HEALTH CONSULTATION

MILL STREET PLANT BROWNFIELD REDEVELOPMENT ASSESSMENT

CITY OF ECORSE, WAYNE COUNTY, MICHIGAN

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Prepared by

The Michigan Department of Community Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Abbreviations and Acronyms

ACM	asbestos containing material
AISL	Acute Inhalation Toxicity Screening Level
ATSDR	Agency for Toxic Substances and Disease Registry
Csat	Soil Saturation (Screening Level)
DCC	Direct Contact Criteria
DWC	Drinking Water Criteria
DWPC	Drinking Water Protection Criteria
GCC	Groundwater Contact Criteria
GSI	Groundwater/Surface Water Interface Criteria
GSIPC	Groundwater/Surface Water Interface Protection Criteria
GVIIC	Groundwater Volatilization to Indoor Air Inhalation Criteria
kg	kilogram
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
mg	milligram
MRL	Minimal Risk Level
NESHAP	National Emissions Standards for Hazardous Air Pollutants
PCBs	polychlorinated biphenyls
ppb	parts per billion
ppm	parts per million
PSIC	Particulate Soil Inhalation Criteria
RfD	Reference Dose
SVIIC	Soil Volatilization to Indoor Air Inhalation Criteria
SVOC	semivolatile organic compound
VOC	volatile organic compound
VSIC	Volatile Soil Inhalation Criteria

Foreword

The federal Agency for Toxic Substances and Disease Registry and the Michigan Department of Community Health (MDCH) have a cooperative agreement for conducting assessments and consultations regarding potential health hazards at toxic chemical contamination sites within the State of Michigan. The Michigan Department of Environmental Quality (MDEQ), Superfund Section, has asked the MDCH to evaluate any health risks associated with several properties included in the Brownfield Projects throughout Michigan.

The U.S. Environmental Protection Agency defines Brownfields as "abandoned, idled, or under-used" industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination. Local governmental entities have asked the MDEQ to conduct environmental assessments of the Brownfield properties in their jurisdiction. The MDEQ has consulted with the MDCH concerning public health aspects of these assessments.

The MDCH health consultation for a Brownfield property includes consideration of the following fundamental questions:

- Are there any imminent or urgent threats to public health associated with the property?
- Does the proposed future use of the property pose any long-term public health hazard?
- What specific actions, if any, are necessary to make the property safe for future use?
- Is there enough information available to answer these questions, and if not, what additional information is needed?

The conclusions and recommendations provided in an MDCH health consultation pertain only to human health hazards identified for the property under review given the intended future land use. An MDCH health consultation may not be used to demonstrate compliance with the requirements of the Michigan Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, or the administrative rules promulgated there under.

Summary

The Michigan Department of Environmental Quality (MDEQ) asked the state Department of Community Health (MDCH) to write a health consultation for the Mill Street Plant Brownfield site in Ecorse, Wayne County, Michigan. The property is a former steel mill and slated to be developed into a mixed residential/commercial neighborhood. The physical hazards on the property pose a public health hazard. The City of Ecorse should take steps to ensure that these hazards are removed or secured. (The City already has begun taking these measures.) Although there is environmental contamination on the site, it poses no apparent *current* public health hazard, based on minimal exposure expected. However, if the site is developed as planned, construction workers, neighbors, and future residents could be exposed to the chemicals present. Therefore, the site poses an indeterminate *future* public health hazard until the contamination is more fully characterized and addressed.

Purpose and Health Issues

The purpose of this public health consultation is to evaluate the health risks associated with the Mill Street Plant Brownfield and communicate those risks to the Michigan Department of Environmental Quality (MDEQ), local health and City of Ecorse officials so that appropriately protective measures may be taken during the redevelopment of the property. The MDEQ requested this health consultation from the Michigan Department of Community Health (MDCH). The evaluation considers current neighbors of the site, who might be exposed to environmental contamination on- or off-site, as well as workers employed during redevelopment and future users of the property. The questions listed in the Foreword section of this document will be addressed in the Conclusion section.

Background

The MDEQ requested assistance from MDCH regarding the public health implications of environmental contamination at the Mill Street Plant site in Ecorse, Wayne County, Michigan (Figure 1). The 58-acre property is a former steel mill, owned first by Michigan Steel Corporation, then by Great Lakes Steel Corporation (a division of National Steel Corporation). It was built in 1923 and in operation until the 1960s. The property is located in a mixed residential/commercial neighborhood. The City of Ecorse plans to redevelop the site to an office complex and subdivision, with up to 300 new homes (MDEQ 2004b, Alley 2004).

The MDEQ conducted property reconnaissance on April 13, 2004 to gather information to be used in the development of a sampling plan for the redevelopment assessment. Figure 2 shows the layout of buildings on the site. Other structures include aboveground storage tanks, a pump house, electrical transformers, and a scale house (MDEQ 2004b). Physical hazards noted by the reconnaissance team, and later by MDCH, are discussed later in this document.

On May 25, 2004, two staff persons from MDCH assisted the MDEQ in environmental sampling at the site. Figures 3-5 indicate sampling locations. Field staff took 30 surficial (0-10" depth) and 25 subsurface (0-12' borings) soil samples. They also installed eight

temporary monitoring wells and took samples from six of these (low-flow collection technique). (Two wells would not produce enough water for sampling.) Samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total metals including cyanide, pesticides, and polychlorinated biphenyls (PCBs). Analytical results (Tables 1-3) are discussed in the next section.

Discussion

Environmental Contamination

The sampling results discussed in this consultation are not adjusted for limitations or bias in the sampling plan. The tables presented provide concentration ranges for chemicals of interest detected in the samples collected. Because the sampling design itself was biased (sampling locations chosen based on likelihood of contamination present) and not random, it is inappropriate to apply statistical analyses (averaging, calculating upper confidence levels) to the results.

Chemicals of interest for this consultation were those that were detected in any environmental medium sampled at the property at a concentration above MDEQ Generic Cleanup Criteria (MDEQ 2002). (For a complete list of chemicals tested for and detected at this site, as well as those chemicals that exceeded criteria, refer to Appendix A.) The MDEQ criteria are contaminant levels in environmental media that are developed to be protective of human exposure and the environment under specific land-use scenarios. Chemicals present at concentrations less than these conservative levels are not expected to pose a public health hazard. Concentrations that exceed these levels warrant further evaluation of exposure pathways and toxicity to determine if a public health hazard is likely. Appendix B provides brief descriptions of all of the MDEQ criteria as well as land-use definitions.

Under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR), MDCH conducts public health assessments at sites of environmental contamination in Michigan. ATSDR has established Comparison Values that health assessors can use when evaluating a site. For purposes of this document, MDCH used the MDEQ criteria for initial screening of chemicals of interest, then used the ATSDR Comparison Values for further evaluation.

For this consultation, all MDEQ criteria except the Drinking Water Criteria (DWC) and Drinking Water Protection Criteria (DWPC), for all land uses, were considered. MDCH excluded the DWC and DWPC from consideration because the Ecorse area receives its water supply from the Detroit Water System, which obtains its water from the Detroit River and Lake Huron, is protected under Michigan law as sources of potable drinking water. Persons looking to install wells, usually for irrigation purposes, must meet permit conditions. According to the county health department, there are no known private drinking water wells nor are there any Type II water supplies (e.g., schools, churches) receiving their water from wells (2004, M. Kobylarz, Wayne County Health Department, personal communication).

The Groundwater Surface Water Interface (GSI) criteria for groundwater and soil are applicable to this site because the property borders the Ecorse River to the south, which empties into the Detroit River, less than one-half mile to the east. (The GSI Protection Criteria, or GSIPC, apply to soil concentrations but the concern is contamination of surface water.) As mentioned previously, the Ecorse area receives its drinking water through the Detroit Water System, which obtains the water from the Detroit River and Lake Huron. Several chemicals of interest are regulated in public water supplies. These are noted in the appropriate sections below.

MDEQ criteria are not available for the following detected compounds: calcium, endrin aldehyde, endrin ketone, iodomethane, 4-nitroaniline, potassium, and trans-1,4-dichloro-2-butene. ATSDR develops screening levels, called Minimal Risk Levels (MRLs), for compounds most commonly found at National Priority List ("Superfund") sites, but the chemicals above are not on that list. Therefore, these chemicals are evaluated further in the Human Exposure Pathways and Toxicological Evaluation sections of this document.

Criteria Exceeded

Tables 1-3 show the chemicals for which at least one criterion was exceeded in groundwater, surficial soil, or subsurface soil samples. Groundwater samples exceeded only the Groundwater/Surface Water Interface (GSI) criteria, when exceedances occurred. Surficial soil samples exceeded the Groundwater/Surface Water Interface Protection Criteria (GSIPC), the Residential and Industrial/Commercial Particulate Soil Inhalation Criteria (PSICs), and all Direct Contact Criteria (DCCs), when exceedances occurred. Subsurface soil samples exceeded the same criteria as did surficial samples except for Industrial/Commercial II DCCs, when exceedances occurred. These exceedances are discussed further by chemical group.

VOCs Exceeding Criteria

No VOCs exceeding MDEQ criteria were detected in groundwater or sursurface soil samples. Xylenes were detected above criteria in one surficial soil sample.

SVOCs Exceeding Criteria

No SVOCs exceeding MDEQ criteria were detected in groundwater samples. The following chemicals were detected above criteria in surficial soil samples: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, carbazole, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, naphthalene, and phenanthrene. The following chemicals were detected above criteria in subsurface soils: acenaphthene, benzo(a)pyrene, carbazole, dibenzofuran, fluoranthene, and phenanthrene.

The SVOCs mentioned above are part of a group of chemicals called polycyclic aromatic hydrocarbons (PAHs). There are over 100 different PAHs. These chemicals are commonly found in soot, as they as formed during incomplete combustion of materials such as coal, oil, and gas (ATSDR 1995). Therefore, it is not uncommon for PAHs to be found around smelters and steel mills. Many of the surficial soil sample descriptions provided by MDEQ described the soil as containing slag (the waste from the smelting

process, which can include soot). It is likely that there are areas on the site where slag was piled, causing high concentrations of PAHs to accumulate.

Metals Exceeding Criteria

The following metals were detected above criteria in groundwater samples: antimony, chromium, copper, lead, selenium, silver, vanadium, and zinc. The following metals were detected above criteria in surficial soil samples: arsenic, barium, cadmium, chromium, cobalt, copper, cyanide, iron, lead, manganese, total mercury, nickel, selenium, silver, vanadium, and zinc. The following metals were detected above criteria in subsurface soil samples: arsenic, cadmium, chromium, cobalt, copper, cyanide, lead, manganese, total mercury, nickel, selenium, vanadium, and zinc.

Pesticides and PCBs Exceeding Criteria

No pesticides or PCBs exceeding MDEQ criteria were detected in groundwater samples. Lindane was detected above criteria in at least one sample each of surficial and subsurface soil samples.

Chemicals without MDEQ Criteria

Calcium was found in all samples as well as in the field blank and pump blank for the groundwater samples. (The Field Blank is a sample of deionized water poured into the sampling bottle at the site to check for cross-contamination during sample collection, preservation, and shipment, as well as in the lab. The Field Blank also checks cleanliness of the sampling bottle. The Pump Blank is taken by running deionized water through the polyethylene tubing through which the groundwater sample is then collected. These blanks are used for Quality Assurance/Quality Control procedures.)

Endrin aldehyde, a pesticide metabolite, was not detected in groundwater samples but was detected in one sample each of surficial and subsurface soils (at different sampling locations).

Endrin ketone, a pesticide degradant, was not detected in groundwater samples but was detected in eight surficial and one subsurface soil samples.

Iodomethane, a VOC, was not detected in groundwater samples but was detected in five surficial and 11 subsurface soil samples.

4-Nitroaniline, an SVOC, was not detected in groundwater samples but was detected in five surficial and one subsurface soil samples.

Similar to calcium, potassium was found in all samples as well as in the field and pump blanks for the groundwater samples.

trans-1,4-Dichloro-2-butene, a VOC, was not detected in groundwater or subsurface soil samples. It was detected in one surficial soil sample.

Asbestos

Brownfield assessments normally include evaluating the premises for the presence of asbestos containing materials (ACM). For this site, the MDEQ reconnaissance team estimated, based on a visual inspection, that there was greater than 260 linear feet of ACM on-site. This is the threshold for applying the National Emissions Standards for Hazardous Air Pollutants (NESHAP) guidelines (MDEQ 2004), meaning that removal of the ACM will automatically occur. Therefore, no asbestos samples were taken.

Physical Hazards

During property reconnaissance and environmental sampling, MDEQ and MDCH photo-documented various areas of the property, including areas that could pose a physical hazard. Although locked chain-link fencing surrounds the property, it was apparent that people had access to the grounds. There were graffiti-painted walls, broken glass, and scattered trash throughout the main building area. The buildings are not closed (Figure 6) and contain a number of potential hazards.

Inside the main building, MDCH staff saw gas cylinders, possibly acetylene and oxygen tanks, some of which were not chained to the walls (Figure 7). If these cylinders are not empty, they pose an explosion hazard should someone open a valve and light the gas or if the cylinders are knocked over and the valve is knocked off, causing a sudden release of pressure.

There were several open shallow pits in the main building and outside (Figure 8). These pits were not more than about two feet deep. While a child or adult should not become trapped should they fall into one, there is a risk of injury if a person were to step into the hole while running, not paying attention, or in the dark.

There were numerous piles of chemical containers, paper and cardboard refuse, and records from the former steel plant. Several of the chemical containers were labeled as flammable liquids (Figure 9). While a fire hazard might be of little concern (there is little building structure that would burn), there is concern that a trespasser might start a fire using the chemicals or that, if the trespasser were to start a fire with the paper and cardboard refuse, nearby chemical containers could rupture or explode, releasing not only flammable liquid but potentially toxic fumes. There are residential areas immediately outside the perimeter of the property. Nearby residents could be exposed to chemical fumes released in a fire.

One of the chemical containers had leaked onto the floor, possibly recently (Figure 10). It is not known what chemical had leaked, however several cardboard boxes near the apparent source were labeled as containing flammable liquids. If the chemical were a flammable liquid, the spill would increase the risk of a fire. Direct contact with the unknown chemical could cause acute dermal effects (irritation, burning, blistering).

There are several skywalks between or next to buildings on the site (Figure 11). While it did not appear that trespassers had climbed on these skywalks, the temptation exists as does the access. As well, there are catwalks and upper levels within the main building

that are likely accessible. Since the building has not been maintained for several decades, it is likely that these structures are in some state of disrepair and could collapse if someone were to walk or run on them.

Adequacy of Site Characterization

During its reconnaissance visit, MDEQ documented several storage areas that were labeled as having, or appeared to be holding, containers of PCBs. Although no soil samples contained PCBs above criteria, MDEQ did not sample inside of buildings or storage areas. Further sampling near these areas is warranted to determine levels of potential contamination.

The floor of the main building at this site appears to be a mixture of dirt and cobblestone. Railroad tracks come into the building at several entrances. It is possible that there were open drains in the floor or that spills occurred within the plant during operation. Therefore, the soil beneath the building itself may have levels of chemicals above MDEQ criteria. Once all of the buildings are demolished and removed, the City of Ecorse should analyze surficial and subsurface soil samples from these areas. The sampling design should take into consideration that about 300 new homes are to be built on the property. Therefore, a sampling grid based on expected individual lot size is recommended. As an alternate to further sampling, the City of Ecorse can replace contaminated topsoil, at a depth agreeable to MDEQ, with clean fill and place deed restrictions on the residential properties (for example, no excavations for swimming pools, landscaping, or decks).

There are open areas on this 58-acre site that appear to have been bulldozed in the past. This could be an indication of buried waste or drums. There is no record of an electro-magnetic survey having been performed on the property. To ensure the safety of construction and utility workers, as well as that of current neighbors and future homeowners, an electro-magnetic survey should be conducted and any findings fully investigated.

Human Exposure Pathways

To determine whether persons are, have been, or are likely to be exposed to contaminants, MDCH evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements: (1) a source of contamination, (2) contaminant transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. An exposure pathway is considered complete if there is evidence that all five of these elements are, have been, or will be present at the property. It is considered either a potential or an incomplete pathway if there is no evidence that at least one of the elements above are, have been, or will be present at the property, or that there is a lower probability of exposure. The exposure pathway elements for this site are shown in the following table:

Source	Environ-mental Transport and Media	Chemicals of Concern	Exposure Point	Exposure Route	Exposed Population	Time	Status
Former operations at Mill Street Plant	Ground-water	Table 1	Drinking water (Detroit River)	Ingestion	Users of Detroit City Water	Past	Potential
						Present	Incomplete
						Future	Incomplete
	Ground-water	Table 1	Excavations, utility pipes	Dermal, incidental ingestion	Construction or utility workers, future residents	Past	Potential
						Present	Complete
						Future	Complete
	Soils (surficial and subsurface)	Tables 2 and 3	Drinking water (Detroit River)	Ingestion, inhalation, dermal contact	Users of Detroit City Water	Past	Potential
						Present	Incomplete
						Future	Incomplete
	Soils (surficial and subsurface)	Tables 2 and 3	On-site soils, including excavations	Dermal, incidental ingestion	Construction or utility workers, future residents, trespassers	Past	Potential
						Present	Potential
						Future	Potential
Future de-molition activities at Mill Street Plant	Soils (airborne dusts)	Tables 2 and 3	Indoor and outdoor air	Inhalation	Construction or utility workers, future residents, neighbors	Past	Incomplete
						Present	Incomplete
						Future	Potential
	Outdoor air	Asbestos	Indoor and outdoor air	Inhalation	Demolition workers, neighbors	Past	Incomplete
						Present	Incomplete
						Future	Potential
Chemicals stored on-site	Direct contact	"Flammable Liquid" free product	Open container, spill	Dermal, inhalation	Trespassers	Past	Incomplete
						Present	Potential
						Future	Potential
	Outdoor air	"Flammable Liquid" combustion products	Outdoor air	Inhalation	Trespassers, neighbors	Past	Incomplete
						Present	Potential
						Future	Potential
Cylinders stored on-site	Indoor air (main building)	Explosion potential, sudden release of pressure	Outdoor air	Inhalation, direct contact	Trespassers	Past	Incomplete
						Present	Potential
						Future	Potential

The steel plant on this site started operations in the 1920s, well before the passage of the Clean Water Act and the Safe Drinking Water Act in the 1970s. It is possible that contamination of water supplies occurred before regulations and treatment systems took effect. However, this information is not available. Therefore, MDCH considers past exposure to contaminated groundwater as "potential."

VOCs

There was one occurrence of **xylenes** exceeding an MDEQ criteria, the GSIPC, at the Mill Street Plant site. As mentioned earlier in this document, the GSIPC applies to soil but the concern is surface water. Groundwater at the site discharges to the Detroit River, a public drinking water source. The U.S. Environmental Protection Agency (EPA) regulates the amount of xylenes allowable in public drinking water supplies in the National Primary Drinking Water Regulations (EPA 2002). Therefore, since excess exposure is not expected to occur, there should be no adverse health effects associated with the xylenes found at this site.

SVOCs

Acenaphthene, carbazole, dibenzofuran, fluoranthene, fluorene, naphthalene, and phenanthrene exceeded only their respective GSIPCs. The EPA regulates PAHs in drinking water (EPA 2002). Therefore, since excess exposure is not expected to occur via drinking water, there should be no adverse health effects associated with these chemicals found at this site.

Benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene exceeded their respective Residential/Commercial I DCCs (all at the same sampling location, SS-11, plus SS-18 for dibenzo(a,h)anthracene). These were surficial samples; there were no exceedances in the subsurface samples. There was a maximum of eight DCC exceedances for **benzo(a)pyrene** in surficial samples. (Only one subsurface soil sample out of 25 exceeded the Residential/Commercial I DCC, indicating that subsurface soil concentrations of benzo(a)pyrene are not of concern.)

It is not likely that people who currently access the site are being exposed to elevated PAH levels in the surficial soils for a duration that would result in adverse health effects. The City of Ecorse should practice due care during the future redevelopment of the property to prevent future exposure to and, therefore, any adverse health effects associated with these chemicals at this site.

Metals

Antimony, barium, cadmium, cobalt, copper, cyanide, mercury, nickel, selenium**,** silver, vanadium , and zinc exceeded only their respective GSIs or GSIPCs. **Antimony, barium, cadmium, copper, cyanide, mercury,** and **selenium** are regulated in public drinking water supplies by the EPA (EPA 2002). Therefore, since excess exposure is not expected to occur via drinking water, there should be no adverse health effects associated with these chemicals found at this site. The EPA does not regulate cobalt, nickel, silver, vanadium, and zinc in public drinking water.

The MDEQ GSI for **cobalt** is protective of aquatic life (water fleas), the most protective value for this chemical. There are insufficient data to derive a noncancer human drinking water value (MDEQ 2004a). Eight surficial and 11 subsurface soil samples exceeded the GSIPC (defaulted to background) by up to one order of magnitude (10 times). However, the groundwater samples were all nearly two orders of magnitude (nearly 100 times) less than the GSI, suggesting that soil levels of cobalt were not breaching the groundwater-

surface water interface and should not enter the drinking water supply. Therefore, based on no expected excess exposure, no adverse health effects would be expected.

There was only one GSIPC exceedance each for **nickel** out of 25 subsurface soil samples and 30 surficial soil samples. The groundwater-surface water interface at this site would occur in the subsurface soil. It is unlikely, based on only one exceedance, that the nickel in the soil at this site is impacting the groundwater-surface water interface. Indeed, there were no exceedances of the GSI for nickel, but there was contamination in the field and pump blanks, confounding the results. The MDEQ GSI for nickel is based on the protection of aquatic life. The noncancer human drinking water value for nickel is 2,600 ppb (MDEQ 2004a), well above the highest concentration found in groundwater samples at this site. Therefore, based on no expected excess exposure, no adverse health effects would be expected.

There were only two GSIPC exceedances for **silver** out of 30 surficial soil samples, with the greater exceedance only half an order of magnitude greater than the criterion (defaulted to background). There were no subsurface soil exceedances. Two groundwater samples exceeded the GSI, but there was contamination in the field and pump blanks, confounding the results. The MDEQ GSI for silver is based on the protection of aquatic life and is set at the minimum detection level that current analytical instruments have for this element (0.2 ppb). The noncancer human drinking water value for silver is 130 ppb (MDEQ 2004a), well above any concentrations found in groundwater samples at this site. Therefore, based on no expected excess exposure, no adverse health effects would be expected.

There was only one GSIPC exceedance for **vanadium** out of 25 subsurface soil samples and 6 exceedances out of 30 surficial soil samples. The groundwater-surface water interface at this site would occur in the subsurface soil. It is unlikely, based on only one exceedance, that the vanadium in the soil at this site is impacting the groundwater-surface water interface. However, four groundwater samples did exceed the GSI, but there was contamination in the field and pump blanks, confounding the results. As well, the MDEQ GSI for vanadium is based on the protection of aquatic life. The noncancer human drinking water value for vanadium is 220 ppb (MDEQ 2004a), well above the highest concentration found in groundwater samples at this site. Therefore, based on no expected excess exposure, no adverse health effects would be expected.

There were six GSIPC exceedances for **zinc** out of 25 subsurface soil samples and 22 exceedances out of 30 surficial samples. There were no exceedances of the GSI for zinc, suggesting that soil levels of zinc were not breaching the groundwater-surface water interface and should not enter the drinking water supply. Therefore, based on no expected excess exposure, no adverse health effects would be expected.

There were four Residential/Commercial I DCC exceedances each of subsurface and surficial soil samples for **arsenic**. (None of the subsurface sampling exceedances correlated in location with the surficial exceedances. There were no groundwater exceedances.) It is not likely that people who currently access the site are being exposed

to elevated arsenic levels for a duration that would result in adverse health effects. If future homeowners were to excavate the soil on their property (for example, placing footings to support a deck or digging a pool), they likely would not be exposed to elevated arsenic levels in the subsurface soils for a duration that would result in adverse health effects. The ATSDR Comparison Value for chronic exposure to arsenic in soil is 20 parts per million (ppm) for a child and 200 ppm for an adult. These values are less conservative than the MDEQ with only one soil sample, a subsurface sample, exceeding the child value. The City of Ecorse should err on the more protective side and practice due care during the future redevelopment of the property to prevent future exposure to arsenic at this site.

Groundwater concentrations of **chromium** at the Mill Street Plant site exceeded only the GSI criterion. Chromium is regulated in public drinking water supplies (EPA 2002). As discussed earlier in this section, there should be no adverse health effects associated with the chromium in the groundwater at this site.

Chromium concentrations in surficial and subsurface soil samples at this site exceeded the GSIPC and Residential and Industrial/Commercial PSICs for this chemical. As discussed earlier, the GSIPC exceedances are not of concern. However, the exceedances of the PSICs are of concern because the criteria address "ambient air concentrations of contaminated particulates that would cause adverse human health effects via inhalation" (see Appendix B) and airborne chromium (VI) is carcinogenic (ATSDR 2000). It is not known what form(s) of chromium exists in the soil at the Mill Street Plant site. It is possible that the levels of chromium (VI) present fall below the PSIC specific for that valence. (Tables 1-3 show the most protective criteria for chromium, those for the (VI) valence.) The City of Ecorse should practice due care during the future redevelopment of the property to prevent future exposure to and, therefore, any adverse health effects associated with chromium at this site. Redevelopment of the Mill Street Plant site should include dust control during redevelopment activities, to prevent any contaminated dusts from becoming airborne, and removal of the surficial soils, replacing with clean fill.

There were no exceedances of MDEQ criteria for **iron** in the groundwater and subsurface soil samples. However, there were eight exceedances of the Residential/Commercial I DCC, although by less than an order of magnitude (less than 10 times than the criterion), out of the 30 surficial soil samples. Future redevelopment of the Mill Street Plant site should include removal of the surficial soils, replacing with clean fill, as a precautionary measure.

Groundwater concentrations of **lead** at the Mill Street Plant site exceeded only the GSI criterion. Lead is regulated in public drinking water supplies (EPA 2002). As discussed earlier in this section, there should be no adverse health effects associated with the lead in the groundwater at this site.

Lead concentrations in surficial and subsurface soils at this site exceeded the GSIPC and all DCCs for the chemical. As discussed earlier, the GSIPC exceedance is not of concern. Only one subsurface soil sample out of 25 exceeded the DCCs, indicating that

subsurface levels of lead are not of concern. Up to five surficial samples exceeded the DCCs for lead (dependent on land use), the highest concentration being almost one order of magnitude higher than the Residential/Commercial I criterion (3,110 ppm compared to 400 ppm). It is not likely that people who currently access the site are being exposed to elevated lead levels for a duration that would result in adverse health effects. However, these exceedances are of serious concern for the proposed future residential use of this site. The City of Ecorse should practice due care during the redevelopment of the property to prevent future exposure to and, therefore, any adverse health effects associated with lead at this site. Redevelopment of the Mill Street Plant site should include removal of contaminated surficial soils, replacing with clean fill.

There were no exceedances of MDEQ criteria for **manganese** in the groundwater samples. However, there were exceedances of the GSIPC, Residential and Industrial/Commercial PSICs, and the Residential/Commercial I DCC in both subsurface and surficial soil samples. The data do not indicate that the groundwater/surface water interface has been breached. Therefore, because exposure via drinking water is not expected to occur, the GSIPC exceedances are not of concern. Only one subsurface soil sample out of 25 exceeded the DCCs, indicating that subsurface levels of manganese are not of concern. The magnitude of the Residential/Commercial I DCC exceedances in the surficial soil was not great (no more than 20 percent greater than the criterion). The exposure concern regarding this chemical stems from the PSIC exceedances. The City of Ecorse should practice due care during the future redevelopment of the property to prevent future exposure to and, therefore, any adverse health effects associated with manganese at this site. Similar to the case with chromium, future redevelopment of the Mill Street Plant site should include dust control during redevelopment activities, to prevent any contaminated dusts from becoming airborne, and removal of the surficial soils, replacing with clean fill.

Pesticides and PCBs

Lindane was not detected in the groundwater samples but was detected in surficial and subsurface soil samples, with no more than two GSIPC exceedances. The EPA regulates lindane in drinking water (EPA 2002). Therefore, since excess exposure is not expected to occur via drinking water, there should be no adverse health effects associated with lindane found at this site.

Toxicological Evaluation

If a person is not exposed to a chemical, the chemical cannot have a toxic effect on that person. If the Mill Street Plant site is not remediated and construction workers, neighbors, or future residents are exposed on a regular basis to the high levels of benzo(a)pyrene and other PAHs [benzo(a)anthracene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene], arsenic, chromium, lead, and manganese found in the soils, they could be at risk of developing adverse health effects. Potential health effects are discussed below.

Benzo(a)pyrene and Other PAHs

Skin contact with PAHs may cause irritation and sensitization to sunlight. Prolonged dermal contact with or inhalation of PAHs is associated with some forms of cancer (ATSDR 1995a).

ATSDR develops Minimal Risk Levels (MRLs) for chemicals most often found at hazardous waste sites. (An MRL is a concentration received for a specific time by a specific route that is not expected to result in adverse health effects.) However, there are no MRLs available for benzo(a)pyrene and other PAHs found above the MDEQ criteria at the Mill Street Plant site. The highest concentration of benzo(a)pyrene found in surficial soils (35.9 ppm) exceeds the MDEQ residential Direct Contact Criteria (DCC) more than 15-fold. The other PAHs with exceedances are only marginally above their respective DCCs in comparison. However, the combination of all PAHs might increase the risk of adverse health effects in persons who have regular exposure to them. Additionally, because this site needs further characterization once the buildings are removed, there might be areas with higher concentrations.

Arsenic

Arsenic is a naturally occurring element. Organic forms of arsenic have been used in pesticides. The most common, and recently suspended, use of inorganic arsenic was as a wood preservative (CCA-treated lumber). Arsenic is a known human carcinogen. Noncancer effects following excess oral exposure include discoloration and keratinization (thickening) of the skin, a "pins and needles" sensation in the extremities, and cardiovascular effects (ATSDR 2000a).

The MRL for chronic oral exposure to arsenic is 0.0003 mg/kg/day (ATSDR 2000a). The MRL for a 10-kg child is therefore 0.003 mg/day. If a 10-kg child were to consume 200 mg/day of soil contaminated with the highest level of arsenic found at this site in a surficial soil sample (19.5 ppm), the child's intake of arsenic would be 0.004 mg/day. This is a minor exceedance of the MRL and would not likely result in adverse health effects. However, as discussed earlier, the Mill Street Plant site has not been adequately characterized. There might be higher concentrations of arsenic in soil that will be exposed once demolition is complete.

Chromium

Chromium is a naturally occurring element and is usually found in three forms: elemental (valence state of 0), chromium (III), and chromium (VI). The elemental form is used in making steel whereas uses for the other valences include chrome plating and, formerly, as a wood preservative (CCA-treated lumber). Chromium (III) is an essential nutrient. The valence state of primary health concern is chromium (VI). It is considered a human carcinogen when in air. Breathing high levels of chromium (VI) can negatively affect the nasal passages. Chromium (VI) can cause gastrointestinal, liver, and kidney damage when ingested in large amounts, and dermal contact can cause skin ulcers (ATSDR 2000b).

There are no MRLs for trivalent or hexavalent chromium. Almost half of the surficial soil samples exceeds the MDEQ Particulate Soil Inhalation Criteria (PSIC) for hexavalent chromium for both residential and industrial settings. The residential and industrial PSICs for trivalent chromium are 330,000 ppm and 150,000 ppm, respectively. None of the samples exceed those values. It is unknown what proportion of each soil sample is in the hexavalent form. Until that information is available, public health implications cannot be determined. Also, the site needs further characterization once the buildings are removed to determine chromium levels in soils currently unexposed.

Lead

Lead is a naturally occurring element, but most of the lead in the environment comes from human activities, such as mining, burning leaded gasoline, and production of metal products. Lead is well-known for its neurotoxic effects on children and, for this reason, is no longer used in gasoline or housepaint. Exposure to lead can also damage the kidneys and reproductive system (ATSDR 1999).

There is no MRL for lead. The highest concentration of lead found in surficial soils at this site (3,110 ppm) is nearly one order of magnitude (10 times) greater than the MDEQ residential DCC. The magnitude of this exceedance suggests that there may be a risk of adverse health effects if a person, especially a child, is exposed regularly to the contaminated soil. Additionally, as-yet uncharacterized soils might contain concentrations of lead higher than already found.

Manganese

Manganese occurs naturally, though not in its pure form, and is an essential trace element. Manganese can enter the air from steel plants. Exposure to high concentrations of manganese in the air can cause respiratory problems, sexual dysfunction, and a nervous condition called "manganism," characterized by negative effects on motor skills and balance (ATSDR 2000).

There is no MRL for manganese. The highest concentration of manganese found (30,500 ppm in a surficial soil sample) does not greatly exceed the MDEQ residential DCC. However, the MDEQ residential and industrial PSICs were exceeded by almost an order of magnitude. The magnitude of this exceedance and the number of exceedances suggest that there may be a risk of adverse health effects if a person is exposed to site-related airborne manganese. Additionally, as-yet uncharacterized soils might contain concentrations of manganese higher than already found.

Chemicals without MDEQ Criteria

Calcium is a naturally occurring essential nutrient and is well known for its role in developing strong bones. It is also important for blood clotting, muscle contraction, and nerve transmission. Adverse effects of excessive consumption of dietary calcium include hypercalcemia (excessive calcium in the serum) and kidney stones. An adequate intake of dietary calcium for the average adult is 1,000-1,200 mg/day. For children over the age of 1 year, the range is 500-1,300 mg/day. The suggested upper limit for all persons is 2,500 mg/day (Institute of Medicine 1997). If a child were to consume 200 mg of soil

per day (the default assumption, which is less than 1/8 teaspoon) at the highest concentration of calcium found, 194,000 ppm, the child's daily intake of calcium from soil would equal 38,800 mg, well above the suggested upper dietary intake. The method used to determine calcium concentrations, EPA Method 6010B, reports all calcium detected, whether that calcium is in elemental form or exists as a salt. Therefore, it is unknown in what forms the calcium in the soil exists. It is probable that some of the calcium would not be bioavailable and that the body would not absorb that fraction. It is unlikely that exposure to calcium at this site would result in adverse health effects.

Endrin aldehyde is a minor impurity found in the pesticide endrin. It is also one of the pesticide's metabolites. **Endrin ketone** is also a breakdown product of endrin. Endrin is an organochlorine pesticide, affecting primarily the nervous system. Swallowing large amounts (not likely at this site) may kill a person, but usually exposure is via inhalation or dermal contact. Symptoms of exposure include headache, confusion, vomiting, and convulsions (ATSDR 1996). There is little toxicological information for the aldehyde and ketone forms. For purposes of this health consultation, MDCH assumed that the aldehyde and ketone forms of endrin are of the same toxicity as the parent compound. None of the chemicals were detected in groundwater samples. If the concentrations at each soil sampling location, therefore, were added together, the maximum sums would be 0.0979 ppm for subsurface soils and 2.926 ppm for surficial soils, neither exceeding the criteria for endrin. Therefore, there is likely no appreciable health threat posed by the levels of these chemicals in the soil at the Mill Street Plant site.

The uses of **iodomethane** (methyl iodide) include as an etching agent for electronic circuits and a component in fire extinguishers. It has a pungent, ether-like odor. Exposure to high concentrations via inhalation can cause respiratory and nervous system problems. Skin contact with the pure product can cause irritation and blistering (HSDB 2004). The concentrations of iodomethane found in the soils at this site are quite low (less than 100 ppm or one thousandth of a percent) and should not result in high air concentrations when contaminated soil is exposed during redevelopment activities. Redevelopment of the Mill Street Plant site should include removal to some depth of the surficial soils, which would prevent any exposure to children living at the site in the future.

4-Nitroaniline's uses include as a component of pigments and dyes, a corrosion inhibitor, and a gasoline gum inhibitor. It can be generated by hazardous waste incineration. (There is a city incinerator next to the northwest corner of the site property, as depicted in Figure 2.) 4-Nitroaniline has a slight ammonia odor and a burning sweet taste. Exposure to the chemical can cause methemoglobin to form in the body, resulting in reduced oxygen being delivered to the tissues (HSDB 2004). On the basis of only one detection in subsurface soils, out of 25 samples, workers conducting redevelopment activities at the site likely will not be exposed to any appreciable levels of the chemical. Similarly, there are relatively few (five out of 30) samples of surficial soils containing the chemical. As well, removal and replacement of surficial soils during redevelopment of the site would prevent any exposure to children living there in the future.

Potassium, like calcium, is a naturally occurring essential nutrient. It is required for normal cellular function and is involved in the maintenance of blood pressure, moderating the effects of excess salt, and reducing the risk of kidney stones and bone loss. An adequate intake of dietary potassium for the average adult is 4,700 mg/day. For children over the age of 1 year, the range is 3,000-4,700 mg/day. The nutrient is readily excreted in the urine, therefore an upper limit is not suggested for healthy adults. However, in people with impaired potassium excretion, such as diabetics and kidney or heart patients, it is possible to experience hyperkalemia (increased potassium in the serum) (Institute of Medicine 2004). A child eating 200 mg of soil per day at the maximum concentration of potassium found (in surface soil), 3,330 ppm, would consume 666 mg of potassium. Since there is no upper limit suggested for the intake of dietary potassium, a healthy person would be expected to excrete any excess. However, persons with compromised kidney functions, diabetes, or taking certain heart medication might be at risk for adverse health effects, dependent on their overall intake (Institute of Medicine 2004). The same analytical method for calcium, EPA Method 6010B, was used to determine potassium concentrations. Therefore, it is not apparent what portion of the potassium detected at the Mill Street Plant was in elemental form versus a salt. It is probable that some of the potassium would not be bioavailable and that the body would not absorb that fraction.

Only one detection of **trans-1,4-dichloro-2-butene** was found at the Mill Street Plant site, in surficial soil. On the basis of this one detection, it is unlikely that there will be appreciable exposure to this chemical and therefore no adverse health effects are expected.

ATSDR Child Health Considerations

Children may be at greater risk than adults from exposure to hazardous substances at sites of environmental contamination. Children engage in activities such as playing outdoors and hand-to-mouth behaviors that could increase their intake of hazardous substances. They are shorter than most adults, and therefore breathe dust, soil, and vapors closer to the ground. Their lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. The developing body systems of children can sustain permanent damage if toxic exposures are high enough during critical growth stages. Even before birth, children are forming the body organs they need to last a lifetime. Injury during key periods of growth and development could lead to malformation of organs (teratogenesis), disruption of function, and premature death. Exposure of the mother could lead to exposure of the fetus, via the placenta, or affect the fetus because of injury or illness sustained by the mother (ATSDR 1998). The obvious implication for environmental health is that children can experience substantially greater exposures than adults to toxicants that are present in soil, water, or air.

It is evident that people have been trespassing on the Mill Street Plant property. These trespassers likely include children. Children might be more likely to investigate the various containers and cylinders and are more likely to run and play on the premises, increasing the risk of injury by exposure to chemicals and accidents.

The chemical of primary concern regarding children's health at this site is lead. It is not likely that children who currently access the site are being exposed to elevated lead levels at a duration that would result in adverse health effects. However, if the lead remains in the surficial soils after redevelopment of the property, children living at this site in the future could be at risk of lead poisoning.

Community Health Concerns

As of the date of this writing, MDCH and MDEQ are not aware of any community health concerns related to the Mill Street Plant site.

Conclusions

(The questions from the Foreword section of this document are repeated and answered here.)

- Are there any imminent or urgent threats to public health associated with the property?

No, however **the physical hazards at this site do present a public health hazard.** The site is not reliably restricted, as evidenced by the refuse and graffiti. There are piles of paper, cardboard, and chemical containers, one with evidence of a chemical spill, throughout the main building. The chemical containers are labeled as flammable liquids, creating a potential fire and fume hazard. Also, there are gas cylinders in various areas of the main building that are not secured to prevent their falling over, creating an explosion hazard. If these cylinders are not empty and contain oxygen or acetylene, there exists an explosion hazard if they are leaking or are opened and there is an ignition source. Overhead structures such as skywalks and catwalks could be in poor condition and collapse if unauthorized persons walk on them. While these threats are real and serious, they do not appear to pose an immediate threat.

- Does the proposed future use of the property pose any long-term public health hazard?

People currently accessing the site likely are not being exposed to elevated concentrations of chemicals for a duration that would result in adverse health effects. The environmental contamination at this site poses no apparent current public health hazard. However, construction workers and future residents could be exposed to concentrations of chemicals in the soils that may potentially result in adverse health effects. As well, contamination that may be in the soil under the buildings has not been assessed. There is a possibility that drums are buried on the property. Therefore, until the property is further characterized and then redeveloped in a manner that prevents exposure to

construction workers, neighbors, and future residents, **the environmental contamination at this site poses a future indeterminate public health hazard.**

- What specific actions, if any, are necessary to make the property safe for future use?

The physical hazards on the site should be secured or removed as soon as possible. The asbestos should be removed according to NESHAP guidelines. The site should be further characterized after the buildings are demolished and removed, as these buildings cover a substantial amount of acreage. An electro-magnetic survey of the property should be conducted to determine if there are buried drums.

- Is there enough information available to answer these questions, and if not, what additional information is needed?

MDCH and ATSDR consider a site with environmental contamination an "indeterminate public health hazard" when critical information is lacking (in this case, has not yet been gathered) to support a judgment regarding the level of public health hazard. It is not yet evident where the areas of contamination above MDEQ criteria are in relation to where the residential properties will be built at the Mill Street Plant site. As well, a substantial portion of the property has not yet been sampled because there are numerous and large buildings yet to be demolished and removed.

Some containers, while not labeled as containing hazardous chemicals, appeared to have been opened and possibly refilled with chemicals other than what is printed on the container's label. These containers should either be removed or properly stored.

Recommendations

►Remove or secure physical hazards immediately.

►Remove ACM according the NESHAP guidelines.

►Further characterize soils near PCB storage areas and under buildings, once demolished, and conduct an electro-magnetic survey of the site.

►Characterize soils based upon future residential use of the property and remediate (most likely by removal) surficial soil to prevent exposure to future residents.

►Prevent off-site migration of contamination (airborne dusts) during redevelopment.

<u>Public Health Action Plan</u>

1. The City of Ecorse, as owner of the Mill Street Plant property, will remove or secure the hazards described in this document. (MDCH contacted the mayor of the city on July 14, 2004 and the City has begun taking steps to ensure the safety

of the site and neighborhood: there is now a 24-hour security detail, including guard dog, in place to prevent trespassing.)

2. The City of Ecorse will choose a contractor certified to remove asbestos under NESHAP guidelines.
3. The City of Ecorse, with MDEQ oversight, will test surficial and subsurface soils in potentially affected areas and address any criteria exceedances. As well, the City, with MDEQ oversight, will conduct an electro-magnetic survey and address any buried hazards.
4. The City of Ecorse, with MDEQ oversight, will characterize soils, designing a sampling plan based on future use scenarios, and address any criteria exceedances. The City, with MDEQ oversight, then will devise and implement a plan to prevent exposure of future residents to contaminants found in surficial soils.
5. The City of Ecorse will choose a contractor who understands and agrees to the need to prevent the generation of excess dust during redevelopment.
6. The City of Ecorse, the Wayne County Health Department, MDEQ, and MDCH will make their respective documents available in hardcopy or digital format to the public.

MDCH will remain available as needed for future consultation at this site.

If any citizen has additional information or health concerns regarding this health consultation, please contact the Michigan Department of Community Health, Environmental and Occupational Epidemiology Division, at 1-800-648-6942.

concentrations that would cause adverse human health effects via inhalation. The **Residential and Commercial I Finite VSIC for 5 Meter Source Thickness - Ambient Air** applies to situations where the source thickness is 5 meters or less, regardless of the depth at which contamination is found. Similarly, the **Residential and Commercial I Finite VSIC for 2 Meter Source Thickness - Ambient Air** applies to situations where the source thickness is 2 meters or less. All three of these criteria only address long-term, systemic health effects and do not address acute health effects or physical hazards. The **Industrial and Commercial II, III, IV Infinite VSIC, VSIC for 5 Meter Source Thickness, and VSIC for 2 Meter Source Thickness – Ambient Air** are similar to their respective Residential/Commercial I counterparts, except that they apply to workplace settings.

The **Residential Particulate Soil Inhalation Criteria (PSICs) for Ambient Air** identify concentrations of chemicals in soil that are not expected to yield ambient air concentrations of contaminated particulates that would cause adverse human health effects via inhalation. If subsurface soils are not disturbed, the criteria are applicable to the top 6 inches of soil. Otherwise, the criteria apply to the entire soil column. It is assumed that there is 50 percent vegetative cover for each half-acre of an evaluated property. The criteria only address long-term, systemic health effects. The **Industrial/-Commercial PSICs for Ambient Air** are similar to the Residential/Commercial I criteria, except that they apply to workplace settings.

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Table 1. Groundwater sampling results for Mill Street Plant, Wayne County, Michigan. (All values in ppb. Bold values indicate exceedances of groundwater criteria.)

Chemical	No. detects/ No. samples[1]	Concentration Range	Field Blank	Pump Blank	GSI (no. exceedances)
Acenaphthene	0 / 6	---			19
Antimony	3 / 6	0.956 - 4.28			**2 (2)**
Arsenic	3 / 6	2.17 - 8.64			50
Barium	6 / 6	58.6 - 134	6.80	3.87	670
Benzo(a)anthracene	0 / 6	---			ID
Benzo(b)fluoranthene	0 / 6	---			ID
Benzo(a)pyrene	0 / 6	---			ID
Cadmium	2 / 6	0.186 - 0.572			2.5
Calcium	6 / 6	76,200 - 164,000	6480	6650	
Carbazole	0 / 6	---			10
Chromium [2]	6 / 6	5.17 - 129	8.93	8.95	**11 (4)**
Cobalt	6 / 6	0.368 - 3.17			100
Copper	6 / 6	4.12 - 95.9	11.1	2.83	**13 (3)**
Cyanide	1 / 6	0.0423	0.0177		5.2
Dibenzo(a,h)anthracene	0 / 6	---			ID
Dibenzofuran	0 / 6	---			5
Endrin aldehyde	0 / 6	---			
Endrin ketone	0 / 6	---			
Fluoranthene	0 / 6	---			5
Fluorene	0 / 6	---			12
Iodomethane	0 / 6	---			
Iron	6 / 6	600 - 7,960	690	45.3	NA
Lead	6 / 6	0.608 - 55.6	0.846	0.622	**14 (3)**
Lindane	0 / 6	---			0.03
Manganese	6 / 6	72.3 - 691	2.76	5.10	2,800
Mercury (Total)	0 / 6	---			0.0013
Naphthalene	0 / 6	---			13
Nickel	6 / 6	2.56 - 10.8	1.56	0.301	73
4-Nitroaniline	0 / 6	---			
Phenanthrene	0 / 6	---			5
Potassium	6 / 6	3,300 - 14,000	807	796	
Selenium	3 / 6	0.657 - 7.31			**5.0 (1)**
Silver	4 / 6	0.0794 - 2.16	0.488	0.0716	**0.2 (2)**
trans-1,4-Dichloro-2-butene	0 / 6	---			
Vanadium	6 / 6	0.389 - 84.4	0.167	1.12	**12 (4)**
Xylenes	0 / 6	---			35
Zinc	6 / 6	12.8 - 260	6.98	3.34	**170 (2)**

Acronyms:

GSI	Groundwater Surface Water Interface criteria
ID	insufficent data to calculate criterion
ppb	parts per billion

Notes:

1. One sample location had duplicate samples taken. The duplicates are counted as one sample. Only the higher concentration detected is shown.

2. Laboratory analysis did not speciate chromium. Therefore, the more health-protective values listed for chromium (VI) are used.

Table 2. Surface soil sampling results for Mill Street Plant, Wayne County, Michigan. (All values in ppm. Bold values indicate exceedances of soil criteria.)

Chemical	No. detects/ No. samples	Concentration Range	Mich Bkgd[1]	GSIPC (no. excee-dances)	Res PSIC (no. excee-dances)	Res/C1 DCC (no. excee-dances)	I/C PSIC (no. excee-dances)	I/C2 DCC (no. excee-dances)	C3 DCC (no. excee-dances)	C4 DCC (no. excee-dances)
Acenaphthene	9 / 30	0.0394 - 2.08	NA	4.4	14,000,000	41,000	6,200,000	130,000	180,000	150,000
Antimony	13 / 30	0.128 - 2.27	NA	94	13,000	180	5,900	670	730	700
Arsenic	29 / 30	0.031 - 19.5	5.8	23	720	**7.6 (4)**	910	37	46	41
Barium	30 / 30	35.5 - 1,560	75	**440 (5)**	330,000	37,000	150,000	130,000	150,000	140,000
Benzo(a)an-thracene	30 / 30	0.0466 - 46.3	NA	NLL	ID	**20 (1)**	ID	80	160	110
Benzo(b)-fluoranthene	30 / 30	0.0992 - 38.5	NA	NLL	ID	**20 (1)**	ID	80	160	110
Benzo(a)pyrene	30 / 30	0.0699 - 35.9	NA	NLL	1,500	**2 (8)**	1,900	**8 (4)**	**16 (1)**	**11 (2)**
Cadmium	30 / 30	0.105 - 87.7	1.2	**3 (8)**	1,700	550	2,200	2,100	2,100	2,100
Calcium	30 / 30	6,770 - 194,000								
Carbazole	22 / 30	0.0397 - 3.53	NA	**1.1 (3)**	ID	530	ID	2,400	3,400	2,900
Chromium[2]	30 / 30	13.1 - 1,450	18 (total)	**3.3 (30)**	**260 (14)**	2,500	**240 (14)**	9,200	10,000	9,600
Cobalt	30 / 30	1.43 - 22.2	6.8	**2 (8)**	13,000	2,600	5,900	9,000	10,000	10,000
Copper	30 / 30	9.43 - 5,650	32	**75 (10)**	130,000	20,000	59,000	73,000	79,000	76,000
Cyanide	28 / 30	0.24 - 5.4	0.39	**0.2 (28)**	250	12	250	250	250	250
Dibenzo(a,h)-anthracene	26 / 30	0.0433 - 3.35	NA	NLL	ID	**2 (2)**	ID	8	16	11
Dibenzofuran	10 / 30	0.0421 - 3.7	NA	**1.7 (3)**	ID	ID	ID	ID	ID	ID
Endrin aldehyde	1 / 30	1.19								
Endrin ketone	8 / 30	0.0133 - 1.42								
Fluoranthene	30 / 30	0.131 - 90.0	NA	**5.5 (6)**	9,300,000	46,000	4,100,000	130,000	240,000	170,000
Fluorene	10 / 30	0.0391 - 5.36	NA	**5.3 (1)**	9,300,000	27,000	4,100,000	87,000	120,000	100,000
Iodomethane	5 / 30	0.0487 - 0.0767								
Iron	30 / 30	7,130 - 408,000	12,000	NA	ID	**160,000 (8)**	ID	580,000	620,000	600,000
Lead	30 / 30	10.9 - 3,110	21	**2,500 (1)**	100,000	**400 (5)**	44,000	**900 (3)**	**400 (5)**	**400 (5)**
Lindane	2 / 30	0.0809 - 0.328	NA	**0.02 (2)**	ID	8.3	ID	42	49	45
Manganese	30 / 30	242 - 30,500	440	**56 (29)**	**3,300 (19)**	**25,000 (4)**	**1,500 (25)**	90,000	98,000	94,000
Mercury (Total)	23 / 30	0.00852 - 4.34	0.13	**0.1 (4)**	20,000	160	8,800	580	620	600
Naphthalene	16 / 30	0.0402 - 5.67	NA	**0.87 (3)**	200,000	16,000	88,000	52,000	72,000	61,000
Nickel	30 / 30	11.4 - 78.1	20	**76 (1)**	13,000	40,000	16,000	150,000	160,000	150,000
4-Nitroaniline	5 / 30	0.0422 - 7.38								

Table 2. Surface soil sampling results for Mill Street Plant, Wayne County, Michigan. (All values in ppm. Bold values indicate exceedances of soil criteria.)

Chemical	No. detects/ No. samples	Concentration Range	Mich Bkgd[1]	GSIPC (no. excee-dances)	Res PSIC (no. excee-dances)	Res/C1 DCC (no. excee-dances)	I/C PSIC (no. excee-dances)	I/C2 DCC (no. excee-dances)	C3 DCC (no. excee-dances)	C4 DCC (no. excee-dances)
Phenanthrene	30 / 30	0.0554 - 69.5	NA	**5.3 (4)**	6,700	1,600	2,900	5,200	7,200	6,100
Potassium	30 / 30	85.8 - 3,330								
Selenium	19 / 30	0.046 - 2.11	0.41	**0.4 (17)**	130,000	2,600	59,000	9,600	10,000	10,000
Silver	30 / 30	0.0293 - 1.51	1	**0.5 (2)**	6,700	2,500	2,900	9,000	9,800	9,400
trans-1,4-Dichloro-2-butene	1 / 30	0.051								
Vanadium	30 / 30	7.76 - 435.0	NA	**190 (6)**	ID	750	ID	5,500	6,200	5,900
Xylenes	8 / 30	0.1295 - 1.776	NA	**0.7 (1)**	290,000,000	150	130,000,000	150	150	150
Zinc	30 / 30	27.8 - 44,000	47	**170 (22)**	ID	170,000	ID	630,000	690,000	660,000

Acronyms:	
C3 DCC	Commercial 3 Direct Contact Criteria
C4 DCC	Commercial 4 Direct Contact Criteria
GSIPC	Groundwater Surface Water Interface Protection Criteria
I/C PSIC	Industrial/Commercial Particulate Soil Inhalation Criteria
I/C2 DCC	Industrial/Commercial 2 Direct Contact Criteria
ID	insufficient data to calculate criterion
NA	not applicable
NLL	not likely to leach
ppm	parts per million
Res PSIC	Residential Particulate Soil Inhalation Criteria
Res/C1 DCC	Residential/Commercial 1 Direct Contact Criteria

Notes:

1. If Michigan Background exceeds the generic criterion, Michigan Background is used for the comparison.
2. Laboratory analysis did not speciate chromium. Therefore, the more health-protective values listed from chromium (VI) are used.

Table 3. Subsurface soil sampling results for Mill Street Plant, Wayne County, Michigan. (All values in ppm. Bold values indicate exceedances of soil criteria.)

Chemical	No. detects/ No. samples	Concentration Range	Mich Bkgd[1]	GSIPC (no. excee-dances)	Res PSIC (no. excee-dances)	Res/C1 DCC (no. excee-dances)	I/C PSIC (no. exceedances)	I/C2 DCC (no. excee-dances)	C3 DCC (no. excee-dances)	C4 DCC (no. excee-dances)
Acenaphthene	6 / 25	0.0466 - 5.75	NA	**4.4 (1)**	14,000,000	41,000	6,200,000	130,000	180,000	150,000
Antimony	13 / 25	0.0107 - 7.49	NA	94	13,000	180	5,900	670	730	700
Arsenic	25 / 25	1.19 - 22.8	5.8	23	720	**7.6 (4)**	910	37	46	41
Barium	25 / 25	26.8 - 363.0	75	440	330,000	37,000	150,000	130,000	150,000	140,000
Benzo(a)anthra-cene	22 / 25	0.0456 - 10.8	NA	NLL	ID	20	ID	80	160	110
Benzo(b)fluo-ranthene	21 / 25	0.0424 - 6.53	NA	NLL	ID	20	ID	80	160	110
Benzo(a)pyrene	20 / 25	0.0517 - 6.09	NA	NLL	1,500	**2 (1)**	1,900	8	16	11
Cadmium	25 / 25	0.139 - 6.68	1.2	**3 (3)**	1,700	550	2,200	2,100	2,100	2,100
Calcium	25 / 25	2,360 - 138,000								
Carbazole	12 / 25	0.0427 - 3.66	NA	**1.1 (1)**	ID	530	ID	2,400	3,400	2,900
Chromium [2]	25 / 25	7.17 - 1,980	18 (total)	**3.3 (25)**	**260 (3)**	2,500	**240 (3)**	9,200	10,000	9,600
Cobalt	25 / 25	1.51 - 13.4	6.8	**2 (11)**	13,000	2,600	5,900	9,000	10,000	10,000
Copper	25 / 25	8.56 - 924.0	32	**75 (4)**	130,000	20,000	59,000	73,000	79,000	76,000
Cyanide	5 / 25	0.25 - 0.55	0.39	**0.2 (5)**	250	12	250	250	250	250
Dibenzo(a,h)-anthracene	15 / 25	0.0620 - 1.01	NA	NLL	ID	2	ID	8	16	11
Dibenzofuran	9 / 25	0.0426 - 2.72	NA	**1.7 (1)**	ID	ID	ID	ID	ID	ID
Endrin aldehyde	1 / 25	0.0357								
Endrin ketone	1 / 25	0.0303								
Fluoranthene	24 / 25	0.0431 - 19.8	NA	**5.5 (1)**	9,300,000	46,000	4,100,000	130,000	240,000	170,000
Fluorene	10 / 25	0.0451 - 3.71	NA	5.3	9,300,000	27,000	4,100,000	87,000	120,000	100,000
Iodomethane	11 / 25	0.0429 - 0.0753								
Iron	25 / 25	7,880 - 139,000	12,000	NA	ID	160,000	ID	580,000	620,000	600,000
Lead	25 / 25	7.08 - 422	21	2,500	100,000	**400 (1)**	44,000	900	**400 (1)**	**400 (1)**
Lindane	1 / 25	0.256	NA	**0.02 (1)**	ID	8.3	ID	42	49	45
Manganese	25 / 25	83.7 - 27,500	440	**56 (16)**	**3,300 (4)**	**25,000 (1)**	**1,500 (6)**	90,000	98,000	94,000
Mercury (Total)	22 / 25	0.00432 - 3.62	0.13	**0.1 (3)**	20,000	160	8,800	580	620	600
Naphthalene	12 / 25	0.0492 - 0.445	NA	0.87	200,000	16,000	88,000	52,000	72,000	61,000
Nickel	25 / 25	9.01 - 128.0	20	**76 (1)**	13,000	40,000	16,000	150,000	160,000	150,000
4-Nitroaniline	1 / 25	2.29								

Table 3. Subsurface soil sampling results for Mill Street Plant, Wayne County, Michigan. (All values in ppm. Bold values indicate exceedances of soil criteria.)

Chemical	No. detects/ No. samples	Concentration Range	Mich Bkgd[1]	GSIPC (no. excee-dances)	Res PSIC (no. excee-dances)	Res/C1 DCC (no. excee-dances)	I/C PSIC (no. exceedances)	I/C2 DCC (no. excee-dances)	C3 DCC (no. excee-dances)	C4 DCC (no. excee-dances)
Phenanthrene	22 / 25	0.0833 - 18.1	NA	**5.3 (3)**	6,700	1,600	2,900	5,200	7,200	6,100
Potassium	25 / 25	156.0 - 3,430								
Selenium	9 / 25	0.052 - 2.37	0.41	**0.4 (6)**	130,000	2,600	59,000	9,600	10,000	10,000
Silver	23 / 25	0.0182 - 0.514	1	0.5	6,700	2,500	2,900	9,000	9,800	9,400
trans-1,4-Dichloro-2-butene	0 / 25	---								
Vanadium	25 / 25	4.58 - 316.0	NA	**190 (1)**	ID	750	ID	5,500	6,200	5,900
Xylenes	2 / 25	0.1103 - 0.2566	NA	0.7	290,000,000	150	130,000,000	150	150	150
Zinc	25 / 25	24.3 - 409.0	47	**170 (6)**	ID	170,000	ID	630,000	690,000	660,000

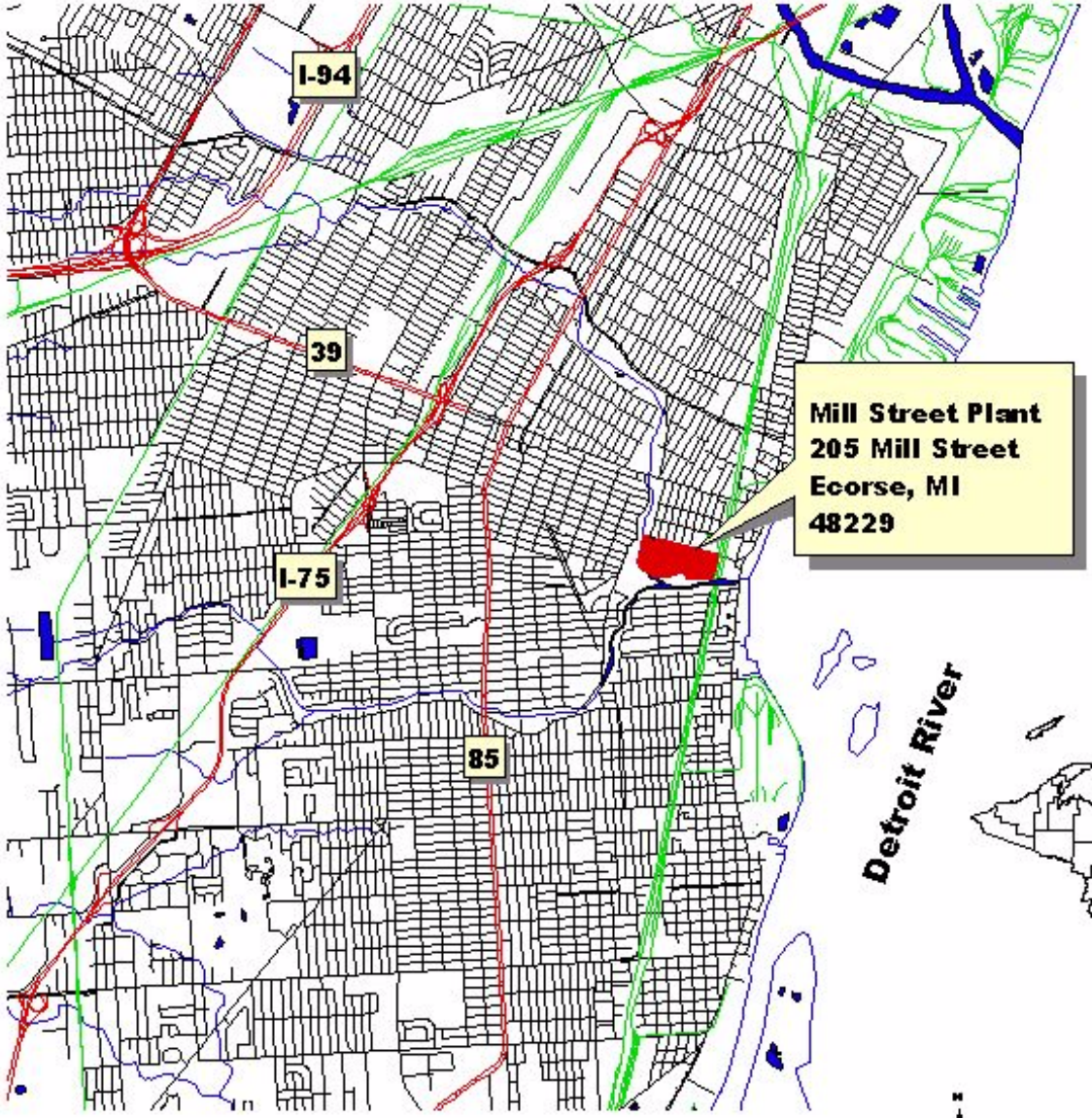
Acronyms:

C3 DCC	Commercial 3 Direct Contact Criteria
C4 DCC	Commercial 4 Direct Contact Criteria
GSIPC	Groundwater Surface Water Interface Protection Criteria
I/C PSIC	Industrial/Commercial Particulate Soil Inhalation Criteria
I/C2 DCC	Industrial/Commercial 2 Direct Contact Criteria
ID	insufficient data to calculate criterion
NA	not applicable
NLL	not likely to leach
ppm	parts per million
Res PSIC	Residential Particulate Soil Inhalation Criteria
Res/C1 DCC	Residential/Commercial 1 Direct Contact Criteria

Notes:

1. If Michigan Background exceeds the generic criterion, Michigan Background is used for the comparison.
2. Laboratory analysis did not speciate chromium. Therefore, the more health-protective values listed from chromium (VI) are used.

Figure 1
Property Location



Mill Street Plant
Site ID # MIB000000107
205 Mill Street
City of Ecorse
Wayne County, MI
Township 3 South
Range 11 East
Sections 16 and 17
Lat: 42 14 11 N*
Lon: -83 09 21 W*
***LAT/LON NAD-27**

Directions to Property

From Lansing take I-96 East to I-275. Take I-275 South to I-94 East (exit 17). Follow I-94 East to exit 203 Southfield Road. Take Southfield Road east (right) to 9th Street. Turn right on 9th Street. Take 9th Street to Mill Street. Turn left on Mill Street. The property is located on the right hand side of the street.

DEQ

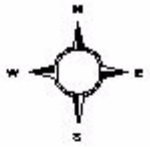
Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Superfund Section
Site Evaluation Unit
Brownfield Program
June2004
Compiled by G.R.

MDEQ Basemap
DOQ, ERG, DEM
Courtesy of Michigan Center for Geographic Information

Datum: NAD-27 Projection: Michigan Coord

Figure 2
Property Features

Mill Street Plant
Site ID # MIB000000107
205 Mill Street
City of Ecorse
Wayne County, MI
Township 3 South
Range 11 East
Sections 16 and 17
Lat: 42 14 11 N*
Lon: -83 09 21 W*
***LAT/LON NAD-27**



DEQ

Michigan Department of Environmental Quality
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Superfund Section
Site Evaluation Unit
Brownfield Program
June2004
Compiled by: G.R.

MIRIS Basemap
DOQ, ERC, ESRI
Courtesy of Michigan Center for Geographic Information

Datum: NAD-27 Projection: Michigan Coord

Figure 3
Surficial Soil Sample Locations

300 0 300 600 Feet

N
W E
S

Mill Street Plant
Site ID # MIB000000107
205 Mill Street
City of Ecorse
Wayne County, MI
Township 3 South
Range 11 East
Sections 16 and 17
Lat: 42 14 11 N*
Lon: -83 09 21 W*
***LAT/LON NAD-27**

DEQ

Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Superfund Section
Site Evaluation Unit
Brownfield Program
June2004
Compiled by: G.R.

MIRIS Basemap
DOQ, ERG, ESRI
Courtesy of Michigan Center
for Geographic Information

Datum: NAD-83 Projection: Michigan Oriented

Figure 4
Soil Boring Sample Locations

300 0 300 600 Feet

N
W E
S

Mill Street Plant
Site ID # MIB000000107
205 Mill Street
City of Ecorse
Wayne County, MI
Township 3 South
Range 11 East
Sections 16 and 17
Lat: 42 14 11 N*
Lon: -83 09 21 W*
***LAT/LON NAD-27**

DEQ

Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Superfund Section
Site Evaluation Unit
Brownfield Program
June2004
Compiled by: G.R.

MIRIS Basemap
DOQ, ERC, EDR
Courtesy of Michigan Center
for Geographic Information

Datum: NAD-83 Projection: Michigan Oconal

Figure 5
Temporary Monitoring Well Locations

300 0 300 600 Feet

Mill Street Plant
Site ID # MIB000000107
205 Mill Street
City of Ecorse
Wayne County, MI
Township 3 South
Range 11 East
Sections 16 and 17
Lat: 42 14 11 N*
Lon: -83 09 21 W*
***LAT/LON NAD-27**

Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Superfund Section
Site Evaluation Unit
Brownfield Program
June2004
Compiled by: G.R.

MIRIS Basemap
DOQ, ERC, EDR
Courtesy of Michigan Center
for Geographic Information

Datum: NAD-83 Projection: Michigan Oconal

Figure 6. Mill Street Plant Brownfield site, Ecorse, Wayne County, Michigan. Easy access to main building.

Figure 7. Mill Street Plant Brownfield site, Ecorse, Wayne County, Michigan. Unsecured gas cylinders.

Figure 8. Mill Street Plant Brownfield site, Ecorse, Wayne County, Michigan. Shallow open pit.

Figure 9. Mill Street Plant Brownfield site, Ecorse, Wayne County, Michigan. Fire and fume hazard.

Figure 10. Mill Street Plant Brownfield site, Ecorse, Wayne County, Michigan. Chemical spill.

Figure 11. Mill Street Plant Brownfield site, Ecorse, Wayne County, Michigan. Skywalks.

Appendix A. Chemicals tested for at the Mill Street Plant Brownfield, sampled May 25, 2004, City of Ecorse, Wayne County, Michigan. (Detected chemicals are underlined. Exceedances of Michigan criteria are shaded.)

VOCs	SVOCs	Metals	Pesticides and PCBs
1,1,1,2-Tetrachloroethane	1,2,4-Trichlorobenzene	Aluminum	4,4'-DDD
1,1,1-Trichloroethane	2,4,5-Trichlorophenol	Antimony	4,4'-DDE
1,1,2,2-Tetrachloroethane	2,4,6-Trichlorophenol	Arsenic	4,4'-DDT
1,1,2-Trichloroethane	2,4-Dichlorophenol	Barium	Aldrin
1,1-Dichloroethane	2,4-Dimethylphenol	Beryllium	alpha-Chlordane
1,1-Dichloroethene	2,4-Dinitrophenol	Cadmium	alpha-Hexachlorocyclohexane
1,2,3-Trichlorobenzene	2,4-Dinitrotoluene	Calcium	Aroclor 1016
1,2,3-Trichloropropane	2,6-Dinitrotoluene	Chromium	Aroclor 1221
1,2,4-Trimethylbenzene	2-Chloronaphthalene	Cobalt	Aroclor 1232
1,2-Dibromo-3-chloropropane	2-Chlorophenol	Copper	Aroclor 1242
1,2-Dibromoethane	2-Methylnaphthalene	Cyanide	Aroclor 1248
1,2-Dichlorobenzene	2-Methylphenol	Iron	Aroclor 1254
1,2-Dichloroethane	2-Nitroaniline	Lead	Aroclor 1260
1,2-Dichloropropane	2-Nitrophenol	Magnesium	Aroclor 1262
1,3,5-Trimethylbenzene	3-Nitroaniline	Manganese	Aroclor 1268
1,3-Dichlorobenzene	4,6-Dinitro-2-methylphenol	Mercury	beta-Hexachlorocyclohexane
1,4-Dichlorobenzene	4-Bromophenyl phenyl ether	Nickel	delta-Hexachlorocyclohexane
2-Butanone	4-Chloro-3-methylphenol	Potassium	Dieldrin
2-Hexanone	4-Chlorophenyl phenyl ether	Selenium	Endosulfan I
4-Isopropyltoluene	4-Methylphenol & 3-Methylphenol	Silver	Endosulfan II
4-Methyl-2-pentanone	4-Nitroaniline	Sodium	Endosulfan sulfate
Acetone	4-Nitrophenol	Thallium	Endrin
Acrylonitrile	Acenaphthene	Vanadium	Endrin aldehyde
Benzene	Acenaphthylene	Zinc	Endrin ketone
Bromobenzene	Anthracene		gamma-Chlordane
Bromochloromethane	Azobenzene		Heptachlor
Bromodichlormethane	Benzo (g,h,i)perylene		Heptachlor epoxide
Bromoform	Benzo(a)anthracene		Lindane
Bromomethane	Benzo(a)pyrene		Methoxychlor
Carbon disulfide	Benzo(b)fluoranthene		Toxaphene
Carbon tetrachloride	Benzo(k)fluoranthene		
Chlorobenzene	Bis(2-chloroethoxy)methane		
Chloroethane	Bis(2-chloroethyl)ether		
Chloroform	Bis(2-chloroisopropyl)ether		
Chloromethane	Bis(2-ethylhexyl)phthalate		
cis-1,2-Dichloroethene	Butyl benzyl phthalate		
cis-1,3-Dichloropropene	Carbazole		
Dibromochloromethane	Chrysene		
Dibromomethane	Dibenzo(a,h)anthracene		
Dichlorodifluoromethane	Dibenzofuran		
Diethyl ether	Diethyl phthalate		
Ethylbenzene	Dimethyl phthalate		
Hexachloroethane	Di-n-butyl phthalate		
Iodomethane	di-n-octyl phthalate		
Isopropylbenzene	Fluoranthene		
m,p-Xylene	Fluorene		
Methy tert-butyl ether	Hexachlorobenzene		
Methylene chloride	Hexachlorobutadiene		
n-Butylbenzene	Hexachlorocyclopentadiene		
n-Propylbenzene	Hexachloroethane		
o-Xylene	Indeno(1,2,3-cd)pyrene		
sec-Butylbenzene	Isophorone		
Styrene	Naphthalene		
tert-Butylbenzene	Nitrobenzene		
Tetrachloroethene	N-Nitrosodimethylamine		
Toluene	N-Nitrosodi-n-propylamine		
trans-1,2-Dichloroethene	N-Nitrosodiphenylamine		
trans-1,3-Dichloropropene	Pentachlorophenol		
trans-1,4-Dichloro-2-butene	Phenanthrene		
Trichloroethene	Phenol		
Trichlorofluoromethane	Pyrene		
Vinyl chloride			

Appendix B. MDEQ Part 201 Generic Clean-up Criteria Terminology

Industrial and Commercial Land-Use Definitions

The primary activity in an **Industrial** land-use setting is industrial in nature. Access to the general public is and will continue to be reliably restricted consistent with use of the property. Exposure assumptions include: a soil ingestion rate of 50 mg/day, up to 245 days/year ingestion frequency, up to 160 days/year dermal exposure to soil, and up to 21 years exposure duration.

A **Commercial I** property is used to house, educate, or provide care for children, the elderly, the infirm, or other sensitive subpopulations. Examples of Commercial I properties are schools, nursing homes, and daycare facilities. Exposure assumptions include: a soil ingestion rate of 200 mg/day (child) or 100 mg/day (adult), up to 350 days/year ingestion frequency; up to 245 days/year dermal exposure to soil, and up to 6 years (child) or 24 years (adult) exposure duration. (These are the same exposure assumptions as for a Residential scenario.)

A **Commercial II** property has activities similar to the Industrial category. Access to the public is reliably restricted, consistent with property use, by means of fencing, security systems, or both. Exposure assumptions are the same as for the Industrial category.

The public has unrestricted access at a **Commercial III** property. However, public access is less in frequency and duration than workers at the facility. The worker population is engaged in activities that are of a low soil-intensive nature. Examples of Commercial III properties are gas stations, auto dealerships, auto service stations, and retail warehouses. Exposure assumptions are the same as for the Industrial category.

The **Commercial IV** property similar to the Commercial III property except the worker population is engaged in activities that are of a high soil-intensive nature, such as grounds maintenance. Examples of Commercial IV properties are professional offices, medical/dental offices and clinics, and banks. Exposure assumptions are the same as for the Industrial category.

MDEQ Groundwater Criteria

The **Residential and Commercial I Drinking Water Criteria (DWC)** identify drinking water concentrations that are safe for long-term, daily residential or light commercial-setting consumption. The criteria are *not* applicable if drinking water use is prohibited by land use restrictions, such as a restrictive covenant, or by an approved institutional control that is part of the Remedial Action Plan. Adverse aesthetic impacts are considered for select chemicals. The **Industrial and Commercial II, III, IV DWC** identify drinking water concentrations that are safe for long-term, daily workplace consumption. Residential/Commercial I DWC are applicable at the site boundary unless off-property use of the aquifer is appropriately controlled. Applicability of the criteria and consideration of aesthetic impacts are the same as for the Residential/Commercial I DWC.

The **Groundwater Surface Water Interface (GSI) Criteria** identify groundwater concentrations that are protective of a receiving surface water. The criteria are based on the most protective value for aquatic life, terrestrial life, or human health.

The **Residential and Commercial I Groundwater Volatilization to Indoor Air Inhalation Criteria (GVIIC)** address the migration of chemical vapors from groundwater through soil into buildings. The criteria identify groundwater concentrations that protect occupants from the inhalation of contaminant concentrations in indoor air that may cause adverse health effects. Therefore, the pathway is relevant only for volatile compounds. The criteria are *not* applicable if a current or future structure does not contain materials, at or below grade, that limit vapor intrusion (poured cement walls versus soil or basements), there is an open sump, or depth to groundwater is less than 3 meters below grade. (These properties require a site-specific assessment.) The **Industrial and Commercial II, III, IV Groundwater Volatilization to Indoor Air Inhalation Criteria** identify groundwater concentrations that protect workers from the inhalation of contaminant concentrations in workplace indoor air that may cause adverse health effects. As for the Residential/Commercial I GVIIC, the criteria are *not* applicable if a current or future structure does not contain materials that limit vapor intrusion (poured cement walls versus soil basements), there is an open sump, or depth to groundwater is less than 3 meters below grade.

The **Groundwater Contact Criteria (GCC)** identify groundwater concentrations that are protective against adverse health effects that may result from dermal exposure to chemicals in groundwater, such as could be experienced by workers in subsurface excavations. The criteria are only protective of chronic systemic human health effects and do not address flammability/explosivity or acute inhalation and dermal toxicity.

Water Solubility Criteria identify theoretical threshold water concentrations above which free phase liquid contaminant may exist. Water solubility is defined as the maximum amount of solute that will dissolve in a given amount of water to produce a saturated solution. Solubilities can be greater than 100 percent.

Flammability and Explosivity Criteria identify concentrations in groundwater that are protective against physical hazards of flammability and explosivity. Criteria are available for those chemicals with a published flash point of less than 140º F and a published lower explosive limit (LEL). The screening level is set using 10 percent of the LEL, then converted to a groundwater value using the chemical-specific Henry's Law Constant.

Acute Inhalation Toxicity Screening Levels (AISLs) identify groundwater concentrations protective against unacceptable air concentrations within enclosed spaces that would cause acute inhalation toxicity. The screening levels are developed using National Institute of Occupational Safety and Health (NIOSH) short-term exposure limits (STELs, defined as 15-minute time-weighted average exposures that should not be exceeded at any time during a workday), then converted to a groundwater value using the chemical-specific Henry's Law Constant.

MDEQ Soil Criteria

The **Residential and Commercial I Drinking Water Protection Criteria (DWPC)** identify soil concentrations not expected to leach and contaminate groundwater at levels greater than the Residential/Commercial I DWC. The criteria are *not* applicable if drinking water use is prohibited by land use restrictions, such as a restrictive covenant, or by an approved institutional control. The **Industrial and Commercial II, III, IV DWPC** identify soil concentrations that are not expected to leach and contaminate groundwater at levels greater than the corresponding DWC on-property and the Residential/Commercial I DWC, or other applicable criteria, at the property boundary.

The **GSI Protection Criteria (GSIPC)** identify soil concentrations of chemicals that are not expected to leach and contaminated groundwater at levels greater than the corresponding GSI criteria.

The **Residential and Commercial I Soil Volatilization to Indoor Air Inhalation Criteria (SVIIC)** address the migration of contaminant vapors from soil into residential and some commercial buildings. These criteria identify soil concentrations that protect occupants from exposure to indoor air concentrations that may cause adverse health effects. The pathway is relevant only for volatile compounds. The criteria are *not* applicable if a current or future structure does not contain materials, at or below grade, that limit vapor intrusion (poured cement walls versus soil basements) or there is an open sump. The criteria may not be protective of odors, physical hazards, or ecological impacts. The **Industrial and Commercial II, III, IV SVIICs** address the migration of contaminants vapors from soil into workplace buildings. These criteria identify soil concentrations that protect workers from exposure to indoor air concentrations that may cause adverse health effects. Workplace exposures are not expected to be more than eight hours per day. Applicability of workplace criteria is the same as for Residential/-Commercial I applications.

The **Groundwater Contact Protection Criteria** identify soil concentrations that are not expected to contaminated groundwater at levels greater than the GCC.

The **Residential and Commercial I Direct Contact Criteria (DCC)** identify soil concentrations that are protective against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil. The criteria do *not* address risks posed by inhalation and physical hazards. The **Industrial and Commercial II DCC, Commercial III DCC, and Commercial IV DCC** are similar to the Residential/-Commercial I DCC, except that each applies to the appropriate workplace setting.

Soil Saturation (Csat) Screening Levels identify theoretical threshold soil concentrations above which free phase liquid contaminant may exist. Csat values serve as an upper limit to the applicability of other soil-based criteria. Csat screening levels are applicable to all soil depths.

The **Residential and Commercial I Infinite Volatile Soil Inhalation Criteria (VSIC) for Ambient Air** identify soil concentrations not expected to yield ambient air

Certification

This **Mill Street Plant Brownfield Redevelopment Assessment** Health Consultation was prepared by the Michigan Department of Community Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures.

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.