE

INFORMATION USED FOR THIS DRAWING WAS OBTAINED FROM, ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS INC., "ELEVATIONS", "DETAILS OF STAIRS & ENCLOSURE TO STAIRS", "LONGITUDINAL SECTION B-B, AND DETAILS", AND "SECTION A-A", DATED OCTOBER 12, 1944 AND FROM BUICK MOTOR COMPANY, "TRANSMISSION BUILDING. FACTORY #40. DETAIL OF TUNNEL.", DATED JANUARY 12, 1920, "FOUNDATION PLAN & SECTION THROUGH MAIN CHAMBER", DATED JANUARY 15, 1920, "PLAN OF TUNNEL HORIZONTAL SECTION THROUGH MEZZANINE CHAMBER", DATED JANUARY 19, 1920, "PLAN OF TUNNEL BETWEEN FACTORIES NO. 40 AND 6", AND "DETAILS OF TUNNEL BETWEEN FACTORIES 40 AND 6", BOTH DATED DECEMBER 29, 1919.

GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

BUILDING 40 TUNNEL AND BASEMENT PLAN AND SECTIONS

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

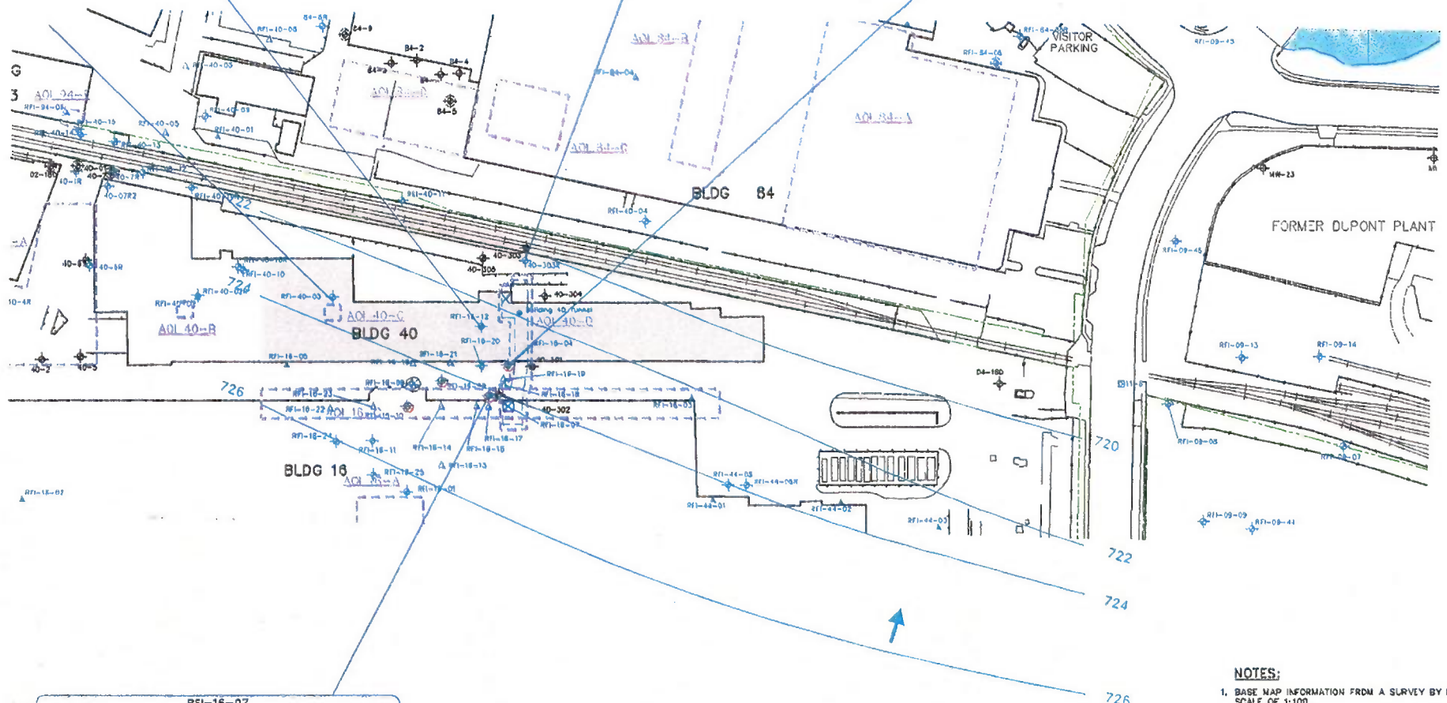
FIGURE 3

X: 64410X00.DWG
L: ON=*, OFF=REF
P: PAGESET/PLT-CDL
8/26/03 SYR-85-DJP LJP
64410001/64410S01

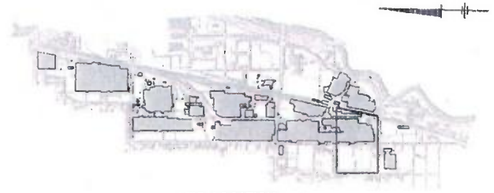
RFI-16-12		
Depth:	0.9-2.9	8.9-10.9
Benzene	ND(0.04)	ND(0.042)
cis-1,2-Dichloroethene	ND(0.04)	1.4
Trichloroethene	0.15	0.17
Vinyl chloride	ND(0.04)	0.16(RSVIA,ISVIA)
Benzo(a)anthracene	ND(0.2)	ND(0.2)
Benzo(a)pyrene	ND(0.2)	ND(0.2)
Benzo(b)fluoranthene	ND(0.2)	ND(0.2)
Benzo(g,h,i)perylene	ND(0.2)	ND(0.2)
Benzo(k)fluoranthene	ND(0.2)	ND(0.2)
bis(2-Ethylhexyl)phthalate	ND(0.2)	ND(0.2)
Chrysene	ND(0.2)	ND(0.2)
Indeno(1,2,3-cd)pyrene	ND(0.2)	ND(0.2)
Arsenic	4.1	14(RDC)
Cyanide (total)	ND(0.2)	ND(0.2)
Lead	250	7.1
Manganese	270	380
Selenium	0.30 J	0.31 J
Vanadium	22	19
Total PCBs	0.033	ND(0.041)

40-303R			
Depth:	1-3	8-10	27-29
Benzene	ND(0.037)	ND(0.039)	ND(0.039)
cis-1,2-Dichloroethene	0.05	0.071	ND(0.039)
Trichloroethene	1.3	ND(0.039)	ND(0.039)
Vinyl chloride	ND(0.037)	ND(0.039)	ND(0.039)
Benzo(a)anthracene	0.154 J	ND(0.19)	ND(0.19)
Benzo(a)pyrene	0.223	ND(0.19)	ND(0.19)
Benzo(b)fluoranthene	0.28	ND(0.19)	ND(0.19)
Benzo(g,h,i)perylene	0.122 J	ND(0.19)	ND(0.19)
Benzo(k)fluoranthene	0.232	ND(0.19)	ND(0.19)
bis(2-Ethylhexyl)phthalate	ND(0.18)	ND(0.19)	ND(0.19)
Chrysene	0.179 J	ND(0.19)	ND(0.19)
Indeno(1,2,3-cd)pyrene	0.131 J	ND(0.19)	ND(0.19)
Arsenic	3.8	3.3	5.1
Cyanide (total)	1.8	0.45	0.11 J
Lead	29	5.5	7.1
Manganese	220	250	360
Selenium	ND(0.097)	ND(0.094)	0.16
Vanadium	9.9	13	19
Total PCBs	0.102	ND(0.039)	0.013

RFI-16-04		
Depth:	0.7-2	4-6
Benzene	ND(0.036)	0.023 J
cis-1,2-Dichloroethene	ND(0.036)	ND(0.038)
Trichloroethene	ND(0.036)	0.04
Vinyl chloride	ND(0.036)	ND(0.038)
Benzo(a)anthracene	0.651	0.276
Benzo(a)pyrene	0.811	0.327 J
Benzo(b)fluoranthene	0.761	0.324 J
Benzo(g,h,i)perylene	0.911 J	0.292 J
Benzo(k)fluoranthene	0.58	0.312 J
bis(2-Ethylhexyl)phthalate	ND(0.18)	ND(0.19)
Chrysene	0.771	0.324
Indeno(1,2,3-cd)pyrene	0.738 J	0.235 J
Arsenic	3.5	2.4
Cyanide (total)	ND(0.2)	ND(0.2)
Lead	12 J	22 J
Manganese	180 J	140 J
Selenium	ND(1.5)	ND(1.2)
Vanadium	9.9 J	8.1 J
Total PCBs	0.097	1.13



RFI-16-07		
Depth:	0.5-2.5	4.5-6.5
Benzene	ND(0.037)	ND(0.038)[ND(0.039)]
cis-1,2-Dichloroethene	ND(0.037)	ND(0.038)[ND(0.039)]
Trichloroethene	ND(0.037)	ND(0.038)[ND(0.039)]
Vinyl chloride	ND(0.037)	ND(0.038)[ND(0.039)]
Benzo(a)anthracene	0.059 J	ND(0.19)[ND(0.19)]
Benzo(a)pyrene	0.0593 J	ND(0.19)[ND(0.19)]
Benzo(b)fluoranthene	0.0555 J	ND(0.19)[ND(0.19)]
Benzo(g,h,i)perylene	0.0829 J	ND(0.19)[ND(0.19)]
Benzo(k)fluoranthene	0.0486 J	ND(0.19)[ND(0.19)]
bis(2-Ethylhexyl)phthalate	0.164 J	ND(0.19)[ND(0.19)]
Chrysene	0.0652 J	ND(0.19)[ND(0.19)]
Indeno(1,2,3-cd)pyrene	0.0604 J	ND(0.19)[ND(0.19)]
Arsenic	3.1	2.5[2.1]
Cyanide (total)	0.065 J	0.059 J[0.083 J]
Lead	31	4.8[3.8]
Manganese	270 J	370 J[420 J]
Selenium	ND(1.4)	ND(1.5)[ND(1.6)]
Vanadium	6.8	4.0[3.4]
Total PCBs	ND(0.036)	ND(0.039)[ND(0.039)]



SITE LOCATION

LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE AOI BOUNDARY
- AOI ID
- BASEMENT AREA
- 84-160 HISTORICAL MONITORING WELL LOCATION
- RFI-12-13 DECOMMISSIONED/ABONDONED MONITORING WELL
- RFI-83/84-03 RFI SOIL BORING LOCATION
- RFI-09-02 RFI SOIL BORING/GRAB GROUNDWATER SAMPLING LOCATION
- RFI-09-01 RFI MONITORING WELL LOCATION
- PROPOSED SOIL BORING LOCATION
- PROPOSED MONITORING WELL LOCATION
- AREA WHERE MEASURABLE LNAPL HAS BEEN DETECTED
- LOCATION WHERE EVIDENCE OF LNAPL WAS OBSERVED IN SOIL
- ESTIMATED LIMITS OF MEASURABLE LNAPL
- ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
- GENERALIZED GROUNDWATER FLOW DIRECTION
- EXCEEDS MICHIGAN PART 201 GENERIC SCREENING CRITERIA:
  IPSIC—INDUSTRIAL PARTICULATE SOIL INHALATION
  ISVIA—INDUSTRIAL SOIL VOLATILIZATION TO INDOOR AIR

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ INC., DATED APRIL 2001, AT A SCALE OF 1:100.
2. SAMPLE LOCATIONS ARE APPROXIMATE.
3. POTENTIOMETRIC SURFACE CONTOURS BASED ON WATER LEVEL MEASUREMENTS TAKEN SEPTEMBER 10-11, 2001.
4. CONSTITUENTS PRESENTED HERE ARE THOSE WHICH EXCEEDED ONE OR MORE MICHIGAN PART 201 GENERIC RESIDENTIAL AND/OR INDUSTRIAL SCREENING CRITERIA IN SOIL OR GROUNDWATER SAMPLES COLLECTED IN THE AREA SHOWN ON THIS FIGURE.
5. ALL CONCENTRATIONS PRESENTED IN DRY-WEIGHT MILLIGRAMS PER KILOGRAM (mg/kg).
6. ND (0.039) – CONSTITUENT NOT DETECTED. ASSOCIATED DETECTION LIMIT PRESENTED IN PARENTHESES.
7. DUPLICATE ANALYSES PRESENTED IN BRACKETS.
8. NS – SAMPLE NOT ANALYZED FOR THIS CONSTITUENT
9. J – ESTIMATED CONCENTRATION
10. RDC – EXCEEDS MICHIGAN PART 201 RESIDENTIAL DIRECT CONTACT CRITERIA.
11. RSVIA – EXCEEDS MICHIGAN PART 201 RESIDENTIAL SOIL VOLATILIZATION TO INDOOR AIR CRITERIA.
12. RPSIC – EXCEEDS MICHIGAN PART 201 RESIDENTIAL SOIL PARTICULATE INHALATION CRITERIA.

0 100' 200'
GRAPHIC SCALE

X: 64410X00.DWG, 64410X01.DWG, 64410X02.DWG, 64410X03.DWG
LMAN: NES
P: PAGESET/PLT-DL
7/10/03 SYR-54-NES LAF JER
64410131/64410C02.DWG

GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE – FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

SOIL ANALYTICAL DATA

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 4

RFI-16-04		
Well		
Date:	8/10/01	9/18/01
Benzene	2.0	NS
cis-1,2-Dichloroethene	ND(1.0)	NS
Trichloroethene	ND(1.0)	NS
Vinyl chloride	ND(1.0)	NS
Benzo(a)anthracene	ND(1.1)	NS
Benzo(a)pyrene	ND(2.1)	NS
Benzo(b)fluoranthene	ND(2.1)	NS
Benzo(g,h,i)perylene	ND(5.3)	NS
Benzo(k)fluoranthene	ND(5.3)	NS
bis(2-Ethylhexyl)phthalate	4.46 J	NS
Chrysene	ND(5.3)	NS
Indeno(1,2,3-cd)pyrene	ND(2.1)	NS
Arsenic(f)	2.6	NS
Cyanide (total)	NS	12
Cyanide (total)(f)	ND(5)	NS
Lead(f)	ND(0.4)	NS
Manganese(f)	160	NS
Selenium(f)	11	NS
Vanadium(f)	3.2	NS
Total PCBs	ND(0.1)	NS
Total PCBs(f)	ND(0.1)	NS

RFI-16-12	
Well	
Date:	2/28/02
Benzene	ND(1.0)
cis-1,2-Dichloroethene	0.90 J
Trichloroethene	ND(1.0)
Vinyl chloride	ND(1.0)
Benzo(a)anthracene	ND(5.0)
Benzo(a)pyrene	ND(2.0)
Benzo(b)fluoranthene	ND(2.0)
Benzo(g,h,i)perylene	ND(5.0)
Benzo(k)fluoranthene	ND(3.0)
bis(2-Ethylhexyl)phthalate	ND(5.0)
Chrysene	ND(5.0)
Indeno(1,2,3-cd)pyrene	ND(2.0)
Arsenic(f)	3.8
Beryllium(f)	44 J(RDW,IDW)
Cyanide (total)	60
Cyanide (total)(f)	62
Lead(f)	1.0 J
Manganese(f)	1,200(RDW)
Selenium(f)	180 J(RDW,IDW)
Vanadium(f)	6.8(RDW)
Total PCBs	ND(0.11)
Total PCBs(f)	ND(0.11)

40-305	
Well	
Date:	9/17/01
Benzene	0.36 J
cis-1,2-Dichloroethene	36
Trichloroethene	4.1
Vinyl chloride	5.8(RDW,IDW)
Benzo(a)anthracene	ND(1.1)
Benzo(a)pyrene	ND(2.1)
Benzo(b)fluoranthene	ND(2.1)
Benzo(g,h,i)perylene	ND(5.3)
Benzo(k)fluoranthene	ND(5.3)
bis(2-Ethylhexyl)phthalate	ND(5.3)
Chrysene	ND(5.3)
Indeno(1,2,3-cd)pyrene	ND(2.1)
Arsenic(f)	5.3
Cyanide (total)	21
Cyanide (total)(f)	24
Lead(f)	ND(0.4)
Manganese(f)	210
Selenium(f)	ND(1.4)
Vanadium(f)	ND(0.8)
Total PCBs	0.04
Total PCBs(f)	ND(0.11)

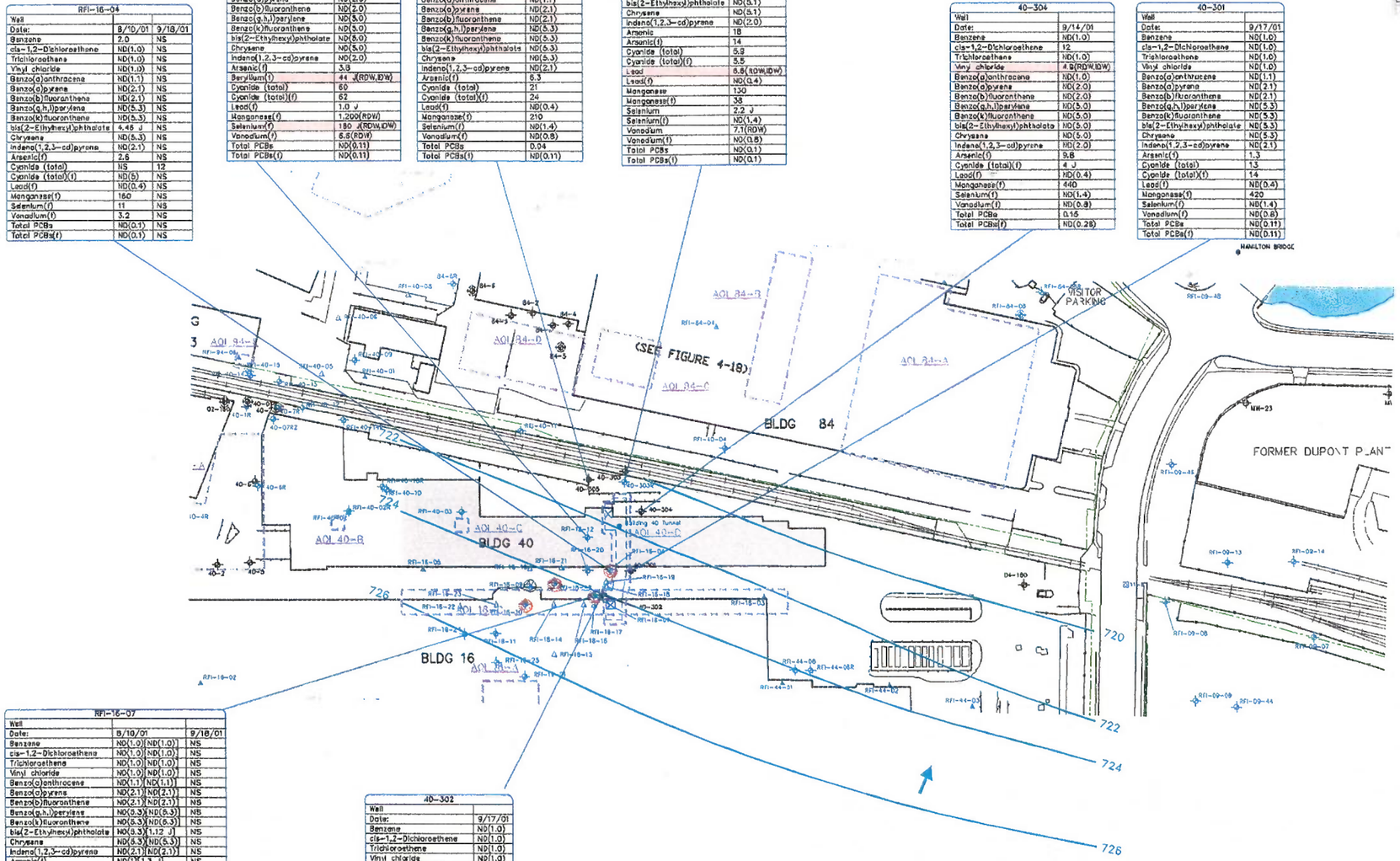
40-303R	
Well	
Date:	12/7/01
Benzene	ND(1.0)
cis-1,2-Dichloroethene	ND(1.0)
Trichloroethene	0.57 J
Vinyl chloride	ND(1.0)
Benzo(a)anthracene	ND(1.0)
Benzo(a)pyrene	ND(2.0)
Benzo(b)fluoranthene	ND(2.0)
Benzo(g,h,i)perylene	ND(5.1)
Benzo(k)fluoranthene	ND(5.1)
bis(2-Ethylhexyl)phthalate	ND(5.1)
Chrysene	ND(5.1)
Indeno(1,2,3-cd)pyrene	ND(2.0)
Arsenic	18
Arsenic(f)	14
Cyanide (total)	5.9
Cyanide (total)(f)	5.5
Lead	6.6(RDW,IDW)
Lead(f)	ND(0.4)
Manganese	130
Manganese(f)	38
Selenium	2.2 J
Selenium(f)	ND(1.4)
Vanadium	7.1(RDW)
Vanadium(f)	ND(0.8)
Total PCBs	ND(0.1)
Total PCBs(f)	ND(0.1)

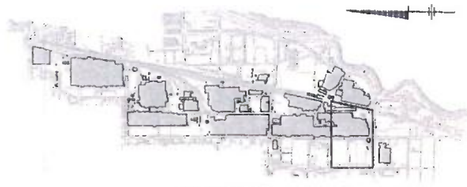
40-304	
Well	
Date:	9/14/01
Benzene	ND(1.0)
cis-1,2-Dichloroethene	12
Trichloroethene	ND(1.0)
Vinyl chloride	4.8(RDW,IDW)
Benzo(a)anthracene	ND(1.0)
Benzo(a)pyrene	ND(2.0)
Benzo(b)fluoranthene	ND(2.0)
Benzo(g,h,i)perylene	ND(5.0)
Benzo(k)fluoranthene	ND(5.0)
bis(2-Ethylhexyl)phthalate	ND(5.0)
Chrysene	ND(5.0)
Indeno(1,2,3-cd)pyrene	ND(2.0)
Arsenic(f)	9.8
Cyanide (total)(f)	4 J
Lead(f)	ND(0.4)
Manganese(f)	440
Selenium(f)	ND(1.4)
Vanadium(f)	ND(0.8)
Total PCBs	0.15
Total PCBs(f)	ND(0.28)

40-301	
Well	
Date:	9/17/01
Benzene	ND(1.0)
cis-1,2-Dichloroethene	ND(1.0)
Trichloroethene	ND(1.0)
Vinyl chloride	ND(1.0)
Benzo(a)anthracene	ND(1.1)
Benzo(a)pyrene	ND(2.1)
Benzo(b)fluoranthene	ND(2.1)
Benzo(g,h,i)perylene	ND(5.3)
Benzo(k)fluoranthene	ND(5.3)
bis(2-Ethylhexyl)phthalate	ND(5.3)
Chrysene	ND(5.3)
Indeno(1,2,3-cd)pyrene	ND(2.1)
Arsenic(f)	1.3
Cyanide (total)	1.3
Cyanide (total)(f)	1.4
Lead(f)	ND(0.4)
Manganese(f)	420
Selenium(f)	ND(1.4)
Vanadium(f)	ND(0.8)
Total PCBs	ND(0.11)
Total PCBs(f)	ND(0.11)

RFI-16-07		
Well		
Date:	8/10/01	9/18/01
Benzene	ND(1.0)[ND(1.0)]	NS
cis-1,2-Dichloroethene	ND(1.0)[ND(1.0)]	NS
Trichloroethene	ND(1.0)[ND(1.0)]	NS
Vinyl chloride	ND(1.0)[ND(1.0)]	NS
Benzo(a)anthracene	ND(1.1)[ND(1.1)]	NS
Benzo(a)pyrene	ND(2.1)[ND(2.1)]	NS
Benzo(b)fluoranthene	ND(2.1)[ND(2.1)]	NS
Benzo(g,h,i)perylene	ND(5.3)[ND(5.3)]	NS
Benzo(k)fluoranthene	ND(5.3)[ND(5.3)]	NS
bis(2-Ethylhexyl)phthalate	ND(5.3)[1.12 J]	NS
Chrysene	ND(5.3)[ND(5.3)]	NS
Indeno(1,2,3-cd)pyrene	ND(2.1)[ND(2.1)]	NS
Arsenic(f)	ND(1)[1.3 J]	NS
Cyanide (total)	NS	1.9 J
Cyanide (total)(f)	ND(3)[ND(3)]	NS
Lead(f)	ND(0.4)[ND(0.4)]	NS
Manganese(f)	350[370]	NS
Selenium(f)	ND(1.4)[ND(1.4)]	NS
Vanadium(f)	ND(0.8)[ND(0.8)]	NS
Total PCBs	ND(0.1)[ND(0.11)]	NS
Total PCBs(f)	ND(0.1)[ND(0.1)]	NS

40-302	
Well	
Date:	9/17/01
Benzene	ND(1.0)
cis-1,2-Dichloroethene	ND(1.0)
Trichloroethene	ND(1.0)
Vinyl chloride	ND(1.0)
Benzo(a)anthracene	ND(1.1)
Benzo(a)pyrene	ND(2.1)
Benzo(b)fluoranthene	ND(2.1)
Benzo(g,h,i)perylene	ND(5.3)
Benzo(k)fluoranthene	ND(5.3)
bis(2-Ethylhexyl)phthalate	ND(5.3)
Chrysene	ND(5.3)
Indeno(1,2,3-cd)pyrene	ND(2.1)
Arsenic(f)	3.2
Cyanide (total)	1.1 J
Cyanide (total)(f)	1.8 J
Lead(f)	ND(0.4)
Manganese(f)	120
Selenium(f)	ND(1.4)
Vanadium(f)	ND(0.8)
Total PCBs	ND(0.11)
Total PCBs(f)	ND(0.11)





LEGEND

- PROPERTY BOUNDARY
- APPROXIMATE AOI BOUNDARY
- AOI ID
- BASEMENT AREA
- HISTORICAL MONITORING WELL LOCATION
- DECOMMISSIONED/ABONDONED MONITORING WELL
- RFI SOIL BORING LOCATION
- RFI SOIL BORING/GRAB GROUNDWATER SAMPLING LOCATION
- RFI MONITORING WELL LOCATION
- PROPOSED SOIL BORING LOCATION
- PROPOSED MONITORING WELL LOCATION
- AREA WHERE MEASURABLE LNAPL HAS BEEN DETECTED
- LOCATION WHERE EVIDENCE OF LNAPL WAS OBSERVED IN SOIL
- ESTIMATED LIMITS OF MEASURABLE LNAPL
- ESTIMATED POTENTIOMETRIC SURFACE CONTOUR
- GENERALIZED GROUNDWATER FLOW DIRECTION
- EXCEEDS MICHIGAN PART 201 GENERIC SCREENING CRITERIA:
  IDW–INDUSTRIAL DRINKING WATER
  GCC–GROUNDWATER CONTACT
  GAI–GROUNDWATER ACUTE INHALATION

0 100' 200'
GRAPHIC SCALE

NOTES:

1. BASE MAP INFORMATION FROM A SURVEY BY BMJ INC., DATED APRIL 2001, AT A SCALE OF 1:100.
2. SAMPLE LOCATIONS ARE APPROXIMATE.
3. POTENTIOMETRIC SURFACE CONTOURS BASED ON WATER LEVEL MEASUREMENTS TAKEN SEPTEMBER 10–11, 2001.
4. ALL CONCENTRATIONS PRESENTED IN MICROGRAMS PER LITER (ug/L).
5. ND (1.0)–CONSTITUENT NOT DETECTED. ASSOCIATED DETECTION LIMIT PRESENTED IN PARENTHESES.
6. DUPLICATE ANALYSES PRESENTED IN BRACKETS.
7. f–FILTERED SAMPLE.
8. J–ESTIMATED CONCENTRATION.
9. RDW–EXCEEDS MICHIGAN PART 201 RESIDENTIAL DRINKING WATER CRITERIA.

GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE – FLINT, MICHIGAN
BUILDING 40 TUNNEL AND BASEMENT

GROUNDWATER ANALYTICAL DATA

BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 5

X: 64410X00.DWG, 64410X01.DWG, 64410X02.DWG, 64410X03.DWG
LMAN: NES
P: PAGESET/PLT-DL
7/10/03 SYR-54-NES LAF JER
64410131/64610C01.DWG

Appendix A

1993 Tunnel Inspection Notes

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Commercial Diving & Marine Services, Inc.
317 Rawlins Street Port Huron, Michigan 48060
810-987-8898 1-800-722-0879 810-982-8582 fax

Flint Buick Tunnel Inspection, Building 40
June 7, 1993

0845 On site
placing visqueen on floor on area above tunnel
CDMS setting up diving stations

1105 All equipment ready, diver gearing up

1122 Diver in
Gondola cart directly beneath hole
South- a narrow gondola 24" wide
½" material on bottom, dark on top, lighter underneath
Moving from south to east- floor drain 12" x 12"
Electrical junction box, jars, etc, on bottom
35'- further east, sediment 2" deep, dark in color
Some oil globules overhead
Sediment 6" deep on floor (45')
Oil trapped in corner between wall and ceiling
End of tunnel (50') sediment 12" deep- broken concrete, re-bar Tunnel blocked by debris at end
Ceiling- pipes, everything covered by dark silt
Moving north- floor covered with 5" silt
Pockets of oil- not in large quantities
Looking west along wall (70')
Making 90 degree turn
Around corner, heading west- debris on bottom, ladders
Lot of wood debris on bottom
Continuing west- lot of debris (could be wood pallets)
Pockets of oil on ceiling, floating timbers
90 degree turn- looking north (30')
Overhead door (38') on east wall- looks like a partition may have been built
Stairway- (50') debris on bottom, bicycle wheels
Cement block and what appears to be pallets on bottom
Oil on ceiling
Northwest- Back in area of entrance point. Light fixture, pockets of oil on ceiling
90 degree turn, north turn to west, by gondola at entrance
Gondola- 3/4 full of silt, debris
North wall, diver moving to left
Moving west, light socket by ceiling, elec. fixtures
pocket of oil (35')
Air space above, largest accumulation of oil so far (46')
Silt suspended in layers

By second hole (60'), material on floor, flexible paneling?
5-6" pipe through ceiling (78')
Pipe running across tunnel (100') Some pockets of oil (110') square opening on ceiling 12" by 12"
Wall taking a turn (or doorway?)
Doorway- door's open
Stairway, streak of orange stringy material. Orange on ceiling (130')
Air, extensive pocket of oil on ceiling (6' wide by 8-10')
Oil collected at ceiling
Insulation falling off pipe- diver moving along pipe
Less than 1/4" slippery silt on bottom
Right hand turn (150') turning toward north- ceiling seems clean- coming up to dead end wall, moving west again
Old garbage can on floor
90 degree turn (180')- overhead door open 6"
10-12 foot wide door
Back to main part of tunnel- north wall, moving west
Large pocket of air overhead
View topside of tunnel- No evidence of flourescent fixtures
190' Tunnel making turn to right
Could not see opening above water
Area seen above water - no debris on bottom
Looking east directly at overhead door
208' Small room off north, angle iron bolted to wall 12" off floor
Fairly clean on wall and ceiling
Moving to room at north- overhead door to floor (have been in this room, May be as far as we can go on the north side)
2 overhead doors at this end of tunnel- like they are closing off an area.
Moving east along south wall (stirred up from trip in tunnel) Oil on surface, pipe opening- 6" pipe (130') through ceiling Light sockets seem to create an air pocket, trap oil
Floor fairly clean
125' Moving along south wall
Vertical pipe (portable light fixture stand)
Turn to right (pump on floor) Manhole steps- can see daylight ahead (100') Manhole grating to street- diver marked with black rod (5th step down)
Coming along south wall- east
58' no large debris, several inches of silt
Oil pockets on ceiling, lot of floating particles
6" pipe floor opening (36')
Gondola in area of access hole
1250 Inspection complete, diver on standby for containers for samples
1310 Diver up, began breakdown

Appendix B

2003 Tunnel Inspection Video

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Appendix C

1992 Basement Cleanup Documentation

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

MPC ENVIRONMENTAL
8631 WEST JEFFERSON, DETROIT, MI 48209
(313) 849-2333 800-521-8232

DAILY WORKSHEET

EPA ID # MID 049277718
HAZARDOUS WASTE SPECIALISTS SINCE 1968
DIVISION OF MARINE POLLUTION CONTROL

COMPANY BOC GASES
ADDRESS 440 S. SAGINAW
CITY, STATE, ZIP FLINT, MI
CONTACT NAME [illegible] BARTIS
TELEPHONE 313-236-4220

HAZ-MAT ☒ Yes ☐ No
INDICATE AIR MASK WORN BY *
EMERGENCY CALL-OUT ☐
SPILL CLEAN-UP ☐ Land ☐ Water
MILEAGE TO SITE

DAY/DATE 8-3-92
P.O. #
MPC JOB #
JOB TIME 1630 TO 1630

JOB DESCRIPTION: LOAD AND MOBILIZE TRAILER AND PUMP TO TRUCK RUNS BLDG 40

PERSONNEL NAME	TIME WORKED	TITLE	STRAIGHT TIME HOURS	STRAIGHT TIME RATE	STRAIGHT TIME AMOUNT	OVERTIME HOURS	OVERTIME RATE	OVERTIME AMOUNT	AMOUNT
J. WALKER	8	ES							
D. NICHOLAS	10	RT							

'A' TOTAL

EQUIP. I.D. #	EQUIPMENT DESCRIPTION	TIME WORKED	RENTAL RATE	DAY RATE	AMOUNT
1	OPS VEHICLE	1 DAY			
39	STAKE TRUCK	1 DAY			
	PORTA JOHN	1 WEEK			
	OFFICE TRAILER				
	GENERATOR				

'B' TOTAL

SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT	SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT

'C' TOTAL

DISPOSAL: DUMP TIME INCLUDED ☐ Yes ☐ No
TICKET #
MANIFEST #
WASTE DESCRIPTION
QUAN. RATE
SITE:
'D' TOTAL

EQUIPMENT
DECONTAMINATION
☐ Yes Ticket # ☐ No
TANK WASH REQUIRED
☐ Yes Ticket # ☐ No
'E' TOTAL

SUBCONTRACTOR
NAME: HANSON
P.O. #: F-22556
'F' TOTAL

TOTALS	
'A' TOTAL	
'B' TOTAL	
'C' TOTAL	
'D' TOTAL	
'E' TOTAL	
'F' TOTAL	
MISC. TOTAL	
GRAND TOTAL	

CHARGES ARE PORTAL TO PORTAL FOUR HOUR MINIMUM CALL-OUT.

PREPARED BY [signature] DATE 8.3.92

CUSTOMER [signature] DATE 8-3-92

MPC ENVIRONMENTAL
8631 WEST JEFFERSON, DETROIT, MI 48209
(313) 849-2333 800-521-8232

DAILY WORKSHEET

EPA ID # MID 049277718
HAZARDOUS WASTE SPECIALISTS SINCE 1968
DIVISION OF MARINE POLLUTION CONTROL

COMPANY FOC FLINT
ADDRESS 1400 S. SAGINAW
CITY, STATE, ZIP FLINT MI
CONTACT NAME PAUL BARTH
TELEPHONE 313-236-4220

HAZ-MAT ☑ Yes ☐ No
INDICATE AIR MASK WORN BY *
EMERGENCY CALL-OUT ☐
SPILL CLEAN-UP ☐ Land ☐ Water
MILEAGE TO SITE

DAY/DATE 5-4-92
P.O. #
MPC JOB #
JOB TIME 0600 TO 1900

DESCRIPTION: BEGIN PCB DECON OF BASEMENT IN BLDG 40 DRUM DEBRIS & REMOVE WATER AND SLUDGE

PERSONNEL NAME	TIME WORKED	TITLE	STRAIGHT TIME HOURS	STRAIGHT TIME RATE	STRAIGHT TIME AMOUNT	OVERTIME HOURS	OVERTIME RATE	OVERTIME AMOUNT	AMOUNT
J. WALKER *	13	FS							
D. NICHOLAS *	11	ZT							
J. KENNEDY *	13	RT							
PER DIEM 2 MEN									

'A' TOTAL

EQUIP. I.D. #	EQUIPMENT DESCRIPTION	TIME WORKED	RENTAL RATE	DAY RATE	AMOUNT
4	OPS VEHICLE	1 DAY			
27	OPS VEHICLE	1 DAY			
	PCB VACUUM	1 DAY			
	OFFICE TRAILER	1 DAY			
	CONTAINATOR	1 DAY			

3 D.

'B' TOTAL

SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT	SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT
CLASS C DRUMS	5			DISPOSABLE RESPIRATORS	4		
CLASS B DRUMS	1			BROOMS / SHOVELS	4 SET		
ABSORBENT ROLL	1 ROLL			LARGE BAGS	6		
SORBENT PADS	1 PACK			BARRICADE TAPE	1 ROLL		
PROTECTIVE				2x4 x 12'	4		
CLOTHING	6 ST.			½ x 4 x 8' PLYWOOD	4		

'C' TOTAL

DISPOSAL: DUMP TIME INCLUDED ☑ Yes ☐ No
TICKET #
MANIFEST #
WASTE DESCRIPTION
TRAN. RATE
SITE:

'D' TOTAL

EQUIPMENT
DECONTAMINATION
☐ Yes Ticket # ☐ No
TANK WASH REQUIRED
☐ Yes Ticket # ☐ No

'E' TOTAL

SUBCONTRACTOR
NAME:
P.O. #:

'F' TOTAL

TOTALS	
'A' TOTAL	
'B' TOTAL	
'C' TOTAL	
'D' TOTAL	
'E' TOTAL	
'F' TOTAL	
MISC. TOTAL	
GRAND TOTAL	

CHARGES ARE PORTAL TO PORTAL FOUR HOUR MINIMUM CALL-OUT.

PREPARED BY — DATE 5-4-92

CUSTOMER — DATE 5-6-92

MPC ENVIRONMENTAL
8631 WEST JEFFERSON, DETROIT, MI 48209
(313) 849-2333 800-521-8232

DAILY WORKSHEET

EPA ID # MID 049277718
HAZARDOUS WASTE SPECIALISTS SINCE 1968
DIVISION OF MARINE POLLUTION CONTROL

COMPANY BOC BUICK
ADDRESS 4100 S. SAGINAW
CITY, STATE, ZIP FLINT MI 48557
CONTACT NAME D. BARTH
TELEPHONE 313-236-4220

HAZ-MAT ☐ Yes ☐ No
INDICATE AIR MASK WORN BY *
EMERGENCY CALL-OUT ☐
SPILL CLEAN-UP ☐ Land ☐ Water
MILEAGE TO SITE

DAY/DATE 1-15-92
P.O. #
MPC JOB #
JOB TIME 0700 TO 1700

JOB DESCRIPTION: COLUMBIA 3006 40 TREATMENT DECON. FLUSH DEBRIS REMOVAL / DRUMMING

PERSONNEL NAME	TIME WORKED	TITLE	STRAIGHT TIME HOURS	STRAIGHT TIME RATE	STRAIGHT TIME AMOUNT	OVERTIME HOURS	OVERTIME RATE	OVERTIME AMOUNT	AMOUNT
J WALKER *	10	FS							
D NICHOLAS *	10	RT							
J KENNEDY *	10	RT							
2 HR DEM 2 MEN									

'A' TOTAL

EQUIP. NO. #	EQUIPMENT DESCRIPTION	TIME WORKED	RENTAL RATE	DAY RATE	AMOUNT
4	OPS VEHICLE	1 DAY			
7	OPS VEHICLE	1 DAY			
	OFFICE TRAILER	1 DAY			
	2" DIAPHRAGM PUMP.	1 DAY			

'B' TOTAL

SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT	SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT
LARGE C DRUM	14						
LARGE E DRUMS	1						
PROTECTIVE CLOTHING	6						
RESPIRATOR REPLACERS	3						
BOOM/SHOVELS/SCRAPERS	ASST						

'C' TOTAL

DISPOSAL: DUMP TIME INCLUDED ☐ Yes ☐ No
TICKET #
MANIFEST #
WASTE DESCRIPTION
TON. RATE
RATE:

'D' TOTAL

EQUIPMENT
DECONTAMINATION
☐ Yes Ticket # ☐ No
TANK WASH REQUIRED
☐ Yes Ticket # ☐ No

'E' TOTAL

SUBCONTRACTOR
NAME:
P.O. #:

'F' TOTAL

TOTALS	
'A' TOTAL	
'B' TOTAL	
'C' TOTAL	
'D' TOTAL	
'E' TOTAL	
'F' TOTAL	
MISC. TOTAL	
GRAND TOTAL	

CHARGES ARE PORTAL TO PORTAL FOUR HOUR MINIMUM CALL-OUT.

PREPARED BY — DATE 1-16-92

CUSTOMER — DATE 1-16-92

MPC ENVIRONMENTAL

8631 WEST JEFFERSON, DETROIT, MI 48209
(313) 849-2333 800-521-8232

DAILY WORKSHEET

EPA ID # MID 049277718
HAZARDOUS WASTE SPECIALISTS SINCE 1968
DIVISION OF MARINE POLLUTION CONTROL

COMPANY GOC BUICK
ADDRESS 4100 S. SAGINAW
CITY, STATE, ZIP FLINT MI 48557
CONTACT NAME P. BARTH.
TELEPHONE 313-236-4220

HAZ-MAT ☐ Yes ☐ No
INDICATE AIR MASK WORN BY *
EMERGENCY CALL-OUT ☐
SPILL CLEAN-UP ☐ Land ☐ Water
MILEAGE TO SITE

DAY/DATE 8.6.92
P.O. #
MPC JOB #
JOB TIME 0730 TO 1500

JOB DESCRIPTION: CONTINUE BLDG 40 BASEMENT DECON. BEGIN APSUR APPLICATIONS

PERSONNEL NAME	TIME WORKED	TITLE	STRAIGHT TIME HOURS	STRAIGHT TIME RATE	STRAIGHT TIME AMOUNT	OVERTIME HOURS	OVERTIME RATE	OVERTIME AMOUNT	AMOUNT
J. WALKER *	10.5	FS							
T. KEMENY *	10.5	RT							
J. NICHOLS *	10.5	RT							

'A' TOTAL

EQUIP. I.D. #	EQUIPMENT DESCRIPTION	TIME WORKED	RENTAL RATE	DAY RATE	AMOUNT
24	OPS VEHICLE				
27	OPS VEHICLE				
	OFFICE TRAILER				
	PCB VACUUM				
	2" DIAPHRAGM PUMP				
	PCB FOAMER/CAPSUR				

'B' TOTAL

SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT	SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT
CLASS E DRUMS	1						
DISPOSABLE RESPIRATORS	84						
PROTECTIVE CLOTHING	6						
BROOM/SQUEEGEES	ASST						
CAPSUR	10 GAL						

'C' TOTAL

DISPOSAL: DUMP TIME INCLUDED ☐ Yes ☐ No
TICKET #
MANIFEST #
WASTE DESCRIPTION
TRANS. RATE
SITE:

'D' TOTAL

EQUIPMENT
DECONTAMINATION
☐ Yes Ticket # ☐ No
TANK WASH REQUIRED
☐ Yes Ticket # ☐ No

'E' TOTAL

SUBCONTRACTOR
NAME: HANDIJON
P.O. #:

'F' TOTAL

TOTALS	
'A' TOTAL	
'B' TOTAL	
'C' TOTAL	
'D' TOTAL	
'E' TOTAL	
'F' TOTAL	
MISC. TOTAL	
GRAND TOTAL	

CHARGES ARE PORTAL TO PORTAL FOUR HOUR MINIMUM CALL-OUT.

PREPARED BY _____ DATE 8.6.92

CUSTOMER _____ DATE _____

MPC ENVIRONMENTAL

8631 WEST JEFFERSON, DETROIT, MI 48209
(313) 849-2333 800-521-8232

DAILY WORKSHEET

EPA ID # MID 049277718
HAZARDOUS WASTE SPECIALISTS SINCE 1968
DIVISION OF MARINE POLLUTION CONTROL

COMPANY EOC QUICK
ADDRESS 4700 S. SAGINAW
CITY, STATE, ZIP FLINT MI
CONTACT NAME P BARTH
TELEPHONE

HAZ-MAT ☐ Yes ☐ No
INDICATE AIR MASK WORN BY *
EMERGENCY CALL-OUT ☐
SPILL CLEAN-UP ☐ Land ☐ Water
MILEAGE TO SITE

DAY/DATE 8-7-92
P.O. #
MPC JOB #
JOB TIME 0730 TO 1830

JOB DESCRIPTION: CONTINUE MOBE TO BASEMENT DECON. COMPLETE CAPSUR APPLICATION — DO FINAL DEBRIS REMOVAL & DOWN UNSQUEEN RUNNERS. SECURE SITE, DEPART

PERSONNEL NAME	TIME WORKED	TITLE	STRAIGHT TIME HOURS	STRAIGHT TIME RATE	STRAIGHT TIME AMOUNT	OVERTIME HOURS	OVERTIME RATE	OVERTIME AMOUNT	AMOUNT
J WALKER *	11	RT							
J KEMENY *	11	RT							
D. NICHOLS *	9½	RT							

'A' TOTAL

EQUIP. I.D. #	EQUIPMENT DESCRIPTION	TIME WORKED	RENTAL RATE	DAY RATE	AMOUNT
24	OPS VEHICLE	1 DAY			
27	OPS VEHICLE	1 DAY			
	OFFICE TRAILER	1 DAY			
	PCB VACUUM	1 DAY			
	PCB CAPSUR FOAMER	1 DAY			
	2" DIAPHRAGM PUMP	1 DAY			

'B' TOTAL

SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT	SUPPLIES AND MATERIALS	NUMBER	PRICE	AMOUNT
PROTECTIVE CLOTHING	7			UNSQUEEN	1 ROLL		
CLASS E DRUMS	1						
CLASS C DRUMS	4						
DISPOSABLE RESPIRATORS	6						
CAPSUR	10 GAL						
RECOVERED/STORED							

'C' TOTAL

DISPOSAL: DUMP TIME INCLUDED ☐ Yes ☐ No
TICKET #
MANIFEST #
WASTE DESCRIPTION
TRAN. RATE
SITE:

'D' TOTAL

EQUIPMENT
DECONTAMINATION
☐ Yes Ticket # ☐ No
TANK WASH REQUIRED
☐ Yes Ticket # ☐ No

'E' TOTAL

SUBCONTRACTOR
NAME: HANDI JON
P.O. #:

'F' TOTAL

TOTALS	
'A' TOTAL	
'B' TOTAL	
'C' TOTAL	
'D' TOTAL	
'E' TOTAL	
'F' TOTAL	
MISC. TOTAL	
GRAND TOTAL	

CHARGES ARE PORTAL TO PORTAL FOUR HOUR MINIMUM CALL-OUT.

PREPARED BY J Walker DATE 8.7.92

CUSTOMER DATE

BOC BUICK CITY

MPC JOB No F8926

BUILDING 40 BASEMENT

PCB DECONTAMINATION

DAY 1

4 Aug 1992 WX Partly Cloudy 68

0745	MPC Jim Walker and Jim Kemeny on site
0750	BOC Environmental Engineer Paul Barth on site
0752	MPC Don Nicholas on site
0818	BOC P. Barth depart
0830	Safety meeting
0900	Monitor O2 LEL 20.9% 0%
0910	Clean up CRZ lay new 10 mil at base of stairs with sorbent
0950	Stage equipment
1030	Power 120 volt & water off notify BOC
1045	Commence debris remove. personnel in level C
1157	BOC P. Barth on site for water & power problem. MPC currently using MPC generator for power. O2 LEL check.
1222	Barth off site
1235	Crew break temp check
1255	Crew back at work drumming debris
1500	Crew luch. temp check
1540	Air monitor O2 LEL ok check
1550	Crew in level C back to work G. Roberts on site
1640	Crew break - basement getting hotter. most of sludge and debris off floor ready to cut up big items
1645	Monitor crew temp J. Kemeny 97.8
1715	Return to basement Level C finish cutting wood debris squeege back section of floor
1735	Begin drum transfer from basement to ramp area
1830	Clean up & secure area
1900	Depart site

BOC BUICK CITY

MPC JOB No F8926

BUILDING 40 BASEMENT

PCB DECONTAMINATION

DAY 2

5 Aug 1992 WX Sunny 61

0700	MPC J. Kemeny D. Nicholas J. Walker on site
0705	MPC Mark Adams on site with additional drums and pump. off load
0725	MPC M. Adams departed site
0730	Safety meeting held by J. Walker all MPC personnel participated
0750	MPC generator inoperative. No power from BOC yet. No air. Water available
0755	P. Barth on site - informed him of utilities problem.
0815	BOC Personnel checking into power and air problems. Crew on standby
0818	P. Barth off site
0845	P. Barth back on site
0855	P. Barth off site
0945	MPC still on standby
1038	Power on and air ok
1100	Suit up Level C Back to work. O2 LEL check 20.9% 0%
1310	BOC Personnel removed 4 drums solids PCB debris drumming continued
1400	Crew break. Crew temp check 98.4 98.6
1415	Continue debris drumming. Crew in Level C O2 LEL check 20.9% 0%
1610	Complete drumming of solids. prep area for capsure
1645	Clean up and secure site
1700	Depart site

BOC BUICK CITY

MPC JOB No F8926

BUILDING 40 BASEMENT

PCB DECONTAMINATION

DAY 3

6 Aug 1992 WX Sunny 67

0730	Crew on site J. Walker J. Kemeny D. Nicholas Safety meeting
0800	Crew in level C. Scrape gondola cars O2 LEL check 20.9% 0%
0930	Begin capsur application. BOC drum removal in progress. 15 class C removed. complete 100%
1115	Crew on break
1135	Crew back to work O2 LEL check 20.9% 0%
1245	J. Walker off site for supplies & lunch
1330	Crew break for lunch. 1/4 of basement -- western wing complete.
1400	Back to work. remove oil from surface opening and decontaminate gondolas.
1610	Crew on break. O2 LEL check 20.9% 0%
1630	Back to work. complete 1/2 of basement with 3-4 applications of capsur. Notice oil seeping in from tunnel.
1730	Clean and secure site
1800	Depart BOC

BOC BUICK CITY

MPC JOB No F8926

BUILDING 40 BASEMENT

PCB DECONTAMINATION

DAY 4

7 Aug 1992 WX Sunny 66

0720	MPC on site safety meeting
0730	Monitor O2 LEL 20% 0%
0745	Crew in Level C doing clean up
0750	Called Paul Barth to inform of oil coming into basement through cracks.
0810	Paul Barth BOC Mark Keyes Advance on site. Discussed grease/oil buildup problems and oil migration from tunnel. Barth wants MPC to complete scope of work and lay down visqueen runners.
0905	MPC J. Walker & crew in basement applying capsur
1035	MPC J. Walker in clean zone for additional capsur O2 LEL check 20.9% 0%
1130	Crew on break/lunch
1200	Back to work Level C
1315	BOC drum personnel on site 4 liquid drums removed. 1 left for 2nd shift
1318	G. Roberts/R. Landis on site
1332	Paul Barth on site
1350	BOC drum crew depart
1400	J. Kemeny on break - begin tear down and equipment wrap up basement basement complete
1630	Equipment wrap up and storage complete. Clean and secure site. Remove MPC generator. 1 liquid drum & 3 solid debris drums palletized for BOC pick-up - dike area secure.
1700	Depart BOC flint. En Route to Detroit.

Solid Drums 22 TOTAL

Liquid Drums 5 TOTAL

DAILY SAFETY MEETING FORM

DATE 8/14/92
PAGE 1/1

Conducted by: J.D. Walker

NAME	EMPLOYEE ID#
J. WALKER	
J. KEMENY	
D. NICHOLAS	
P. BARTH.	

DAILY AREA ACCESS LOG

8.4.92

PAGE 1

Name	Social Security Number	Task Number	Time In	Time Out
PAUL BARTH	373-50-1821		0750	0818
" "	" " "		1157	1222
MARY FIELD			15-18	1520
J. ROBERTS	519-66-6115		15-50	1645

BOC/B40/APPENDIX C

DAILY AREA ACCESS LOG

8-5-92

PAGE 1 / 1

Name	Social Security Number	Task Number	Time In	Time Out
PAUL BARTH	373-50-1812	ENV.	0755	0818
" "	BOC		0845	0855
M. ADAMS.	MPC	SUPPLIES	0705	0725
C. WEBSTER	BOC		0950	0953
P. BARTH	BOC		0955	1014
G. ROBERTS	MPC	PLANT MGR	1602	1619
C. NAUSS			1610	1621

DAILY SAFETY MEETING FORM

DATE 8/6/92
PAGE ___/___

Conducted by: J Walker

NAME	EMPLOYEE ID#
J. Kemeny	
D. Nicholas	

OC/B40/APPENDIX E

DAILY SAFETY MEETING FORM

DATE 8/6/92
PAGE 1

Conducted by: [signature]

NAME	EMPLOYEE ID#
J Kemeny	
D. Nicholas	

OC/B40/APPENDIX E

DAILY AREA ACCESS LOG

8-6-92

PAGE 1

Name	Social Security Number	Task Number	Time In	Time Out
PAUL BARTH	ENV.		0801	0855
BOC PERSONNEL	BOC		0930	
DRUM REMOVAL				1002

DAILY SAFETY MEETING FORM

DATE 8/7/92
PAGE ____/____

Conducted by: J Walker

NAME	EMPLOYEE ID#
J Kemeny	
D. Nicholas	

OC/B40/APPENDIX E

DAILY AREA ACCESS LOG

PAGE 8-7-92 1

Name	Social Security Number	Task Number	Time In	Time Out
PAUL BARTH	BOC		0810	0849
MARK KEYES	ADVANCED		0810	0848
PAUL BARTH	BOC		1138	1149
BOB METCALF	BOC		1138	1149
G. ROBERTS	MPC		1318	1421
D. GANDIS	MPC		1318	1421
P. BARTH			1332	1421
BOC DRUM	BOC		1315	
PERSONNEL				1350

General Motors Corporation

GENERAL MOTORS CORPORATION
BOC-FLINT / BUICK
MAIL DROP 26C
4100 S. SAGINAW
FLINT MI
48557 US

VENDOR NUMBER 04-927-7718
MARINE POLLUTION CONTROL
8031 WEST JEFFERSON
DETROIT MI
48209

SHIP TO: BOC-FLINT/BUICK
ATTN: RECEIVING
BLDG. 69/DOCK 1
LEITH STREET
FLINT MI
48550 US

INVOICE TO: GENERAL MOTORS CORPORATION
BOC DISBURSEMENT CENTER
P. O. BOX 2069
WARREN MI
48090-2069 US

Purchase Order: BUS08129

REQUISITIONER'S COPY

6

This Number Must Appear On All Invoices, Packing Slips, Packages and Bills of Lading.
(2) copies of your packing slip must accompany each shipment. Item Identification Number(s) must be shown on Packing Slips and Invoices.
Invoice Attn: Accounts Payable
Do Not Declare Valuation of Express Shipments or Insure Parcel Post.

This order is not binding until accepted. Acceptance should be executed on acknowledgment copy which should be returned to Buyer.
On the reverse side hereof are the terms and conditions to which Seller agrees by acceptance of this order.
This order, including the terms and conditions on the face and reverse side hereof, contains the complete and final agreement between Buyer and Seller and no other agreement in any way modifying any of said terms and conditions will be binding upon the Buyer unless made in writing and signed by Buyer's authorized representative.
If Government Contract Number is Shown Hereon, additional Terms and Conditions Attached Hereto Apply.

ORDER DATE	PHONE: 313/236-4609
07/09/92	MJ SNYDER
ALTERATION ISSUE DATE	F64 Buyer
ALTERATION EFFECTIVE DATE	G JOHNSON/MCALIND
	DIRECTOR OF SUPPLIER MANAGEMENT

TERMS	F.O.B. DESTINATION UNLESS OTHERWISE INDICATED	SHIP VIA
25TH PROX.	SP	BEST WAY

QUANTITY ORDERED	ITEM IDENTIFICATION NUMBER	NOUN NAME	DESCRIPTION	RFQ NUMBER	DATE REQUIRED	TAX CODE/%	BASE UNIT PRICE	PRICE MULTIPLE	UNIT OF MEASURE
			** PLEASE REFERENCE BUYER'S NAME ** ON ENVELOPE OF ALL CORRESPONDENCE ** (AC)						
			ALL SUPPLIERS WHO CURRENTLY ARE NOT RECEIVING PAYMENT VIA EFT (ELECTRONIC FUNDS TRANSFER) SHOULD BE ADVISED THAT GENERAL MOTORS WILL NOT ISSUE PAPER CHECKS DURING THE TIME PERIOD OF JULY 20, 1992 THROUGH JULY 31, 1992. CHECKS WILL BE MAILED ON THE FIRST GENERAL MOTORS BUSINESS DAY IMMEDIATELY FOLLOWING THIS PERIOD (AUGUST 3, 1992). IN CONTRAST, EFT PAYMENTS WILL BE ISSUED AND FUNDS WILL BE AVAILABLE DURING THE TWO WEEK DOWNTIME. (REFERENCE EFT AGREEMENT DATED 4/91) IF YOU ARE INTERESTED IN PARTICIPATING IN EFT, PLEASE CONTACT YOUR BUYER.						
1	PRWE0337 001				06/25/92	C 0.00%	16548.0000	1	LOT
			KABIR ABD NATEROAK REQUIRED FOR REMEDIATION AND CLEAN UP OF BUILDING #40. M.P.C. WILL PROVIDE CONTAINERS FOR DISPOSAL. 0 BOC-FLINT WILL CO-ORDINATE DISPOSAL OF CONTAINERS THROUGH GM APPROVED SOURCE 0 IF ADDITIONAL CLEANING IS DEEMED NECESSARY WORK WILL NOT PROCEED WITHOUT PRIOR APPROVAL OF PURCHASING.						

General Motors Corporation

GENERAL MOTORS CORPORATION
BOC-FLINT / BUICK
MAIL DROP 206
4100 S. SAGINAW
FLINT MI
48557 US

VENDOR NUMBER 04-927-7718
MARINE POLLUTION CONTROL
8631 WEST JEFFERSON
DETROIT MI
48209

SHIP TO: BOC-FLINT/BUICK
RECEIVING
BLDG. 65/BUICK 1
CEDAR STREET
FLINT MI
48550 US

INVOICE TO: GENERAL MOTORS CORPORATION
BOC DISBURSEMENT CENTER
P. O. BOX 2069
WARREN MI
48090-2069 US

Purchase Order: BOS[illegible]129

PAGE 2

6

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Invoice Attn: Accounts Payable
Do Not Declare Valuation of Express Shipments or Insure Parcel Post.

ORDER DATE	PHONE: 313/236-4609
07/09/92	MJ SNYDER
ALTERATION ISSUE DATE	FE4 Buyer
ALTERATION EFFECTIVE DATE	G JOHNSON/MCALIND
	DIRECTOR OF SUPPLIER MANAGEMENT

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On the reverse side hereof are the terms and conditions to which Seller agrees by acceptance of this order.
This order, including the terms and conditions on the face and reverse side hereof, contains the complete and final agreement between Buyer and Seller and no other agreement in any way modifying any of said terms and conditions will be binding upon the Buyer unless made in writing and signed by Buyer's authorized representative.
If Government Contract Number is Shown Hereon, additional Terms and Conditions Attached Hereto Apply.

TERMS	F.O.B. DESTINATION UNLESS OTHERWISE INDICATED	SHIP VIA
25TH PROX.	SP	BEST WAY

QUANTITY ORDERED	ITEM IDENTIFICATION NUMBER	NOUN NAME DESCRIPTION	RFQ NUMBER	DATE REQUIRED	TAX CODE/%	BASE UNIT PRICE	PRICE MULTIPLE	UNIT OF MEASURE
		REFERENCE QUOTE BU0083823 CODE 200-001592-NE LABOR RELATION #92-02 REQUESTED BY PAUL BARTH 236-4220 WHO ORDERED: 2558 P BARTH ACCT: 537000 054000000008686 WO: MW AA9286 PRICED PER REQUEST FOR QUOTATION BU0083823 RIGHT TO KNOW: MIOSHA H.B. NO. 4111 --- THE CONTRACTOR SHALL CONFORM TO THE REQUIREMENTS OF THE "RIGHT TO KNOW" LAW, MIOSHA H.B. #4111, INCLUDING DEVELOPMENT AND IMPLEMENTATION OF A "RIGHT TO KNOW" PROGRAM; INFORMING THEIR EMPLOYEESOF HAZARDOUS CHEMICALS THAT MAY BE LOCATED IN THE GENERAL AREA OF THIS CONSTRUCTION PROJECT; PROVIDING B-O-C FLINT WITH U.M. MATERIAL SAFETY DATA SHEETS, OR EQUIVALENT, FOR ALL CHEMICAL MATERIALS BROUGHT ON SITE; AND FOR ENSURING THAT ALL CHEMICAL MATERIALS BROUGHT ON SITE ARE PROPERLY LABELED. ADDITIONAL INFORMATION REGARDING CHEMICAL MATERIAL IN THE GENERAL AREA, MATERIAL SAFETY DATA SHEETS, SAFE USE INSTRUCTIONS, ETC. MAY BE OBTAINED BY CONTACTING THE FACTORY HAZARDOUS MATERIAL COORDINA-						

General Motors Corporation

GENERAL MOTORS CORPORATION
BOC-FLINT / BUICK
MAIL DROP 2BC
4100 S. SAGINAW
FLINT MI
48557 US

VENDOR NUMBER 04-927-7718
MARINE POLLUTION CONTROL
8631 WEST JEFFERSON
DETROIT MI
48209

SHIP TO: BOC-FLINT/BUICK
ZD RECEIVING
BLDG. 35/DOCK 1
LEITH STREET
FLINT MI
48550 US

INVOICE TO: GENERAL MOTORS CORPORATION
BOC DISBURSEMENT CENTER
P. O. BOX 2069
WARREN MI
48090-2069 US

Purchase Order: 4USO3129

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This order, including the terms and conditions on the face and reverse side hereof, contains the complete and final agreement between Buyer and Seller and no other agreement in any way modifying any of said terms and conditions will be binding upon the Buyer unless made in writing and signed by Buyer's authorized representative.
If Government Contract Number is Shown Hereon, additional Terms and Conditions Attached Hereto Apply.

ORDER DATE	PHONE: 313/236-4609
07/09/92	MJ SNYDER
ALTERATION ISSUE DATE	F84 Buyer
ALTERATION EFFECTIVE DATE	S JOHNSON/MCALIND DIRECTOR OF SUPPLIER MANAGEMENT

TERMS	F.O.B. DESTINATION UNLESS OTHERWISE INDICATED	SHIP VIA
25TH PROX.	SP	BEST WAY

QUANTITY ORDERED	ITEM IDENTIFICATION NUMBER	NOUN NAME DESCRIPTION	RFQ NUMBER	DATE REQUIRED	TAX CODE/%	BASE UNIT PRICE	PRICE MULTIPLE	UNIT OF MEASURE
		FOR DR MR. T.DUTCHER, BUILDING #30, (313) 236-5590. (AF)						

BY ACCEPTANCE OF THIS PURCHASE ORDER THE SELLER OF GOODS AND/OR SERVICES GRANTS BUYER THE RIGHT TO AUDIT ALL CHARGES AND AGREES THAT ALL RECORDS SUPPORTING CHARGES WILL BE AVAILABLE FOR AUDIT BY GENERAL MOTORS CORPORATION FOR A PERIOD OF ONE (1) YEAR BEYOND FINAL PAYMENT.

•

YOUR SIGNATURE AND RETURN OF THE ATTACHED ACKNOWLEDGMENT COPY CONSTITUTES A FIRM PRICE SCHEDULE FOR THE PERIOD SPECIFIED. ANY INCREASE OF PRICE WILL NOT BECOME EFFECTIVE UNTIL 30 DAYS AFTER PRESENTATION TO, AND ACCEPTANCE BY, THE BUYER IN WRITING.

•

ACTUAL REQUIREMENTS FOR THE PERIOD INDICATED WILL BE SPECIFICALLY COVERED BY SUBSEQUENT RELEASES.

•

THIS ORDER SUBJECT TO CANCELLATION BY BUYER ON 30 DAY WRITTEN NOTICE.

•

DO NOT SHIP OR INVOICE BEYOND THE DATE SHOWN. (RL)

ANY CHANGES IN COST OR DELIVERY RESULTING FROM ALTERATIONS IN WORK SCHEDULES OR SPECIFICATIONS MUST

General Motors Corporation

GENERAL MOTORS CORPORATION
BOC-FLINT / BUICK
MAIL DROP 206
4100 S. SAGINAW
FLINT MI
48557 US

VENDOR NUMBER 04-927-7718
MARINE POLLUTION CONTROL
8031 WEST JEFFERSON
DETROIT MI
48209

SHIP TO: BOC-FLINT/BUICK
LS RECEIVING
BLDG. 35/DOOR 1
LEITH STREET
FLINT MI
48550 US

INVOICE TO: GENERAL MOTORS CORPORATION
BOC DISBURSEMENT CENTER
P. O. BOX 2069
WARREN MI
48090-2069 US

Purchase Order: P05081129

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Do Not Declare Valuation of Express Shipments or Insure Parcel Post.

This order is not binding until accepted. Acceptance should be executed on acknowledgment copy which should be returned to Buyer.
On the reverse side hereof are the terms and conditions to which Seller agrees by acceptance of this order.
This order, including the terms and conditions on the face and reverse side hereof, contains the complete and final agreement between Buyer and Seller and no other agreement in any way modifying any of said terms and conditions will be binding upon the Buyer unless made in writing and signed by Buyer's authorized representative.
If Government Contract Number is Shown Hereon, additional Terms and Conditions Attached Hereto Apply.

ORDER DATE	PHONE: 313/236-4609
07/09/92	MJ SNYDER
ALTERATION ISSUE DATE	F24 Buyer
	S JOHNSON/MCALIND
ALTERATION EFFECTIVE DATE	DIRECTOR OF SUPPLIER MANAGEMENT

TERMS	F.O.B. DESTINATION UNLESS OTHERWISE INDICATED	SHIP VIA
25TH PROX.	SP	BEST WAY

QUANTITY ORDERED	ITEM IDENTIFICATION NUMBER	NOUN NAME	DESCRIPTION	RFQ NUMBER	DATE REQUIRED	TAX CODE/%	BASE UNIT PRICE	PRICE MULTIPLE	UNIT OF MEASURE
			BE AUTHORIZED BY THE PURCHASING DEPARTMENT. NOTIFY BUYER IN WRITING OF AFFECT ON COST AND DELIVERY. (EB)						
			DO NOT INVOICE MICHIGAN SALES AND USE TAXES. WE WILL PAY ALL MICHIGAN SALES AND USE TAXES DIRECTLY TO THE STATE OF MICHIGAN UNDER LICENSE NUMBER ME-0600440.(TX)						
			QUESTIONS CONCERNING PAYMENT ISSUES SHOULD BE DIRECTED TO B-O-C DISBURSEMENT ANALYSIS IN WARREN, MICHIGAN. 313-492-1181 OR 313-492-1177. (WR)						

Appendix D

Risk Calculations for Exposure of Demolition Workers

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

APPENDIX D

Risk Calculations for Exposures of Demolition Workers To LNAPL in Basement and Tunnel Water

1.0 INTRODUCTION

The calculations discussed in this Appendix pertain to the potential exposure of workers who may come in contact with light nonaqueous-phase liquids (LNAPLs) occasionally while performing demolition activities in the basement and tunnel of Building 40. For occasional contact of LNAPL for demolition workers, the potential exposure pathways evaluated in Section 3 of the Building 40 Tunnel and Basement Report include the following:

- Dermal contact with LNAPL, and
- Inhalation of vapor from the LNAPL.

The exposure concentrations and exposure factors used in the evaluation of these pathways are discussed in Sections 2.0 and 3.0 of this Appendix, respectively. The toxicity information is discussed in Sections 4.0 of this Appendix. The derivation of risk-based criteria for evaluating exposures of workers performing demolition activities are discussed in Section 5.0. Tables are presented in the Attachment to this Appendix. References cited in this Appendix are found in Section 6.0.

2.0 EXPOSURE CONCENTRATIONS

2.1 LNAPL

The highest concentrations of all constituents detected in the LNAPL samples from Building 40 are used as the exposure concentrations. PCBs were the only constituents detected in the LNAPL samples. Five additional constituents (benzo(a)anthracene, chrysene, 1,1-dichloroethane, naphthalene, and pyrene) were detected in tunnel and basement water samples. The highest concentration of each chemical detected in the water samples is conservatively assumed to be the exposure concentration in LNAPL. The LNAPL concentrations used in the calculations are shown in the Attachment to this Appendix.

2.2 LNAPL Vapor Concentrations in Air

The vapor concentration of LNAPL constituents in the air as a result of emission from LNAPL that is exposed in an open excavation pit is estimated using the "oil film surface emission model". This model is described by the equations in Table 5-7 of the *Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF) – Air Emission Models* (U.S. EPA 1987). The use of this vapor emission model assumes that a layer of free-phase LNAPL will be present on the floor of the excavation pit. The vapor concentration of LNAPL constituents in the air as a result of emission from groundwater that is exposed in an open excavation pit is estimated as follows:

$$C_{air} = C_{LNAPL} \times J_L \times C/Q$$

where C_{LNAPL} is the concentration of a chemical in the LNAPL, J_L is the vapor flux from exposed groundwater to air, and C/Q is the dispersion factor for a 15-foot x 15-foot excavation pit. The LNAPL concentrations discussed in Section 2.1 of this Appendix are used for C_{LNAPL}. The vapor flux is calculated using a U.S. EPA-recommended screening-level emission model for calculating gaseous emissions from aqueous-phase contaminants pooled at soil surface (U.S. EPA 1995a). The dispersion factor is estimated using the screening-level air dispersion model SCREEN3 (U.S. EPA 1995b). The area-source algorithm in SCREEN3 is used with worst-case meteorological conditions (selected by the model) to estimate maximum 1-hour concentrations at ground level. The excavation pit is approximated as a square source, since the maximum calculated air concentration is independent of wind direction. The maximum 1-hour air concentrations calculated by SCREEN3 are converted to maximum 24-hour air concentrations using a conservative factor of 0.4 for on-source air concentrations. The air concentrations estimated by this approach are conservative (i.e., expected to predict higher than actual air concentrations to which workers would be exposed). Calculations of the vapor concentrations in the air are shown in the Attachment to this Appendix.

As shown by the model's equations, the oil film model is capable of accounting for depletion of constituents in the LNAPL over time as they volatilize. However, the calculations shown in the accompanying tables conservatively assume that the constituent in the exposed LNAPL layer do not deplete. This assumption is used because it is possible for the exposed LNAPL in the excavation to be refreshed by "fresh" LNAPL draining into the excavation, such as when workers attempt to "dewater" the excavation. Because the size of excavations for occasional maintenance or construction activities are expected to be small relative to the size of the LNAPL plumes, "fresh" LNAPL would be available to drain into an open excavation.

3.0 EXPOSURE FACTORS

For the potential exposures of demolition workers at Building 40, exposure is quantified in terms of a dose, as follows:

$$Dose = Concentration \times Intake$$

The dose for evaluating cancer risk is averaged over a lifetime and is called the lifetime average daily dose (LADD). For evaluating long-term (or chronic) noncancer effects, the dose is averaged over the period of exposure and is called the average daily dose (ADD).

The concentration term in the dose equation refers to the chemical concentration in LNAPL basement and tunnel waters, as discussed in Section 2.0. The intake term refers to the intake rate of the LNAPL in basement and tunnel waters, which is a function of the magnitude, frequency, and duration of exposure, as discussed below.

The exposure factors used for evaluating high-end exposure of workers performing demolition activities at Building 40 are presented in the Attachment to this Appendix. The key factors are discussed as follows:

LNAPL Dermal Contact Rate

The exposed skin area is 3,300 cm^2. Workers are assumed to be covered with LNAPL over this exposed skin surface area for 2 hours per day. The absorbed dose for organic chemicals is estimated using the non-steady state approach suggested by U.S. EPA (2001), which is more conservative than the steady state approach recommended in early guidance (U.S. EPA 1989), particularly for hydrophobic organic compounds. The permeability coefficient (K_p) for dermal absorption of organic chemicals from LNAPL is estimated following U.S. EPA guidance (1992).

Exposure Frequency and Duration

The duration of demolition activities for the Building 40 tunnel and basement is assumed to be 50 days, which is assumed to occur during the period of one year. This corresponds to an exposure frequency of 50 days/year and an exposure duration of 1 year. It should be recognized that the exposure frequency for the demolition scenario refers to the days when workers are engaged in actual demolition of the Building 40 basement and tunnel, rather than the days when workers are engaged in other activities (e.g., building above-ground structures). This combination of exposure frequency and exposure duration is expected to be conservative for the amount of time these workers are actually in contact with the LNAPL in the basement and tunnel waters.

Body Weight

The body weight of 70 kg is the standard U.S. EPA-recommended body weight for assessing exposure to adults (U.S. EPA 1989).

Averaging Time

The averaging time for evaluating cancer risk is equal to a lifetime of 70 years, and the averaging time for evaluating noncancer risk is equal to the exposure duration (U.S. EPA 1989).

4.0 TOXICITY ASSESSMENT

A toxicity assessment identifies potential adverse health effects that are associated with exposure to chemicals, and the dose-response relationship between exposure and the occurrence of adverse effects. Toxicological information used in the evaluation of risks from potential exposure of demolition workers to LNAPL in basement and tunnel waters, is compiled from the following U.S. EPA hierarchy of sources, as follows:

1. Integrated Risk Information System (IRIS)
2. Health Effects Assessment Summary Tables (HEAST)
3. National Center for Environmental Assessment (NCEA)

When toxicological information is not available from these sources, other U.S. EPA sources of toxicological information are consulted. The toxicity information used in the evaluation of risks from potential exposure to chemicals in the LNAPL in basement and tunnel waters is presented in the Attachment to this Appendix and discussed below.

4.1.1 Carcinogens

U.S. EPA considers chemicals belonging to the following U.S. EPA cancer weight-of-evidence groups as human carcinogens:

Group A: Known Human Carcinogen-sufficient evidence of carcinogenicity in humans

Group B1: Probable Human Carcinogen-limited evidence of carcinogenicity in humans

Group B2: Probable Human Carcinogen-sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans

Group C: Possible Human Carcinogen-limited evidence of carcinogenicity in animals and inadequate or lack of evidence in humans

As shown in the Attachment to this Appendix, U.S. EPA has designated each of the constituents as belonging to one of these weight-of-evidence groups. Most of those constituents are designated as Group B2 or Group C, which means that U.S. EPA acknowledges that there is either inadequate or a lack of evidence that these constituents actually cause cancer in humans. Therefore, evaluating these constituents as human carcinogens in the risk evaluation is highly conservative.

U.S. EPA-derived cancer slope factors (SFs) and inhalation unit risk factors (URFs) for these constituents and their sources are presented in the Attachment to this Appendix.

The oral SFs and URFs represent 95% upper confidence bounds on the probability of getting cancer over a lifetime per unit dose. As recognized by U.S. EPA, there is significant scientific evidence that some of the SFs and URFs may be overly conservative and may ignore the potential existence of threshold doses. Nonetheless, they are used here as conservative assessment tools.

4.1.2 Noncarcinogens

Constituents designated by U.S. EPA as belonging to the cancer weight-of-evidence Group D (Not Classifiable as to Human Carcinogenicity) are considered noncarcinogens. Constituents not designated as belonging to any cancer group are potential carcinogens and/or noncarcinogens. U.S. EPA-derived subchronic reference doses (RfDs) and subchronic inhalation reference concentrations (RfCs) for these constituents and their sources are presented in the Attachment to this Appendix. Subchronic exposures are defined by U.S. EPA as exposures from two weeks to seven years, and thus are appropriate for these calculations.

The subchronic oral RfDs and inhalation RfCs represent conservative estimates of the daily exposure to the human population, including sensitive subpopulations, which are likely to be without an appreciable risk of deleterious effects over a period of two weeks to seven years. These RfDs and RfCs typically incorporate several safety factors to account for uncertainties in their derivation, which in combination often result in overall uncertainty factors of 1,000 or more. Furthermore, for many constituents, there is significant scientific debate about the validity of these RfDs and RfCs, and the association of these doses and concentrations to potential adverse health consequences. Nonetheless, the RfDs and RfCs are used here as conservative assessment tools.

4.1.3 Extrapolation of Toxicity Values

The U.S. EPA sources of toxicological information listed above do not provide dermal toxicity values for any of the constituents. Therefore, oral toxicity values (i.e., oral SFs and RfDs) are used as dermal toxicity values in this risk evaluation. No adjustment to the oral toxicity values is made in this route-to-route extrapolation, consistent with current U.S. EPA guidance (U.S. EPA 2001), which recognizes that there is currently insufficient scientific basis to support any adjustment.

The U.S. EPA sources of toxicological information listed above do not provide inhalation toxicity values (URFs and RfCs) for all of the constituents. For constituents where no URF or RfC was available, the inhalation SF and RfD was used in this risk evaluation. Consistent with U.S. EPA guidance (1989), the SFs and RfDs are converted to URFs and RfCs. For constituents where no inhalation toxicological values were available, oral toxicological values (SFs and RfDs) were used as inhalation toxicological values in this risk evaluation. No adjustment to the oral toxicity values is made in this route-to-route extrapolation, since there is currently insufficient scientific basis to support any adjustment.

The U.S. EPA sources of toxicological information listed above do not provide subchronic toxicity values (RfDs and RfCs) for all of the constituents. For constituents where no subchronic values were available, the chronic RfC and RfD were used in this risk evaluation. No adjustment to the chronic toxicity values were made in this route-to-route extrapolation, since there is currently insufficient scientific basis to support any adjustment.

5.0 CANCER RISK AND NONCANCER HAZARD INDEX

The cancer risk associated with potential exposure to a carcinogenic chemical is calculated by multiplying an estimate of the LADD by the SF for the chemical, as follows:

$$Risk = LADD \times SF$$

For the inhalation route, the inhalation cancer risk is calculated using the chemical concentration in air (C_{air}) and the URF, as follows:

$$Risk = C_{air} \times URF \times \frac{EF \times ED}{AT}$$

where EF is exposure frequency, ED is exposure duration, and AT is averaging time.

The noncancer hazard quotient (HQ) associated with potential exposure to a noncarcinogenic chemical is calculated by dividing an estimate of the ADD by the reference dose (RfD) for the chemical, as follows:

$$HQ = \frac{ADD}{RfD}$$

For the inhalation route, the inhalation HQ is calculated using C_{air} and the RfC, as follows:

$$HQ = \frac{C_{air}}{RfC} \times \frac{EF \times ED}{AT}$$

The potential cancer risk and noncancer effects that may result from exposure to the combination of the constituents in LNAPL in basement and tunnel water at Building 40 are estimated following U.S. EPA guidance (U.S. EPA 1989), as follows:

$$Cumulative\ Risk = \sum_i Risk_i$$

$$Hazard\ Index = \sum_i HQ_i$$

where:

$Risk_i$ = estimated cancer risk for the *i*th constituent
HQ_i = hazard quotient for the *i*th constituent

This approach may result in estimates of cumulative cancer and noncancer risks that are more conservative than necessary. For example, different chemicals may cause different and unrelated health effects, so that summing the HQs for their individual effects would overestimate the significance of their combined effects. Nonetheless, this approach is used here as a conservative assessment tool. The cumulative cancer risk and HI estimates for the LNAPL in basement and tunnel waters are presented in the Attachment to this Appendix.

6.0 REFERENCES

U. S. Environmental Protection Agency (U.S. EPA). 1989. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund. Volume I, Human Health Evaluation Manual. Washington, DC. EPA/540-1-89-002. OSWER Directive 9285.7-01a. December.

U. S. Environmental Protection Agency (EPA). 1992. Office of Research and Development. Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B. January.

U. S. Environmental Protection Agency (U.S. EPA). 1995a. Office of Air Quality Planning and Standards. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources. AP-42, Fifth Edition.

U. S. Environmental Protection Agency (U.S. EPA). 1995b. Office of Air Quality Planning and Standards. SCREEN 3 Model User's Guide. EPA-454/B-95-004.

U. S. Environmental Protection Agency (U.S. EPA). 2001. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). EPA/540/R/99/005. September.

Attachment to Appendix D

Toxicity Values
NAO Flint Operations Site - Flint, Michigan

Chem Group	Chemical	CASRN	Cancer Class	SF_{oral} $(mg/kg/d)^{-1}$			URF $(ug/m^3)^{-1}$			Subchronic RfD_{oral} (mg/kg/d)				Subchronic RfC (mg/m^3)			
				Value	Ref	Notes	Value	Ref	Notes	Value	UF	Ref	Notes	Value	UF	Ref	Notes
VOC	1,1-Dichloroethane	75-34-3	C							1.0E+00	100	2	26	5.0E+00	100	2	3
SVOC	Benzo(a)anthracene	56-55-3	B2	7.3E-01	10	5	2.1E-04	10	5,4,45								
SVOC	Chrysene	218-01-9	B2	7.3E-03	10	5	2.1E-06	10	5,4,45								
SVOC	Naphthalene	91-20-3	C							2.0E-02	3000	1	62	3.0E-03	3000	1	62
SVOC	Pyrene	129-00-0	D							3.0E-01	300	2		1.1E-01	3000	1	4,44,62
P/PCB	PCBs (total)	1336-36-3	B2	2.0E+00	1	30,32	5.7E-04	1	4,30,32,45	5.0E-05	100	2	72	7.0E-05	300	1	72,4,44,62

References:

1 USEPA. Integrated Risk Information System (IRIS). On-line database.

2 USEPA. 1997. Health Effects Assessment Summary Tables (HEAST). FY-1997 Update. EPA 540/R-97-036. July.

10 USEPA. 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/2-93/089. July.

Notes:

3 HEAST Alternate Method.

4 ENVIRON obtained value by route-to-route extrapolation.

5 Based on analogy to Benzo(a)pyrene [CASRN 50-32-8] using USEPA relative potency described in the indicated reference.

26 USEPA obtained value by route-to-route extrapolation.

30 Upper-bound slope factor.

32 High risk & persistence tier.Use for: food chain exposure;sediment/soil ingestion;dust/aerosol inhalation;dermal exposure, if an absorption factor has been applied; presence of dioxin-like,tumor-promoting/persistent congeners;all early life exposures.

44 ENVIRON derived CRFC from CRFDI value presented in the indicated reference, using standard USEPA methodology presented in HEAST.

45 ENVIRON derived URFI from CSFI value presented in the indicated reference, using standard USEPA methodology presented in HEAST.

62 ENVIRON used chronic value as a surrogate for the subchronic value.

72 ENVIRON used Aroclor 1254 [CASRN 11097-69-1] value from the indicated reference as a surrogate for Polychlorinated biphenyls [CASRN 1336-36-3].

High-End Exposure Factors NAO Flint Operations Site - Flint, Michigan			
			Demolition Scenario
Ambient Air Inhalation			
Exposure Frequency	days/year	**EF**	50
Expoure Duration	years	**ED**	1
Averaging Time, cancer	days	**AT_c**	25,550
Averaging Time, noncancer	days	**AT_{nc}**	365
Oil Dermal Contact			
Event Time	hr	**t**	2
Skin Surface Area	cm^2	**SA**	3,300
Events per Day	1/d	**EV**	1
Exposure Frequency	d/yr	**EF**	50
Exposure Duration	yr	**ED**	1
Body Weight	kg-bw	**BW**	70
Averaging Time, carc	d	**AT_c**	25,550
Averaging Time, noncarc	d	**AT_{nc}**	365

Estimated Ambient Air Concentration from Excavation Into Soil with Free-Phase NAPL in Tunnel Water NAO Flint Operations Site - Flint, Michigan											
TCL/TAL Group	Chemical	CASRN	C_{NAPL} (mg/kg)	MW (g/mole)	K_{eq} (unitless)	D_{air} (cm^2/s)	Sc	k_G (m/s)	K (m/s)	J_L (mg/m^2-s)	$C_{air, worker}$ (mg/m^3)
VOC	1,1-Dichloroethane	75-34-3	3.75E-03	9.90E+01	4.13E-03	7.42E-02	1.88E+00	0.0015336	6.33E-06	2.09E-05	2.29E-04
SVOC	Benzo(a)anthracene	56-55-3	2.37E-01		1.91E-12	5.10E-02	2.74E+00	0.0011929	2.27E-15	4.75E-13	5.21E-12
SVOC	Chrysene	218-01-9	3.08E-01		1.13E-13	2.48E-02	5.63E+00	0.0007359	8.32E-17	2.26E-14	2.47E-13
SVOC	Naphthalene	91-20-3	4.01E-01		1.54E-06	5.90E-02	2.36E+00	0.0013153	2.03E-09	7.16E-07	7.85E-06
SVOC	Pyrene	129-00-0	1.31E-01		8.33E-11	2.72E-02	5.13E+00	0.0007829	6.52E-14	7.50E-12	8.22E-11
P/PCB	PCBs (total)	1336-36-3	1.44E+02		1.40E-09	8.00E-02	1.74E+00	0.0016129	2.25E-12	2.86E-07	3.14E-06
Notes:											
Physical Properties of Air											
	Pressure	1	atm	assumed							
	Molecular Weight	28.8	g/g mol	Perry and Chilton (1973)							
	Viscosity	1.80E-04	g/(cm.s)	Perry and Chilton (1973)							
	Density	0.00129	g/cm^3	Perry and Chilton (1973)							
Physical Properties of NAPL											
	Molecular Weight	271	g/g mol								
	Density	0.88	g/cm^3								
Physical Characteristics of Excavation Pit											
	Windspeed	0.5	m/s	assumed							
	Surface Area	2.1.E+01	m^2								
	Effective Diameter of Area	5.2.E+00	m	calculated							

Demolition Scenario Cancer Risk Calculations - Tunnel Water
NAO Flint Operations Site - Flint, Michigan

				NAPL Dermal Contact					NAPL Vapor Inhalation			
Chem Group	Chemical	CASRN	Cancer Class	C_{NAPL} (mg/L)	DA (L/cm^2)	LADD (mg/kg/d)	SF_{derm} $(mg/kg/d)^{-1}$	Risk	$C_{air, worker}$ (mg/m^3)	C_{air} (mg/m^3)	URF (m^3/mg)	Risk
VOC	1,1-Dichloroethane	75-34-3	C	3.30E-03	2.99E-04	9.11E-08			2.29E-04	4.48E-07		
SVOC	Benzo(a)anthracene	56-55-3	B2	2.09E-01			7.3E-01		5.21E-12	1.02E-14	2.1E-01	2.1E-15
SVOC	Chrysene	218-01-9	B2	2.71E-01	5.32E-09	1.33E-10	7.3E-03	9.7E-13	2.47E-13	4.84E-16	2.1E-03	1.0E-18
SVOC	Naphthalene	91-20-3	C	3.53E-01	6.77E-05	2.20E-06			7.85E-06	1.54E-08		
SVOC	Pyrene	129-00-0	D	1.15E-01	9.95E-09	1.06E-10			8.22E-11	1.61E-13		
P/PCB	PCBs (total)	1336-36-3	B2	1.27E+02	1.75E-09	2.05E-08	2.0E+00	4.1E-08	3.14E-06	6.14E-09	5.7E-01	3.5E-09
		Cumulative Risk:						4E-08				4E-09

Demolition Scenario Hazard Index Calculations - Tunnel Water
NAO Flint Operations Site - Flint, Michigan

				NAPL Dermal Contact					NAPL Vapor Inhalation			
Chem Group	Chemical	CASRN	Cancer Class	C_{NAPL} (mg/L)	DA (L/cm^2)	ADD (mg/kg/d)	Subchronic RfD_{derm} (mg/kg/d)	HQ	$C_{air, worker}$ (mg/m^3)	C_{air} (mg/m^3)	Subchronic RfC (mg/m^3)	HQ
VOC	1,1-Dichloroethane	75-34-3	C	3.30E-03	2.99E-04	6.38E-06	1.0E+00	6.4E-06	2.29E-04	3.13E-05	5.0E+00	6.3E-06
SVOC	Benzo(a)anthracene	56-55-3	B2	2.09E-01					5.21E-12	7.13E-13		
SVOC	Chrysene	218-01-9	B2	2.71E-01	5.32E-09	9.32E-09			2.47E-13	3.39E-14		
SVOC	Naphthalene	91-20-3	C	3.53E-01	6.77E-05	1.54E-04	2.0E-02	7.7E-03	7.85E-06	1.07E-06	3.0E-03	3.6E-04
SVOC	Pyrene	129-00-0	D	1.15E-01	9.95E-09	7.39E-09	3.0E-01	2.5E-08	8.22E-11	1.13E-11	1.1E-01	1.1E-10
P/PCB	PCBs (total)	1336-36-3	B2	1.27E+02	1.75E-09	1.43E-06	5.0E-05	2.9E-02	3.14E-06	4.30E-07	7.0E-05	6.1E-03
		Cumulative Risk:						4E-02				7E-03