Documentation of Environmental Indicator Determination
RCRA Corrective Action
Environmental Indicator (EI) RCRAInfo Code (CA725)
Current Human Exposures under Control

Facility Name: **General Motors Corporation – Linden Assembly Plant**
Facility Address: **1016 West Edgar Road, Linden, New Jersey**
Facility EPA ID#: NJD 002186690

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

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EIs) are measures being used by the Resource Conservation and Recovery Act (RCRA) Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved) to track changes in the quality of the environment. The two EIs 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 objectives of the RCRA Corrective Action program, the EIs 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 is for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and does 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 determination status codes should remain in the Resource Conservation Recovery Information System (RCRAInfo) national database ONLY as long as they remain true (i.e., RCRAInfo status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Information

Site Description

The GM Linden Assembly Plant ("GM" or the "Facility") is located on approximately 94 acres of land in an area of mixed industrial/manufacturing and commercial facilities. The Facility is located along Routes 1 and 9 in Linden, Union County, New Jersey, in the northwestern$^{(TN)}$ (TN is reference to true north) and northeastern$^{(TN)}$ portions of the 7.5 minute Perth Amboy, New Jersey and Arthur Kill, New York topographic quadrangles, respectively (Figure 1). Small areas of residential development lie to the north$^{(PN)}$ (PN is reference to Plant North), east$^{(PN)}$, and south$^{(PN)}$ of the Facility.

The topography of the Facility is generally flat, with a slight slope to the southeast$^{(TN)}$ towards the Rahway River and Arthur Kill. The area surrounding the Facility is generally developed, flat-lying and is located in an area of industrial and commercial properties.

The Facility began operation in 1937, in the manufacture of automobiles, as it does currently. (The Facility did support the manufacture of aircrafts during World War 2 period.) The plant currently consists of one large assembly building, an attached administration building, several significantly smaller buildings, and the wastewater treatment plant (WWTP). The main assembly building occupies approximately 37.5 acres. Current and historic waste management facilities are located around the exterior of the main manufacturing building.

The Facility is a RCRA-regulated generator. Rather than pursue a full operating permit, the Facility opted to stop functioning as a treatment, storage and disposal facility (TSDF) and changed its RCRA status from a TSDF to a generator. As such, the Facility submitted a closure plan in May 1989 for one indoor hazardous waste storage tank (SWMU 6 located in AOI 6) and two former outdoor hazardous waste container storage areas (AOIs 1 and 15). The Facility then closed its TSD units and changed its RCRA status to a generator. The Facility's EPA Identification Number is NJD 002 186 690.

The Facility is currently conducting a voluntary RCRA corrective action. The voluntary RCRA corrective action program also addresses provisions in a Memorandum of Agreement between GM and the New Jersey Department of Environmental Protection (NJDEP) dated February 27, 1995 (Case No. 95-01-25-1618-35).

The Facility is currently in the investigative stage of the site-wide RCRA corrective action program designed to gather the necessary data to develop a final remedy for the site. The current and following phases of the corrective action program will further refine and/or confirm the characterization of soil and groundwater contamination (off-site) in order to develop an optimal final remedy and a long-term groundwater monitoring system.

In the RCRA facility investigation (RFI) completed to date, GM has performed the necessary activities to reasonably characterize the nature and extent of releases of hazardous waste and/or hazardous constituents at the Facility for evaluating the Environmental Indicator. These activities included preparation of a Current Conditions Report (CCR) that identified and assessed 24 areas of interest (AOIs) at the Facility. The AOIs included all the solid waste management units (SWMUs) and areas of concern (AOCs) identified in USEPA's 1993 "Preliminary Assessment/Visual Site Inspection" report, and other areas at the Facility for which GM has knowledge of past management of hazardous waste or hazardous constituents. [Ref. 1]

The CCR summarizes 24 individual areas (AOI 01 to AOI24) at the Facility that may have had a release to the environment. The report evaluated each AOI and identified those where additional investigation was warranted. Based on information gathered during development of the CCR, certain AOIs were determined not to require further investigation due to the absence of evidence of a release to the environment or because of previous work conducted. The basis for eliminating these AOIs from further investigation is documented in the CCR. GM identified 14 of the 24 AOIs for further investigation, and prepared RFI Work Plan and addenda (i.e., sampling matrices) that described the objectives, approach, rationale, and procedures for these investigations. [Ref. 2]

Five additional AOIs (AOI 25 through AOI 29) have been identified during implementation of the RFI. These AOIs are:

AOI 25	Former Drum Storage Area
AOI 26	Suspected Abandoned UST
AOI 27	Stained Asphalt Area
AOI 28	Southern [PN] Facility Boundary Area
AOI 29	Monitoring Well 18 Area

See Attachment A.

It should be noted that contamination at each of the AOIs at the site have been reasonably delineated and all the AOIs are paved with concrete or asphalt. As a conservative position, GM also evaluated two areas (off-site and adjacent to the AOI6 and AOI29 areas), where there are potential surface soil contamination and are unpaved, for exposure potential. (It is probable that the contamination in these two areas can be attributed to the use of historic fill, but nevertheless, GM included these two areas in the Environmental Indicators CA725 evaluation.) It should also be noted that the site is entirely fenced and has 24-hour security.

References:

1. ENCORE. 2002. Current Conditions Report, GM Linden Assembly Plant, Linden, New Jersey.

2. Haley & Aldrich. 2002. RCRA Facility Investigation Work Plan, GM Linden Assembly Plant, Linden, New Jersey

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, AOCs)?

Media	Yes	No	?	Rationale / Key Contaminants
Groundwater	X			*See Tables 2-3a to 2-3f in the EI Report*
Air (indoors)[2]		X		
Surface Soil (e.g., <2 ft)	X			*See Table 2-1a and 2-1b in the EI Report.*
Surface Water	X			*See Table 2-5a in the EI Report*
Sediment	X			*See Table 2-4a and 2-4b in the EI Report*
Subsurface Soil (e.g., >2 ft)	X			*See Table 2-1a and 2-1b in the EI Report.*
Air (outdoors)		X		

	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 and 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:

A discussion of the hydrology and hydrogeology will assist in understanding the contamination at the site.

The predominant drainage systems in the vicinity of the Facility are the Rahway River and the Arthur Kill. The Rahway River discharges into the Arthur Kill approximately four miles to the southeast(TN) of the Facility. Local drainage occurs in small creeks and brooks that drain into the Rahway River or directly into the Arthur Kill. The Rahway River is located approximately one mile to the south(TN) of the Facility.

Two local drainage ways are present near the Facility; Kings Creek to the southwest(TN) of the Facility and West Brook (also called Morses Creek) to the northeast(TN) of the Facility. Kings Creek drains into the Rahway River. The nearest surface water to the Facility is Morses Creek, which is located about ¼-mile northeast(TN) of the facility. Stormwater run-off from the Facility discharges via storm water sewer into Morses Creek. Nearby surface water bodies are depicted on Figure 4. Morses Creek, which receives the storm water run-off from

[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.

the Facility via storm sewers, discharges into two small man-made reservoirs on a refinery site to the northeast(TN) of the Facility. Morses Creek ultimately discharges directly into the Arthur Kill.

Groundwater at and in the vicinity of the Facility is present in three zones. These zones are characterized as overburden (shallow and deep), weathered bedrock and bedrock (semi-confined flow zone). The groundwater movement within these flow zones is in response to hydraulic gradients, with flow from areas of higher to lower hydraulic head.

Based on the RFI/RI investigation and as reported by Merck and Safety Kleen, groundwater flow in the overburden, weathered bedrock and bedrock is predominantly south(TN) towards the Rahway River (refer to Reference 1, Figures 10,11, 13 and 14 and Appendix I - Merck & Safety Kleen Groundwater Contour Maps). In addition, groundwater investigations at the Facility indicate that there is generally a downward gradient from the overburden to the bedrock and within the upper portion of the bedrock, with the exception of the MW-15 cluster which has exhibited a slight upward gradient.

Overburden
Based on water level measurements from the wells during the RFI/RI, the overburden groundwater ranges from 7 feet to 16 -feet below ground surface depending on the location on the Facility and seasonal variation.

The following observations were noted:

- At the northern(PN) portion of the Facility in the vicinity of the former USTs, the potentiometric surface contains a localized high, in or near the former UST excavation. This feature had been backfilled with more permeable fill than the surrounding native materials creating a localized perched groundwater effect.

- To the west(PN) of the former USTs (MW-15 cluster) a slight upward gradient is observed.

- On the western(PN) portion of the Facility, localized flow to the west(PN) is inferred from the potentiometric contours. The cause of this inferred flow is not known, but may be related to recent pumping by Merck or subsurface utilities.

Based on the above observations and groundwater flow paths, overburden groundwater flow appears to be controlled by surface water drainage (to Rahway River and Arthur Kill) as well as underground utilities.

Based on a typical gradient of 0.002 from the March 2004 potentiometric surface contours, a typical permeability of the overburden on the order of 5×10^{-4} cm/sec, and an assumed porosity of approximately 30% (Freeze and Cherry, 1979), the average groundwater velocity is on the order of 0.5 feet per year.

Weathered Bedrock Groundwater
The weathered bedrock exhibits a permeability that ranges from 10^{-2} to 10^{-3} cm/sec with a typical permeability of approximately 5×10^{-3} cm/sec. Observations during well installations identified a silty sand layer existing above the weathered bedrock at the bottom of the overburden.

Based on water level measurements taken from the 17 weathered bedrock monitoring wells during March 2004, the potentiometric surface of the weathered bedrock groundwater ranges

from 7 to 15 -feet below ground surface, with a typical depth of approximately 12.5 feet. The following observations were noted from the contours:

- Groundwater generally flows towards the south(PN) to southeast(PN) from a potentiometric high at MW-15W.

- The potentiometric surface contours indicate a downward gradient from the overburden to the bedrock water bearing zones across much of the Facility. However in the MW-15 cluster location the potentiometric surface contours indicate a neutral or upward gradient.

Based on a typical horizontal gradient of 0.002 from the December 2003 and March 2004 potentiometric surface contours, a typical permeability of the weathered bedrock on the order of 5×10^{-3} cm/sec, and an estimated weathered bedrock porosity of approximately 20% (Freeze and Cherry, 1979), the average horizontal groundwater velocity is on the order of two feet per year.

Bedrock Groundwater
Interpreted groundwater flow in the bedrock is southerly(PN) based on December and March events. However, the distribution and depth of the existing bedrock wells suggests these wells may not be monitoring the same fracture zones across the Facility, and, therefore, may not have comparable water level elevations. .

Monitoring wells in the bedrock were packer tested and evaluated using downhole geophysical techniques (BEC-1B, 2B, 4B, and MW-16B, 17B and 18B). Appendix J contains the information collected from this investigation. In summary, water-producing fractures were minimal in the bedrock wells. Fractures identified in MW-18B were considered near vertical at the top of the borehole. This is consistent with the packer testing of this borehole. However, the test results did not record any flow into the well below 53 feet. Bgs in MW-18B. Similarly, for BEC-2B a near vertical fracture was noted to yield approximately 0.03 gpm near the bottom of the borehole. Again, this is consistent with the packer testing of this hole.

The hydraulic conductivity of the competent rock, as measured by packer testing (Table 3.5 of the RFI), is low (10^{-6} cm/sec or less). In many of the tests, the borehole did not take water, therefore, a hydraulic conductivity could not be calculated. As noted above, both BEC-2B and MW-18B did take water in specific intervals of the open borehole. The hydraulic conductivity of these fracture intervals was observed to be approximately 10^{-4} cm/sec from the packer testing.

[See Reference 1 for a more detailed discussion.]

Groundwater:

The groundwater underneath the site is considered to be contaminated based on the data gathered in the site investigation.

Groundwater quality data from on-site monitoring wells are summarized on Table 2-3a and Table 2-3b in Attachment B. The locations of the monitoring wells are shown on Figure 5 in Attachment A.

The screening criteria for groundwater include criteria that are based on drinking water exposures, vapor intrusion, and construction worker contact. The drinking water criteria include state and federal drinking water standards and the NJDEP Class IIA Groundwater Quality Standards, which are applicable to groundwater that is used as a potable water supply. The locations and depth intervals at which concentrations in groundwater are considered to meet the definition of "contamination" are summarized on Table 2-3d to Table 2-3f in Attachment B. [Ref. 2]

Soil:

Soil that meets the definition of "contamination" for the purposes of the CA725 determination is identified using the direct contact criteria derived from the Preliminary Remediation Goals (PRGs) and the vapor intrusion criteria. On Table 2-1a in Attachment B, the highest concentration of each constituent in surface and subsurface soil at an area is compared to these two sets of screening criteria by calculating the ratio of the highest concentration to each criterion. Ratios higher than 1 are considered to meet the definition of "contamination" and are highlighted (i.e., exceeds the criteria). [Ref. 3]

Surface Soil (< 2')
All AOIs within the Facility boundaries are paved (with concrete or asphalt), with the exceptions of two areas off-site and adjacent to AOI6 and AOI29 which are not paved. There are no known releases attributed to GM in these areas and it is very likely that the contamination is attributed to use of historic fill. However, as a conservative position, the two unpaved off-site areas adjacent to AOI6 and AOI29 are considered contaminated and were included for evaluation for potential exposure. Note that the on-site soil data were used in the risk assessment. [Ref. 4]

This is a conservative assumption. The concentrations of certain constituents in soil (primarily PAHs and lead) are higher than the soil screening criteria at some AOIs, and these concentrations extend with decreasing trend toward parts of the Facility's eastern and western boundaries. So the off-site adjacent areas are expected to show less. Exposure of workers and trespassers to these constituents in soil at unpaved areas along these boundaries on the adjoining industrial properties is possible, as discussed in Q3. [Ref. 5]

Subsurface soil (>2')
As shown on Table 2-1a, the ratios for certain constituents are higher than 1 at the following 10 areas:

- AOI 3 – Existing Drum Storage Area/Fill Area
- AOI 6 – Paint Mix Building
- AOI 7 – Former Bulk Fluids AST
- AOI 8 – Former Powerhouse Heating Oil ASTs
- AOI 10 – Former Storage Shed
- AOI 11 – Former Reclamation Area
- AOI 20 – Bone Yard
- AOI 25 – Former Drum Storage Area
- AOI 28 – Southern Boundary Area
- AOI 29 – MW-18 Area

These AOIs all have constituents in soil with concentrations that are higher than the screening criteria based on direct contact. These constituents consist of primarily polycyclic aromatic hydrocarbons (PAHs) and lead. A few volatile organic compounds (VOCs) have concentrations higher than the screening criteria based on direct contact, and were found at only AOI 06 and AOI 07. Note that no AOI has constituents in soil with concentrations that are higher than the screening criteria based on vapor intrusion.

LNAPL in soil
In addition to the soil characterization data summarized on Table 2-1a, chemical characterization data were collected for a light nonaqueous-phase liquid (LNAPL) found at the water table in monitoring well MW-19S at AOI 6 during the RFI. Table 2-2a in Attachment B provides a summary of the LNAPL characterization data, which shows that the LNAPL contains relatively high concentrations of several VOCs, semi-volatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs). [Ref. 6]

The upper-bound smear zone soil concentrations estimated using the concentrations detected in the LNAPL at AOI 6 are shown on Table 2-2b in Attachment B, and are compared with the soil screening criteria discussed above. As shown on Table 2-2b, these concentrations are higher than the screening criteria, and therefore, the smear zone soil at AOI 6 meets the definition of "contamination."

Air (indoor):

Actual sampling of indoor-air was not conducted, but the potential for indoor-air impacts was indirectly evaluated based on groundwater and soil data. Indoor-air quality can potentially be impacted by groundwater (on-site and off-site scenarios) contaminated with VOCs. Indoor-air can also be impacted if an occupied building overlies soil that is contaminated with VOCs or LNAPL "smear zone" soil.

Vapor intrusion from groundwater contamination
Based on the groundwater data collected during the RFI, shallow groundwater with VOCs at concentrations higher than the vapor intrusion screening criteria do not appear to extend under any on-site buildings. Similarly, shallow groundwater with VOCs exceeding the vapor intrusion criteria do not appear to extend beyond the down-gradient Facility boundary. (The off-site groundwater vapor intrusion screening criterion scenario is based on residential setting.) Therefore, a current vapor intrusion pathway does not appear to exist on-site or off-site. However, as a conservative position, GM performed a risk assessment as part of the RFI Report with the conservative assumption that this exposure pathway for contaminated groundwater exists and then evaluated its significance for vapor intrusion. The significance of this assumed exposure potential is discussed below in Q.3 and Q.4 below.
[Ref. 7]

The two sets of groundwater screening criteria based on vapor intrusion were derived to identify groundwater conditions that might result in potentially significant indoor-air exposures if constituents in groundwater were to volatilize and migrate through cracks in building foundations into indoor air. One set of these criteria was used to identify such groundwater conditions on-site, and were derived in a manner similar to the derivation of the vapor intrusion criteria for soil. These criteria were derived using the same vapor intrusion modeling approach, the same soil properties, the same building characteristics, and the same PELs/TLVs. These criteria were used

to evaluate groundwater data collected from on-site monitoring wells screened at or near the water table (i.e., the upper aquifer), since groundwater quality nearest the water table is the most appropriate for evaluating the potential for vapor intrusion.

The second set of criteria was used to identify the potential for significant vapor intrusion off-site and down-gradient of the site. These criteria were derived in a manner similar to the derivation of the on-site criteria, except the building characteristics were based on conservative regulatory default assumptions for a hypothetical residential building, and they were calculated using USEPA-derived inhalation unit risk factors (URFs) and inhalation reference concentrations (RfCs). These criteria were used to evaluate groundwater data collected from the most down-gradient on-site monitoring wells screened at the upper aquifer. Derivation of both sets of vapor intrusion screening criteria for groundwater is discussed in Appendix M of the RFI Report. [Ref. 8]

Vapor intrusion from soil contamination
AOI 25 is the only area with contaminated soil located under an occupied building. Potential exposure of workers to constituents in soil at AOI 25 via vapor intrusion is theoretically possible, but no VOCs were detected in soil at AOI 25, and no concentration of SVOCs or PCBs were detected in soil at AOI 25 exceeding the screening criteria based on vapor intrusion. [Ref. 9] Therefore, it is reasonable to consider the exposure pathway for vapor intrusion from soil contaminated with VOCs does not exist.

Vapor intrusion from LNAPL "smear zone" soil contamination
No exposure of workers to constituents in the LNAPL at AOI 6 via vapor intrusion is possible either, because the LNAPL is not under an occupied building. (See Subsurface Soil above.) Therefore, it is reasonable to consider the exposure pathway for vapor intrusion from LNAPL "smear zone" soil does not reasonably exist.

Surface water:

There is no surface water body traversing the site. There is, however, a storm water sewer system which ultimately discharges to Morse Creek at about 600' north$^{(TN)}$ of the site.

Stormwater
The RFI stormwater characterization data are summarized on Table 2-5a in Attachment B, which shows the detected constituents, their detection frequencies, their ranges of detected concentrations, and the ratios of the highest measured concentrations to the screening criteria. The screening criteria on Table 2-5a are the same as the groundwater screening criteria based on drinking water exposures.
[Ref. 10]

The storm water samples were analyzed for only PAHs and lead on the basis of the concentrations found in the stormwater sewer sediment samples. (See below.) It is reasonable to consider the sediment samples had PAHs and lead at concentrations that were high enough to warrant sampling the storm water to determine whether these constituents might be transported in the dissolved phase at potentially significant concentrations. It is also reasonable to exclude arsenic because the highest concentration of arsenic (23 mg/kg) found in the storm sewer sediment is essentially equal to the NJ state-wide background concentration for arsenic in soil (20 mg/kg).

As shown on Table 2-5a, the only constituent in stormwater samples with concentrations higher than the screening criteria is lead. The locations at which lead concentrations in the storm water are considered to meet the definition of "contamination" are summarized on Table 2-5b in Attachment B and are discussed in Section 4 of the RFI Report. [Ref. 11]

Morses Creek
The three surface water samples collected from Morses Creek during the RFI were analyzed for only lead (the constituent expected to be associated with GM activity). Lead was not detected in two samples at a quantitation limit of 0.00022 mg/L and was detected at 0.0033 mg/L in the third sample. Because the detected concentration is lower than the MCL of 0.015 mg/L, which is a highly conservative criterion for evaluating recreational exposure to surface water, the surface water in Morses Creek does not meet the definition of "contamination."
[Ref. 12]

Sediment:

Stormwater sewer sediment
The RFI sediment characterization data from the stormwater sewers are summarized on Table 2-4a in Attachment B, which shows the detected constituents, their detection frequencies, their ranges of detected concentrations and the ratios of the highest measured concentrations to the screening criteria. The screening criteria on Table 2-4a are the same as the soil screening criteria based on direct contact.

As shown on Table 2-4a, the constituents in stormwater sewer sediment samples with concentrations higher than the screening criteria are primarily PAHs and lead. The locations at which concentrations in the stormwater sewer sediment are considered to meet the definition of "contamination" are summarized on Table 2-4b in Attachment B and are discussed in Section 4 of the RFI Report. [Ref. 13]

Morses Creek Sediment
The three sediment samples collected from Morses Creek during the RFI were analyzed for only lead. (Target Compound List SVOCs were not sampled at these locations because it was determined that off-site concentrations, based on the detections at the outfalls, would be similar and indistinguishable from anthropomorphic concentrations.) The lead concentration among these samples range from 21.3 mg/kg to 101 mg/kg. Since potential exposures associated with recreational contact with sediment in Morses Creek are expected to be much lower than residential contact with soil, comparison of these lead concentrations with USEPA's residential soil screening criterion of 400 mg/kg shows that the sediment in Morses Creek does not meet the definition of "contamination." [Ref. 14]

Air (Outdoors):

There are no AOIs that are a source of unacceptable outdoor-air impacts.

References:

1. RFI, Section 3
2. RFI Report, section 4.02.A
3. EI Doc, section 2.2.1
4. EI Doc, section 2.3.1, RFI Report, section 4.08
5. RFI Report, section 5.04.D.1
6. EI Doc, section 2.2.1
7. EI Doc, section 2.2.2
8. RFI Report, Appendix M
9. EI Doc, section 2.3.1
10. EI Doc, section 2.2.4
11. RFI Report, section 4
12. EI Doc, section 2.2.4
13. RFI Report, section 4
14. EI Doc, section 2.2.4
15. RFI Report, Appendix I

["EI Doc"] = ENVIRON International Corporation, 2004. Resource Conservation and Recovery Act Environmental Indicator CA725 Report Determination of Current Human Exposures Under Control, , GM Linden Assembly Plant, Linden, New Jersey. June 11, 2004.

["RFI Report"] = Haley & Aldrich. 2004. RCRA Facility Investigation Report, GM Linden Assembly Plant, Linden, New Jersey. June.

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

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

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) are shaded gray. While these conditions 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:

Groundwater:

The groundwater exposure pathway is considered complete for Construction (on-site and off-site) Worker. A **"No*"** entry is given for the Resident pathway as a conservative position and is explained below.

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

Potential exposure of construction workers (on-site and off-site) via contact with shallow groundwater during construction activities (on-site and off-site) that extend into the water table is possible where excavation is required.

It should be noted that groundwater is not used as a potable or nonpotable water supply at the Facility or within at least a one-mile radius downgradient of the Facility. The Facility and the surrounding area obtain potable water from surface water sources via the Elizabethtown Water Company. A survey of groundwater uses conducted during the RFI found no current groundwater use within approximately one mile of the Facility, as discussed in Section 3.09 of the RFI Report. [Ref. 1] Therefore, no exposure to groundwater via potable or nonpotable use currently exists at or around the Facility.

No* entry explanation: As discussed in Q2, based on groundwater data collected during the RFI, shallow groundwater with VOCs at concentrations higher than the vapor intrusion screening criteria do not appear to extend under any on-site buildings. Similarly, shallow groundwater with VOCs exceeding the vapor intrusion screening criteria does not appear to extend beyond the down-gradient Facility boundary. Therefore, based on current information, a current vapor intrusion pathway does not appear to exist on-site or off-site. However, the potential exposure to constituents in shallow contaminated groundwater off-site is considered possible via vapor intrusion in areas where groundwater with VOCs could migrate under buildings off-site (as a future scenario). GM conservatively assumes this pathway is complete—i.e., as a future scenario–and then evaluated the exposure significance. The significance of the potential exposures via vapor intrusion from groundwater migrating off-site is discussed in Q4.

Surface Soil (< 2'):

Although all the AOIs at the Facility is under pavement (concrete or asphalt), the surface soil exposure pathway is considered complete for Workers (off-site), Construction Workers (off-site), and Trespassers (off-site) due to the two off-site unpaved areas adjacent to AOI6 and AOI29. The two areas are Merck property and CSX property. Potential exposure of off-site workers to constituents in soil at unpaved areas along some parts of the Facility's western and eastern boundaries is possible. It should be noted that the two areas of uncovered soil contamination are not near any residential area.
[Ref. 2]

The exposure potential for Trespasser is also possible, but the risk is expected to be less than the risk for Workers.

Surface water:

Stormwater
The surface water exposure pathway is considered complete for Workers (on-site in stormwater sewer) and Construction Workers (on-site in stormwater sewer).

Morses Creek
The off-site surface water (Morses Creek) exposure pathway is not considered complete for Residents, Workers, Construction Workers, Trespassers, Recreation because the surface water in Morses Creek is not considered contaminated, based on current sampling data. [Ref. 3]

Sediment:

The Sediment exposure pathway is considered complete for Workers (on-site/off-site storm water sewer) and Recreationists.

Sediment and storm water that meet the definition of "contamination" were found in the stormwater sewers. Because portions of the storm sewers at the Facility extend off-site, workers could become potentially exposed to constituents in sediment and stormwater during occasional maintenance activities that require entry into the storm sewers.

Note that the sediment and surface water samples collected from Morses Creek during the RFI were analyzed for only lead. (See Q.2.) Target Compound List SVOCs were not sampled at these locations because it was determined that off-site concentrations, based on the detections at the outfalls, would be similar and indistinguishable from anthropomorphic concentrations.

The concentrations of lead in these sediment and surface water samples are lower than the screening criteria. However, certain PAHs in the storm sewer sediment, which have concentrations higher than the screening criteria, could possibly discharge to Morses Creek. Exposure of recreational waders to these PAHs in sediments in Morses Creek is therefore possible. PAH data taken at the catch basin was used to evaluate the potential risk to Recreators. (It is conservative to assume the same level of PAHs exist at Morses Creek sediments as was detected at the sediments in the catch basin on-site. Some attenuation is expected.) [Ref. 4]

Subsurface soil (>2'):

The subsurface soil exposure pathway is considered complete for Construction Workers only (on-site).

All areas at the Facility where soil is considered to be contaminated are either under pavement or under a building. This means workers at the Facility currently do not have a potential to contact contaminated soil during routine operations. During construction or maintenance activities that involve removal of pavement or excavation, such Construction Workers are potentially exposed to subsurface contamination—contaminated soil and LNAPL "smear zone" soil. [Ref. 5]

References

1. RFI Report, section 3.09
2. EI Doc, section 2.4.1
3. EI Doc, section 2.2.4.
4. EI Doc, section 2.2.3 and 2.2.4
5. RFI Report, section 4.

["EI Doc"] = ENVIRON International Corporation, 2004. Resource Conservation and Recovery Act Environmental Indicator CA725 Report Determination of Current Human Exposures Under Control, , GM Linden Assembly Plant, Linden, New Jersey. June 11, 2004.

["RFI Report"] = Haley & Aldrich. 2004. RCRA Facility Investigation Report, GM Linden Assembly Plant, Linden, New Jersey. June.

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 cannot 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:

Groundwater:

Construction Workers

The exposure pathway for groundwater is complete for Construction, but the exposure is considered insignificant. The exposure pathway for groundwater/LNAPL is also complete for Construction, but the exposure is considered insignificant.

Potential exposure of construction workers via contact with shallow groundwater during on-site/off-site construction activities that extend into the water table is possible. However, the potential for such exposures during on-site construction activities is considered insignificant because the Facility's health and safety procedures ensure that workers involved with these activities will not have a significant exposure.

The significance of potential exposures of construction workers (off-site) via contact with shallow groundwater is evaluated in the baseline risk assessment discussed in the RFI Report. Potential exposure of construction workers to shallow groundwater is evaluated using conservative exposure factors for incidental ingestion, dermal contact, and inhalation, in combination with USEPA-derived toxicity values. The assessment determined that the cumulative cancer risk and noncancer HI for this scenario are 2×10^{-8} and 1×10^{-2}, respectively, as shown in Table 5.7 in Attachment C. These conservative estimates of risks are insignificant, since they are much lower than the USEPA-established acceptable cumulative cancer risk and HI limits of 10^{-4} and 1, respectively.
[Ref. 1]

[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.

The risk estimates for exposure of construction workers to groundwater underlying the LNAPL at AOI 6 is included in Table 5.7 in Attachment C. These estimates are conservatively based on the concentrations detected in the water sample collected from under the LNAPL, which likely include contributions from NAPL in addition to the dissolved-phase. The estimates of cumulative cancer risk and HI are 6×10^{-6} and 0.9, respectively. These conservative estimates of risks are insignificant, since they are much lower than the USEPA-established acceptable cumulative cancer risk range (10^{-4} to 10^{-6}) and HI limits 1. [Ref. 2]

Residents
As a conservative assumption, the exposure pathway of groundwater to Residents was assumed to be complete. The significance of potential exposures via vapor intrusion off-site is also evaluated in the baseline risk assessment discussed in the RFI Report. Potential exposure of off-site residents via vapor intrusion is evaluated using USEPA-derived inhalation toxicity values (URFs and RfCs) with conservative vapor intrusion modeling for a hypothetical residential building. The assessment determined that the cumulative cancer risk and non cancer HI for this scenario are 2×10^{-10} and 7×10^{-6}, respectively, as shown in Table 5.10 in Attachment C. These conservative estimates of risks are insignificant, since they are much lower than the USEPA-established acceptable cumulative cancer risk and HI limits of 10^{-4} and 1, respectively. [Ref. 3]

Surface Soil (< 2'):

Workers, Construction Workers
Potential exposure of off-site workers to constituents in soil at two unpaved (landscaped) areas along the Facility's western and eastern boundaries is possible. In the risk assessment described in the RFI Report, the significance of these exposures is evaluated using on-site soil data within these boundaries. This approach is expected to be conservative because the on-site concentrations of these constituents (primarily PAHs and lead) decrease toward the Facility boundaries, so that the off-site concentrations of these constituents should be lower. [Ref. 4]

As a conservative position, the potential for exposure of workers to soil along the western Facility boundary across from AOI 29 (MW 18 Area) is evaluated using the soil data for AOI 29, and the potential for exposure of off-site workers to soil along the eastern Facility boundary is evaluated using the soil data within 100 ft of the Facility fence line. The cumulative cancer risk and hazard index (HI) estimates for exposure of workers at these areas are summarized on Table 2-6 in Attachment C, and the methods used in deriving the estimates are discussed in Section 5.06.B.1 of the RFI Report. These estimates of cumulative cancer and non cancer risks are insignificant since they are lower than the USEPA-established acceptable limits of 10^{-4} and 1, respectively (USEPA 1991).
[Ref. 5]

Trespassers
Trespassers to the facility are highly unlikely due to the 24-hr security and the site being entirely fenced. The risk associated with Trespassers to the two adjacent areas (off-site) are also expected to be less than the risk calculated for Workers due to the industrial setting and accessibility of the areas.

Surface water/Sediment:

Workers/Construction Workers

This exposure pathway is considered complete only for Workers in an on-site scenario. Exposure pathway for off-site surface water is not complete because the surface water (Morses Creek) is not considered contaminated, based on the sampling data. [Ref. 6]

The significance of potential exposures of construction workers via contact with sediment and stormwater in storm sewers is evaluated in the baseline risk assessment discussed in the RFI Report. Potential exposure of construction workers to sediment is evaluated using conservative exposure factors for incidental ingestion and dermal contact in combination with USEPA-derived toxicity values. The assessment determined that the cumulative cancer risk and non cancer HI for this scenario are 8×10^{-7} and 4×10^{-3}, respectively, as shown in Table 5.9 in Attachment C. These conservative estimates of risks are insignificant, since they are much lower than the USEPA-established acceptable cumulative cancer risk and HI limits of 10^{-4} and 1, respectively. [Ref. 7]

Potential exposure of construction workers to lead in stormwater is conservatively evaluated in the risk assessment by comparing the lead concentrations with the drinking water standard of 0.015 mg/L. This approach is highly conservative because exposure to lead in stormwater is much lower than exposure via drinking water consumption. The highest concentration of lead in stormwater samples collected during the RFI from the on-site storm sewers is 0.1 mg/L. This concentration is approximately 10 times higher than the MCL. However, the exposure of construction workers in this scenario is more than 1,000 times lower than exposure via drinking water. Therefore, potential exposure of constructions workers to the concentrations of lead in stormwater in the on-site sewers is considered to be insignificant. [Ref. 8]

Recreation

The sediment and surface water samples collected from Morses Creek during the RFI were analyzed for only lead. The concentrations of lead in these sediment and surface water samples are lower than the screening criteria—i.e., the sediment and surface water are not considered contaminated. However, certain poly-aromatic hydrocarbons (PAHs) in the stormwater sewer sediment, which have concentrations higher than the screening criteria, could possibly discharge to Morses Creek. Exposure of recreational waders to these potential PAHs in sediment in Morses Creek is therefore possible. [Ref. 9]

PAH data at the catch basin on-site was used to evaluate the potential risk to Recreators, (with the conservative assumption that the same level of PAH exist at Morses Creek). The significance of potential exposures of recreational waders via contact with sediment in Morses Creek is evaluated in the risk assessment discussed in the RFI Report. Potential exposure of recreational waders to sediment is evaluated using conservative exposure factors for incidental ingestion and dermal contact in combination with USEPA-derived toxicity values. The assessment determined that the cumulative cancer risk and non cancer HI for this scenario are 2×10^{-5} and 0.05, respectively, as shown in Table 5.11 in Attachment C. These conservative estimates of risks are insignificant, since they are much lower than the USEPA-established acceptable cumulative cancer risk and HI limits of 10^{-4} and 1, respectively.
[Ref. 10]

Subsurface soil (>2'):

Construction Workers

All areas at the Facility where soil is considered to be contaminated are either under pavement or under a building. This means workers at the Facility currently do not have a potential to contact contaminated soil during routine operations. During construction or maintenance activities that involve removal of pavement or excavation, such workers follow the Facility's health and safety procedures to avoid or minimize the potential for significant exposure to constituents in soil (and subsurface LNAPL at AOI 6). Therefore, the potential for current exposure to contaminated soil (and LNAPL at AOI 6) is considered insignificant at the site.

References

1. EI Doc, section 2.3.2, RFI Report, section 5.06.B.2
2. RFI Report, section 5.06.B.2 and section M5.2 of Appendix M
3. EI Doc, section 2.4.2
4. RFI Report, section 5.04.D.1
5. EI Doc, section 2.4.1; RFI Report, section 5.06.B.1
6. EI Doc, section 2.2.4
7. RFI Report, section M3.2 of Appendix M
8. RFI Report, section 5.06.C.2
9. EI Doc, section 2.2.4
10. RFI Report, section 5.6.2.5 and section M6.1 of Appendix M

["EI Doc"] = ENVIRON Internatio nal Corporation, 2004. Resource Conservation and Recovery Act Environmental Indicator CA725 Report Determination of Current Human Exposures Under Control, , GM Linden Assembly Plant, Linden, New Jersey. June 11, 2004.

["RFI Report"] = Haley & Aldrich. 2004. RCRA Facility Investigation Report, GM Linden Assembly Plant, Linden, New Jersey. June.

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:

This question is not applicable.

6. Check the appropriate RCRAINFO 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 Corporation – Linden Assembly Plant EPA ID Number NJD002186690, located at 1016 West Edgar Road, Linden, New Jersey, 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.

Attachments:

A. Figures 1, 2, 3, 4, and 5

B. Tables 2-1a, 2-2a, 2-3a, 2-3b, 2-3d, 2-3e, 2-3f, 2-4a, 2-4b, 2-5a, and 2-5b

C. Tables 2.6, 5.7, 5.9, 5.10, and 5.11

Completed by:

Clifford Ng, Signature: _____ Date: _____
Project Manager
RCRA Programs Branch
EPA Region 2

Barry Tornick, Section Chief Signature: _____ Date: _____
RCRA Programs Branch
EPA Region 2

Approved by:

Adolph Everett, P.E., Chief Signature: Original signed by: Date: September 30, 2004
RCRA Programs Branch
EPA Region 2

Locations where references may be found:

Referenced materials are available for review at two separate locations:

USEPA Region 2, RCRA Records Center, located at 290 Broadway, 15th Floor, New York, New York, 10007-1866.

New Jersey Department of Environmental Protection Office, located at 401 East State Street, Records Center, 6th Floor, Trenton, New Jersey, 08625.

Contact telephone and e-mail numbers:

Clifford Ng, EPA Project Manager
(212) 637-4113
ng.clifford@epamail.epa.gov

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.