DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

Facility Name:	General Motors North American Operations (NAO), Flint Operations Site
Facility Address:	902 East Leith Street, Flint, Michigan
Facility EPA ID #:	MID 005 356 712

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

X If yes - check here and continue with #2 below.

____ If no - re-evaluate existing data, or

____ if data are not available skip to #6 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	Yes	No	?	Rationale / Key Contaminants
Groundwater	X			Manganese, Trichloroethene, Vinyl Chloride, Trichloroethene, Vinyl Chloride, Beryllium, Selenium, Arsenic, Nickel, cis-1,2-Dichloroethene, Antimony, Benzene, PCBs(total), Ethyl Benzene, Lead, Methylene Chloride, 1,1-Dichloroethene, 1,1,1-Trichloroethane, Barium, Chloroethane, Cadmium, 1,2-Dichloroethane, Chromium (total), Thallium, Vanadium, Benzo(a)pyrene, Cyanide (total), Bis(2-Chloroethyl) ether, 1,2-Dichloropropane, Zinc, Tetrachloroethene,
Air (indoors)[2]		X		Contaminants do not exceed OSHA PELs
Surface Soil (e.g., <2 ft)	X			Lead, Chromium(total), Manganese, Trichloroethene, Copper, Benzo(a)pyrene, Dibenz(a)anthracene, Antimony, Pentachlorophenol, 1,1,1-Trichloroethane, 1,1-Dichloroethene, 1,1,2-Trichloro-1,2,2-triflouroethane.
Surface Water		X		
Sediment		X		
Subsurf. Soil (e.g., >2 ft)	X			Trichloroethene, N-Nitroso-di-n-propylamine, Chromium(total), Manganese, Lead, Benzo(a)pyrene, Copper, Antimony, Benzene, Ethyl Benzene, Toluene, Xylenes(total), Arsenic, Pentachlorophenol, Barium, Cadmium, 1,1-Dichloroethene, 1,1,1-Trichloroethane, 1,1,2-Trichloro-1,2,2-triflouroethane, Carbazole, Dibenz(a,h)anthracene, Tetrachloroethene. LNAPL:(Benzo(a)pyrene, PCBs(total), Benzene, Toluene, Xylenes(total), Ethyl Benzene, Napthalene, and Phenanthrene.
Air (outdoors)		X		

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

_X_ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) was conducted at the General Motors North American Operations (NAO) Flint Operations Site in response to the findings presented in the *Description of Current Conditions for Areas South of Leith Street* (BBL, May 30, 2000) and the *Description of Current Conditions for Areas North of Leith Street* (BBL, November 26, 2000). The Current Conditions Report summarized the areas of interest (AOIs) at the site that had a potential for a release to the environment, thus requiring further investigation in the RFI.

During the RFI, samples of soil and groundwater were analyzed, and a screening-level risk evaluation was performed at each area of potential contamination, to evaluate possible risk to human health and the environment.

The screening criteria used to identify contamination in soil are the Michigan Part 201 generic industrial direct contact criteria, industrial soil volatilization to ambient air criteria, industrial particulate inhalation criteria, and industrial volatilization to indoor air criteria (MDEQ 2002). The vapor intrusion pathway is also evaluated using site-specific criteria based on soil properties representative of typical site conditions and occupational exposure limits.

Light non-aqueous phase liquids (LNAPLs) are present at a number of AOIs and at certain storm sewers and storm water discharge outfalls. Theoretical upper-bound concentrations of LNAPL constituents in the smear zone soil were estimated using the chemical characterization data for the LNAPLs, and are compared with the screening criteria for soil.

The screening criteria used to identify contamination in groundwater are the Michigan Part 201 generic industrial drinking water criteria, industrial volatilization to indoor air criteria, and groundwater contact criteria (MDEQ 2002). Groundwater data are also evaluated using site specific volatilization to indoor air criteria and site-specific construction worker groundwater contact criteria. Although some constituents have groundwater concentrations higher than the drinking water criteria, there is no known active drinking water or industrial production well at or near the Site, and all potable water is supplied by the City of Flint. The screening criteria for water from tunnels, storm sewers, and basements are the Part 201 generic groundwater contact criteria and site-specific construction worker groundwater contact criteria. Groundwater data near the Flint River are also evaluated using generic MDEQ groundwater surface water interface criteria (GSI).

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be

reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

"Contaminated" Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food[3]
Groundwater	No	Yes	No	Yes	No	No	No
~~Air (indoors)~~	___	___	___				
Soil (surface, e.g., <2 ft)	No	Yes	No	Yes	Yes	No	No
Surface Water	___	___			___	Yes	___
~~Sediment~~	___	___			___	___	___
Soil (subsurface e.g., >2 ft)	No	No	No	Yes	No	No	No

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated" as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

X If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

Soil

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Contaminated soil identified at AOIs 05-1, 05-6, 12-A, 29-A, 36-2, 81-1, 83/84-2, and 83/84-3 is covered by building floors, heavy machinery, and/or pavement, which prevent current direct contact exposure of workers engaged in routine activities or exposure of trespassers. Additionally, potential exposure of workers engaged in subsurface construction activities at these AOIs is possible.

Contaminated soil at AOIs 02-C, 03-1, 09-A, 09-B, 10-1, 10-3, 36-1, 40-A, 44-A, 81-2, and 86-1 is not covered or not entirely covered, so potential exposure of workers engaged in routine activities and subsurface construction activities, and exposure of trespassers are possible in these areas.

Exposure to constituents that might volatilize and potentially migrate into indoor air is possible at
AOIs 05-1, 05-6, 10-1, 10-3, 36-1, 36-2, 81-1, 81-2, 83/84-2, 83/84-3, and 86-1 which are partially or completely covered by occupied buildings. This list of occupied buildings is current as of June 2004 and takes into account demolition activities that have occurred subsequent to the RFI Phase II Report.

LNAPL and Smear Zone Soil

Potential exposure of workers via direct contact with LNAPL during subsurface construction or maintenance activities is possible at AOIs 03-1, 05-5, 09-A, 09-B, 10-1, 10-4, 12-A, 12-B, 16-C, 23-A, 36-1, 36-2, 36-5, 81-2, 83/84-2, 83/84-4, 85-1, and 86-1, as well as at certain storm sewers and storm water discharge outfalls.

The upper-bound concentrations of several constituents in smear zone soil meet the definition of contamination at AOIs 03-1, 05-5, 09-B, 16-C, and 36-1. Potential exposure of workers via direct contact with contaminated smear zone soil containing LNAPL during subsurface construction activities is possible at these AOIs. In addition, routine workers could be exposed to constituents in LNAPLs and smear zone soils that are beneath buildings via inhalation of contaminants that volatilize and migrate through cracks in building foundations into indoor air at AOIs 05-5, 10-1, 36-1, 36-2, 36-5, 81-2, 83/84-2, and 83/84-4 where occupied buildings are over the LNAPL and smear zone soil.

Groundwater

The hydrogeolgy of the Site is characterized by a shallow groundwater zone with depth to the water table typically ranging from approximately 6 to 16 feet below ground surface (bgs).

The underlying glacial till unit, a depth of approximately 5 to 30 feet, has been characterized as an aquitard.

The Saginaw Formation of bedrock, which underlies the unconsolidated glacial drift in the area of the Site at depths reported to be 60 to 80 ft bgs, was historically the primary source of groundwater in the Flint area. Several production wells in the formation were previously used for industrial and public water supply. As alternative sources of drinking water became available, these wells were taken out of service due to the poor quality of the groundwater (high hardness and dissolved solids values). There are no known active production wells in the City that use the shallow or bedrock formations as a source of groundwater.

Currently, the City of Flint Department of Public Works supplies drinking water to the City of Flint, and Flint Township. The City of Flint Department of Public Works purchases potable water form the City of Detroit, which routes water from a Lake Huron intake to the City of Flint. Therefore, exposure of workers

and others at and around the Site via potable or nonpotable groundwater use is not expected.

Exposure to constituents that might volatilize and potentially migrate into indoor air is possible at areas where buildings are present. Additionally, potential exposure of subsurface construction workers to groundwater is possible at AOIs 36-3 and 40-A, where the depths to water are about 9 and 14 feet, respectively.

Recreational users could be exposed to contaminated groundwater via contact with nearby down gradient surface water in the Flint River where groundwater could enter directly and discharge via on-site storm water sewers that intercept groundwater.

There is no other complete exposure pathway between contaminated soil, groundwater, or LNAPLs and human receptors at the Site that can be reasonably expected under current conditions.

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

X If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Soil

The bounding estimates of cumulative cancer and noncancer risks based on the maximum detected concentration and the conservative exposure factors for evaluation of routine workers in generic commercial/industrial settings are within USEPA's acceptable cancer risk limit of 10^{-4} or HI limit of 1, respectively, for all AOIs identified as having soil contamination except AOIs 09-A, 36-1, 40-A, 81-2, and 83/84-2(See Table 1). In addition, the cumulative cancer and noncancer risks based on receptor-specific maximum concentrations are within USEPA's risk limits for construction workers at all five of these areas and for routine workers at AOIs 36-1 and 83/84-2. High-end routine worker risk estimates using 95% UCLs for the constituents that contributed greatest to the bounding estimates are below USEPA's risk limits for AOI 40-A, but are higher than USEPA's risk limits for AOIs 09-A and 81-2. However, in the latter case, post-remedy risk estimate are below USEPA's risk limits after removing the highest concentrations for the constituents that contributed greatest to the high-end estimates at AOIs 09-A and 81-2. Personal Protective Equipment (PPE) will be used by workers in these areas until soil contamination is addressed.

[4] If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

Potential volatilization and vapor intrusion from soil to indoor air is insignificant in all areas per the Occupational Safety and Health Administrations (OSHA) regulations at 29 CFR 1910.1000(d)(2)(i) *except* AOIs 36-1 and 81-2. Indoor air sampling was conducted by the facility's industrial hygiene staff in these two areas, and found that vapor intrusion is not occurring to a measurable degree.

Mean site-related lead concentrations are below the industrial screening criterion except for AOIs 09-A, 81-1, and 83/84-3. Interim measures plans are being prepared to remove contaminated soil from certain locations at AOI 09-A. In the meantime, the locations with lead concentrations higher than the screening criterion, PPE will be used by workers to prevent unacceptable exposure in these areas. Therefore, the concentrations of constituents at these AOIs do not present a significant exposure.

Bounding estimates of cumulative cancer risk and HI for workers encountering LNAPLs and smear zone soils during subsurface construction activities are within USEPAs acceptable risk limits at all of the AOIs except for exposures to LNAPL AOIs 09-B, 10-4, 16-C, and 36-1. These risk estimates assume that workers who are potentially exposed to the LNAPLs and smear zone soils do not wear any PPE during excavations. All AOIs where recoverable LNAPL is present are being addressed as part of the IMs discussed in the RFI Phase II Report (BBL 2004). PPE will be used by workers in these areas to prevent unacceptable exposures. Potential volatilization and vapor intrusion from LNAPL to indoor air is insignificant per the OSHA regulations in all LNAPL areas. Therefore, the concentrations of constituents at these AOIs do not present a significant exposure.

Groundwater

The bounding risk estimates for construction worker contact with groundwater are less than USEPA's risk limits at all contaminated groundwater areas. Potential volatilization and vapor intrusion from groundwater to indoor air is insignificant per the OSHA regulations in all on-site areas. Additionally, the bounding risk estimates for potential volatilization and vapor intrusion from groundwater to off-site indoor air are less than USEPA's risk limits.

Recreational users could be exposed to contaminated groundwater via contact with surface water in the Flint River where groundwater could enter directly and discharge via on-site storm water sewers that intercept groundwater. Surface water concentrations are estimated using the mass balance approach, which is discussed in Section 6.3.4 of the RFI Phase II Report, for constituents that exceed the MDEQ GSI criteria in groundwater and/or are detected in the storm sewer water samples. The highest detected constituent concentrations in groundwater at monitoring wells selected for GSI criteria comparison (as discussed in Section 4 of the RFI Phase II Report) are conservatively used as the concentrations in groundwater in the mass loading calculation for the receiving water. The mass loading from the storm sewer outfalls are estimated using data collected for the facility's NPDES permits and at various locations along the sewer networks during the RFI. A discussion of this evaluation is provided in Section 6.5.2 and Appendix G of the RFI Phase II Report.

The estimated surface water concentrations are compared against Michigan Water Quality Standards and federal Ambient Water Quality Criteria (AWQC) for surface water used as human drinking water and fish sources, and MDEQ Part 201 generic residential drinking water criteria for groundwater for chemicals without state and federal surface water criteria. Table 2 presents the bounding estimates of surface water

concentrations resulting from groundwater discharging to the Flint River directly and via storm sewers. As shown in Table 2, none of the estimated concentrations in surface water exceed the criteria except PCBs. However, the MDEQ and federal surface water quality criteria for PCBs are at least three orders of magnitude lower than the target detection limit of 2×10^{-4} mg/L, and the PCB concentrations in the discharge are lower than the MDEQ residential drinking water criteria. In addition, there is a State fish advisory on limited consumption for children and women of child bearing age in the Flint River.

5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

_____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

_____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

X YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the General Motors North American Car Group (NACG) Lordstown Assembly Plant and Lordstown Metal Fabricating Division (MFD) Metal Fabricating Plant , EPA ID #OHD 020 632 998, OHD 083 321 091 , located in Lordstown, Ohio under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

____ IN - More information is needed to make a determination.

Completed by (signature) _____ Date _____
(print) Tammy Moore
(title) Environmental Scientist

Supervisor (signature) _____ Date _____
(print) George Hamper
(title) Section Chief
(EPA Region or State) EPA Region 5

Locations where References may be found:

U.S. EPA Records Room
7th floor
77 West Jackson Boulevard
Chicago, IL 60604

All material referenced in this document can be found in the following reports:

1. RCRA Environmental Indicator CA725 Report, Determination of Current Human Exposures Under Control (Environ 2004).

Contact telephone and e-mail numbers

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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

TABLE 1
Bounding Estimates of Cumulative Cancer Risk and Hazard Index by AOI for Soil

AOI	Matrix	Industrial Cumulative Risk	Industrial Hazard Index
02-C	Soil	8×10^{-7}	2×10^{-1}
03-1	Soil	9×10^{-5}	4×10^{-1}
05-1	Soil	2×10^{-5}	8×10^{-1}
05-6	Soil	1×10^{-5}	7×10^{-2}
09-A	Soil	**4×10^{-4}**	**2**
09-B	Soil	1×10^{-4}	1
10-1	Soil	2×10^{-5}	6×10^{-1}
10-3	Soil	2×10^{-5}	2×10^{-1}
12-A	Soil	2×10^{-5}	1
29-A	Soil	2×10^{-6}	1×10^{-1}
36-1	Soil	**3×10^{-4}**	**20**
36-2	Soil	1×10^{-6}	2×10^{-1}
40-A	Soil	**2×10^{-4}**	3×10^{-1}
44-A	Soil	1×10^{-5}	4×10^{-1}
81-1	Soil	3×10^{-5}	6×10^{-1}

AOI	Matrix	Industrial Cumulative Risk	Industrial Hazard Index
81-2	Soil	6×10^{-5}	**10**
83/84-2	Soil	**5×10^{-4}**	**2**
83/84-3	Soil	2×10^{-5}	4×10^{-1}
86-1	Soil	1×10^{-4}	1
Background	Soil	1×10^{-6}	1×10^{-1}