

US EPA ARCHIVE DOCUMENT

**TABLE 6-1
CONCEPTUAL SITE MODEL - SCENARIOS FOR POTENTIAL HUMAN EXPOSURE**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Exposure Area	Receptor Population	Exposure Medium	Exposure Route	Scenario Timeframe		Comments
				Current	Future	
Onsite AOIs involving active operations	Routine Workers	surface soil	ingestion and dermal contact	Yes	Yes	Potential exposures are evaluated at areas without pavement and areas where pavement might be removed.
			inhalation of airborne particulates and vapors	Yes	Yes	
		subsurface soil	inhalation of soil vapors	Yes	Yes	Potential exposures via vapor intrusion through cracks in building foundations into indoor air are evaluated.
			groundwater	inhalation of groundwater vapors	Yes	
	LNAPL (including residual soil)		inhalation of LNAPL and residual soil vapors	Yes	Yes	
	Maintenance Workers	surface and subsurface soil	ingestion and dermal contact	Yes	Yes	Potential exposures for excavation up to 10 ft below surface are evaluated.
			inhalation of airborne particulates and vapors	Yes	Yes	
		groundwater	ingestion, dermal contact, and inhalation of vapors	Yes	Yes	Potential exposures are evaluated for construction and maintenance activities in the flooded basement/tunnel areas (AOI 36-3) in the storm water sewer, and where groundwater is shallow.
	LNAPL (including residual soil)	ingestion (residual soil only), dermal contact, and inhalation of vapors		Yes	Yes	Potential exposures for excavation up to 10 ft below surface are evaluated.
		Trespassers	surface soil	ingestion and dermal contact	Yes	Yes
inhalation of airborne particulates and vapors	Yes			Yes		
Onsite AOIs that are demolished and/or are planned for redevelopment.	Maintenance Workers	surface and subsurface soil	ingestion and dermal contact	Yes	Yes	Potential exposures for excavation up to 10 ft below surface are evaluated.
			inhalation of airborne particulates and vapors	Yes	Yes	
		groundwater	ingestion, dermal contact, and inhalation of vapors	Yes	Yes	Potential exposures are evaluated for construction and maintenance activities in the flooded basement/tunnel areas (AOIs 12-A, 23-A, 40-D), in the storm water sewer, and where groundwater is shallow.
		LNAPL (including residual soil)	ingestion (residual soil only), dermal contact, and inhalation of vapors	Yes	Yes	Potential exposures for excavation up to 10 ft below surface are evaluated.
	Trespassers	surface soil	ingestion and dermal contact	Yes	Yes	Potential exposures are evaluated at areas without pavement and areas where pavement might be removed.
			inhalation of airborne particulates and vapors	Yes	Yes	
	Routine Workers (Commercial and/or Industrial)	surface soil	ingestion and dermal contact	No	Yes	Potential exposures are evaluated at areas without pavement and areas where pavement might be removed.
			inhalation of airborne particulates and vapors	No	Yes	
		subsurface soil	inhalation of soil vapors	No	Yes	Potential exposures via vapor intrusion through cracks in building foundations into indoor air are evaluated.
		groundwater	inhalation of groundwater vapors	No	Yes	
LNAPL (including residual soil)	inhalation of LNAPL and residual soil vapors	No	Yes			

See Note on Page 2.

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**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Exposure Area	Receptor Population	Exposure Medium	Exposure Route	Scenario Timeframe		Comments
				Current	Future	
Onsite AOIs that are demolished and/or are planned for redevelopment (continued).	Redevelopment Construction Workers (Southend Only)	surface and subsurface soil	ingestion and dermal contact	No	Yes	Potential exposures for excavation up to 10 ft below surface are evaluated.
			inhalation of airborne particulates and vapors	No	Yes	
		groundwater	ingestion, dermal contact, and inhalation of vapors	No	Yes	Potential exposures are evaluated for construction and maintenance activities in the flooded basement/tunnel areas (AOIs 12-A, 23-A, 40-D), in the storm water sewer, and where groundwater is shallow.
		LNAPL (including residual soil)	ingestion (residual soil only), dermal contact, and inhalation of vapors	No	Yes	Potential exposures for excavation up to 10 ft below surface are evaluated.
	Recreational users (Southend Only)	surface soil	ingestion and dermal contact	No	Yes	Potential exposures are evaluated at areas without pavement and areas where pavement might be removed for future use as outdoor parks.
			inhalation of airborne particulates and vapors	No	Yes	
	Residents (Possible at Portions of the Southend Only)	surface soil	ingestion and dermal contact	No	Yes	Potential exposures are evaluated at areas that may be developed to residential areas (redevelopment plan to be determined).
			inhalation of airborne particulates and vapors	No	Yes	
		subsurface soil	inhalation of soil vapors	No	Yes	Potential exposures via vapor intrusion through cracks in building foundations into indoor air are evaluated for areas that may be developed to residential areas (redevelopment plan to be determined).
		groundwater	inhalation of groundwater vapors	No	Yes	
	LNAPL (including residual soil)	inhalation of LNAPL and residual soil vapors	No	Yes		
Offsite Areas	Routine Workers	surface and subsurface soil	ingestion and dermal contact	No	No	There is no site-related contamination of offsite soil.
			inhalation of airborne particulates and vapors	Yes	Yes	Potential airborne exposures to constituents in soil at the Site are evaluated.
		groundwater	inhalation of groundwater vapors	No	Yes	Potential exposures via vapor intrusion through cracks in building foundations into indoor air are evaluated. Potential exposure is only possible at areas downgradient of the site.
	Maintenance Workers	groundwater	ingestion, dermal contact, and inhalation of vapors	Yes	Yes	Potential exposures during construction where groundwater is less than 10 ft below surface are evaluated. Potential exposure is only possible at areas downgradient of the site.
	Recreational users	surface water	ingestion, dermal contact, and inhalation of vapors	Yes	Yes	Potential exposures during occasional recreation at Flint River are evaluated.
		fish	ingestion	Yes	Yes	
	Residents	surface and subsurface soil	ingestion and dermal contact	No	No	There is no site-related contamination of offsite soil.
			inhalation of airborne particulates and vapors	Yes	Yes	Potential airborne exposures to constituents in soil at the Site are evaluated.
		groundwater	inhalation of groundwater vapors	No	Yes	Potential exposures via vapor intrusion through cracks in future building foundations into indoor air are evaluated. Potential exposure is only possible at areas downgradient of the site that may be developed for residential use.

Note:

All worker activities in onsite areas are currently governed by OSHA regulations.

**TABLE 6-2
BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR ROUTINE WORKER AND MAINTENANCE
WORKER EXPOSURE TO SOIL**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Parcel	Routine Worker Soil Contact Risk	Routine Worker Soil Contact HI	Maintenance Worker Soil Contact Risk	Maintenance Worker Soil Contact HI
GM-North	03-1	--	7E-05	2E-01	2E-06	2E-01
GM-North	05-1	--	1E-05	4E-01	4E-07	1E-01
GM-North	05-2	--	1E-06	3E-04	2E-08	8E-06
GM-North	05-3	--	2E-06	2E-02	7E-08	6E-03
GM-North	05-4	--	8E-07	6E-03	2E-08	3E-04
GM-North	05-5	--	5E-07	3E-02	5E-08	3E-02
GM-North	05-6	--	9E-06	4E-02	2E-07	3E-03
GM-North	07-1	--	2E-05	5E-02	5E-07	2E-02
GM-North	07-2	--	2E-07	6E-05	3E-09	5E-06
GM-North	07-3	--	8E-06	6E-02	2E-07	1E-02
GM-North	10-1	--	2E-05	3E-01	3E-06	1E-01
GM-North	10-2	--	5E-05	4E-01	1E-06	7E-02
GM-North	10-3	--	1E-05	1E-01	5E-07	9E-02
GM-North	10-4	--	NA	NA	NA	NA
GM-North	21-1	--	7E-06	6E-02	2E-07	4E-02
GM-North	36-1	--	4E-04	1E+01	5E-06	6E-01
GM-North	36-2	--	1E-06	9E-02	1E-06	4E-02
GM-North	36-3	--	3E-06	3E-01	3E-08	7E-03
GM-North	36-4	--	8E-08	7E-03	1E-07	1E-03
GM-North	36-5	--	1E-05	2E-02	4E-07	1E-02
GM-North	38-1	--	3E-06	1E-02	6E-08	6E-03
GM-North	55-1	--	1E-05	1E-01	3E-07	5E-02
GM-North	65-1	--	2E-07	5E-05	4E-09	1E-06
GM-North	81-1	--	2E-05	2E-01	1E-06	6E-02
GM-North	81-2	--	5E-05	2E+01	2E-06	6E-01
GM-North	81-3	--	3E-05	1E-01	5E-07	3E-02
GM-North	81-4	--	7E-06	8E-04	1E-07	3E-05
GM-North	81-5	--	3E-06	3E-02	5E-08	2E-02
GM-North	83/84-1	--	2E-06	2E-02	2E-08	9E-04
GM-North	83/84-2	--	4E-04	9E-01	1E-05	3E-01
GM-North	83/84-3	--	2E-05	8E-02	3E-07	3E-03
GM-North	83/84-4	--	4E-05	2E-01	1E-06	4E-02
GM-North	83/84-5	--	3E-06	1E-03	6E-08	5E-05
GM-North	83/84-6	--	4E-05	4E-03	7E-07	1E-03
GM-North	83/84-7	--	5E-07	6E-03	8E-09	3E-04
GM-North	85-1	--	3E-06	6E-02	4E-08	3E-03
GM-North	86-1	--	9E-05	8E-01	2E-06	2E-01
GM-North	Former Aeration Lagoons	--	6E-06	1E-01	2E-07	4E-02
GM-South	02-A	1	2E-07	1E-02	8E-09	1E-03
GM-South	02-B	1	5E-06	5E-02	1E-07	2E-02
GM-South	02-C	1	8E-07	6E-02	1E-06	1E-02
GM-South	02-D	1	3E-05	5E-03	4E-07	2E-04
GM-South	02-E	1	2E-06	1E-02	4E-08	1E-03
GM-South	02-F	1	4E-07	1E-02	6E-08	1E-02
GM-South	04-A	1	7E-06	3E-03	1E-07	2E-04
GM-South	04-B	1	3E-06	7E-03	5E-08	8E-03
GM-South	04-C	1	4E-07	1E-02	6E-09	4E-04
GM-South	09-A	3	3E-04	8E-01	5E-06	4E-01
GM-South	09-B	3	8E-05	9E-01	2E-06	1E-01
GM-South	12-A	1	2E-05	6E-01	2E-06	1E-01
GM-South	12-B	1	1E-06	6E-02	2E-07	6E-02
GM-South	12-C	1	4E-08	1E-03	4E-10	3E-05
GM-South	12-D	1	1E-06	7E-03	3E-08	1E-02
GM-South	16-A	1	3E-06	2E-02	1E-07	5E-03
GM-South	16-B	1	3E-08	4E-03	5E-09	8E-04
GM-South	16-C	1	3E-05	2E-01	7E-07	4E-02
GM-South	16-D	1	3E-08	6E-03	2E-09	5E-03
GM-South	17-A	2	4E-06	6E-02	9E-08	3E-03

See Notes on Page 2.

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**TABLE 6-2
BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR ROUTINE WORKER AND MAINTENANCE
WORKER EXPOSURE TO SOIL**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Parcel	Routine Worker Soil Contact Risk	Routine Worker Soil Contact HI	Maintenance Worker Soil Contact Risk	Maintenance Worker Soil Contact HI
GM-South	23-A	1	2E-06	4E-03	3E-08	7E-04
GM-South	29-A	1	1E-06	5E-02	7E-07	1E-02
GM-South	40-A	1	2E-04	2E-01	3E-06	2E-02
GM-South	40-B	1	4E-06	1E-02	7E-08	8E-04
GM-South	40-C	1	1E-06	2E-02	3E-08	3E-02
GM-South	40-D	1	2E-06	2E-02	3E-08	1E-03
GM-South	44-A	1	7E-06	1E-01	8E-07	2E-01
GM-South	84-A	2	7E-06	4E-02	2E-07	3E-03
GM-South	84-B	2	1E-06	7E-03	4E-08	7E-04
GM-South	84-C	2	5E-06	3E-02	1E-07	2E-03
GM-South	84-D	2	3E-06	2E-02	1E-07	1E-02
GM-South	94-A	2	3E-06	3E-02	8E-08	4E-02
GM-South	94-B	2	1E-06	2E-03	2E-08	2E-04
GM-South	94-C	2	9E-07	1E-02	6E-08	1E-02
GM-South	94-D	2	4E-07	1E-03	9E-09	3E-04
GM-South	94-E	2	2E-06	1E-02	5E-08	6E-04
GM-South	Former Admin Building	6	2E-06	2E-02	5E-08	6E-03
GM-South	Build 94 Parking Lot	2	9E-06	5E-01	2E-07	2E-02
GM-South	FEP	4	2E-05	1E-02	3E-07	3E-04
GM-South	Harriet Street Area	7	7E-06	5E-01	1E-07	2E-02

Notes:

- Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI .
- Only AOIs where constituents were detected in soil are shown.
- Parcels at the Southend are defined in Section 6.5.2.1 of the RFI Phase II Report and shown on Figure 6-1.
- Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
- Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
- NA indicates that no organics were detected in AOI 10-4 and detected concentrations of metals in this AOI were below background levels.
- Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.

**TABLE 6-3
HIGH-END CUMULATIVE CANCER RISK AND HAZARD INDEX FOR ROUTINE WORKER
EXPOSURE TO SOIL**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Estimates of Bounding Risks for Surface Soil Concentrations		Estimates of High-End Risks for Surface Soil Concentrations	
	Routine Worker Cumulative Risk	Routine Worker HI	Routine Worker Cumulative Risk	Routine Worker HI
36-1	4E-05	3E-01	NA	NA
81-2	5E-05	2E+01	2E-05	4E-01
83/84-2	3E-05	6E-01	NA	NA

Notes:

1. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
2. NA indicates that the bounding estimates of risk were acceptable, therefore no high-end risks were calculated.
3. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
4. High-end cumulative risk estimates do not include the concentrations of 1,1-dichloroethane, 1,1,1-trichloroethane, and 1,1,2-trichloro-1,2,2-trifluoroethane from RFI-81-38 (1-3 foot depth) at AOI 81-2.
5. Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.

**TABLE 6-4
SOUTHEND LOCATIONS WITH UNACCEPTABLE BOUNDING CUMULATIVE CANCER RISK OR HI
FOR ROUTINE WORKER SOIL CONTACT**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Parcel	AOI	Location	Estimates of Bounding Risks		Area-Weighted Estimates of Risks	
			Routine Worker Soil Contact Risk	Routine Worker Soil Contact HI	Routine Worker Soil Contact Risk	Routine Worker Soil Contact HI
3	09-A	RFI-09-03	3E-04	2E-01	2E-05	2E-01
1	40-A	RFI-40-12	2E-04	3E-01	3E-05	9E-02

Notes:

1. Parcels at the Southend are defined in Section 6.5.2.1 of the RFI Phase II Report and shown on Figure 6-1.
2. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
3. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
4. Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.

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**TABLE 6-5
MEAN LEAD CONCENTRATIONS IN SOIL BY AOI**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Mean Lead Concentration in Surface Soil (mg/kg)	Ratio of Surface Mean to Industrial Criterion	Mean Lead Concentration in Soil at any Depth (mg/kg)	Ratio of any-Depth Mean to Industrial Criterion
GM-North	03-1	2.6E+02	2.9E-01	2.3E+02	2.5E-01
GM-North	05-1	4.7E+02	5.3E-01	5.2E+02	5.7E-01
GM-North	05-2	4.7E+00	5.2E-03	5.9E+00	6.5E-03
GM-North	05-3	3.9E+01	4.4E-02	9.1E+01	1.0E-01
GM-North	05-4	1.1E+01	1.2E-02	1.1E+01	1.2E-02
GM-North	05-5	2.1E+01	2.3E-02	2.8E+01	3.1E-02
GM-North	05-6	2.1E+01	2.3E-02	3.9E+02	4.4E-01
GM-North	07-1	5.5E+01	6.1E-02	5.2E+01	5.8E-02
GM-North	07-2	1.4E+01	1.6E-02	1.4E+01	1.6E-02
GM-North	07-3	1.8E+01	2.0E-02	1.8E+01	2.0E-02
GM-North	10-1	1.7E+02	1.9E-01	2.3E+02	2.5E-01
GM-North	10-2	6.2E+01	6.9E-02	4.8E+01	5.4E-02
GM-North	10-3	6.1E+01	6.8E-02	5.5E+01	6.1E-02
GM-North	10-4	NA	NA	6.0E+00	6.7E-03
GM-North	21-1	7.1E+01	7.9E-02	7.1E+01	7.9E-02
GM-North	36-1	3.9E+01	4.4E-02	3.9E+01	4.4E-02
GM-North	36-2	2.4E+01	2.6E-02	2.4E+01	2.6E-02
GM-North	36-3	1.0E+01	1.1E-02	1.7E+01	1.9E-02
GM-North	36-4	2.6E+01	2.8E-02	2.6E+01	2.8E-02
GM-North	36-5	1.1E+02	1.2E-01	1.1E+02	1.2E-01
GM-North	38-1	1.3E+01	1.5E-02	1.5E+01	1.6E-02
GM-North	55-1	3.7E+01	4.1E-02	4.1E+01	4.5E-02
GM-North	65-1	1.2E+01	1.3E-02	1.2E+01	1.3E-02
GM-North	81-1	2.3E+02	2.6E-01	1.3E+04	1.5E+01
GM-North	81-2	2.5E+02	2.7E-01	2.2E+02	2.5E-01
GM-North	81-3	3.9E+01	4.4E-02	6.4E+01	7.1E-02
GM-North	81-4	1.3E+01	1.4E-02	1.3E+01	1.4E-02
GM-North	81-5	3.8E+01	4.2E-02	3.6E+02	4.0E-01
GM-North	83/84-1	8.1E+00	9.0E-03	2.3E+01	2.5E-02
GM-North	83/84-2	4.1E+02	4.5E-01	1.2E+03	1.3E+00
GM-North	83/84-3	4.2E+03	4.6E+00	4.4E+03	4.9E+00
GM-North	83/84-4	1.4E+02	1.5E-01	1.9E+02	2.1E-01
GM-North	83/84-5	1.3E+01	1.4E-02	1.3E+01	1.4E-02
GM-North	83/84-6	8.6E+02	9.5E-01	8.6E+02	9.5E-01
GM-North	83/84-7	3.3E+01	3.7E-02	3.3E+01	3.7E-02
GM-North	85-1	2.0E+01	2.2E-02	3.1E+01	3.4E-02
GM-North	86-1	1.2E+02	1.3E-01	1.2E+02	1.3E-01
GM-North	Former Aeration Lagoons	6.9E+01	7.7E-02	3.8E+01	4.2E-02
GM-South	02-A	7.7E+02	8.6E-01	7.7E+02	8.6E-01
GM-South	02-B	1.4E+02	1.6E-01	1.7E+02	1.9E-01
GM-South	02-C	5.8E+02	6.5E-01	5.8E+02	6.5E-01
GM-South	02-D	6.7E+00	7.4E-03	4.2E+01	4.7E-02
GM-South	02-E	1.9E+01	2.1E-02	1.2E+02	1.3E-01
GM-South	02-F	1.0E+01	1.1E-02	2.1E+01	2.4E-02
GM-South	04-A	3.2E+01	3.6E-02	3.2E+01	3.6E-02
GM-South	04-B	2.2E+01	2.4E-02	3.2E+01	3.6E-02
GM-South	04-C	8.7E+00	9.7E-03	8.7E+00	9.7E-03
GM-South	09-A	6.9E+03	7.6E+00	7.0E+03	7.7E+00
GM-South	09-B	1.9E+02	2.1E-01	2.1E+02	2.4E-01
GM-South	12-A	5.4E+02	6.0E-01	9.8E+02	1.1E+00
GM-South	12-B	2.4E+02	2.7E-01	2.7E+02	3.0E-01
GM-South	12-C	5.5E+00	6.1E-03	6.2E+00	6.9E-03
GM-South	12-D	2.0E+01	2.2E-02	2.0E+01	2.2E-02
GM-South	16-A	4.1E+00	4.6E-03	1.1E+01	1.2E-02
GM-South	16-B	8.6E+00	9.6E-03	1.3E+01	1.4E-02
GM-South	16-C	6.7E+01	7.4E-02	7.1E+01	7.9E-02
GM-South	16-D	7.6E+00	8.4E-03	9.4E+00	1.0E-02
GM-South	17-A	1.7E+02	1.9E-01	1.7E+02	1.9E-01

See Notes on Page 2.

**TABLE 6-5
MEAN LEAD CONCENTRATIONS IN SOIL BY AOI**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Mean Lead Concentration in Surface Soil (mg/kg)	Ratio of Surface Mean to Industrial Criterion	Mean Lead Concentration in Soil at any Depth (mg/kg)	Ratio of any-Depth Mean to Industrial Criterion
GM-South	23-A	5.2E+01	5.8E-02	5.3E+01	5.9E-02
GM-South	29-A	6.9E+02	7.7E-01	6.9E+02	7.7E-01
GM-South	40-A	1.1E+02	1.2E-01	1.0E+02	1.1E-01
GM-South	40-B	1.2E+01	1.3E-02	1.2E+01	1.3E-02
GM-South	40-C	1.2E+01	1.3E-02	1.3E+01	1.4E-02
GM-South	40-D	2.3E+01	2.5E-02	2.3E+01	2.5E-02
GM-South	44-A	3.1E+01	3.5E-02	4.1E+01	4.5E-02
GM-South	84-A	3.0E+02	3.4E-01	3.0E+02	3.4E-01
GM-South	84-B	1.6E+01	1.8E-02	1.6E+01	1.8E-02
GM-South	84-C	1.4E+02	1.6E-01	1.4E+02	1.6E-01
GM-South	84-D	1.5E+02	1.7E-01	1.1E+02	1.2E-01
GM-South	94-A	4.2E+00	4.7E-03	1.0E+01	1.1E-02
GM-South	94-B	9.5E+01	1.1E-01	8.4E+01	9.3E-02
GM-South	94-C	1.3E+02	1.4E-01	1.4E+02	1.5E-01
GM-South	94-D	1.6E+02	1.8E-01	1.6E+02	1.8E-01
GM-South	94-E	7.5E+01	8.3E-02	7.5E+01	8.3E-02
GM-South	Former Admin Building	3.4E+01	3.7E-02	3.5E+01	3.8E-02
GM-South	Build 94 Parking Lot	5.0E+01	5.6E-02	5.1E+01	5.7E-02
GM-South	Harriet Street	NA	NA	1.2E+01	1.4E-02

Notes:

1. The site-specific background concentration for lead (93.5 mg/kg) was not subtracted from the concentrations when calculating ratios.
2. The industrial criterion for lead is 900 mg/kg.
3. NA indicates that no surface samples were analyzed for lead.

**TABLE 6-6
MAXIMUM LEAD CONCENTRATIONS BY BORING AT SOUTHEND
LOCATIONS**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Location	Max Conc (mg/kg)	Depth Interval (feet)
09-A	RFI-09-01	1.20E+05	1 - 3
09-A	RFI-09-01R *	1.20E+05	NA
12-A	RFI-12-02	1.10E+04	6 - 8
12-A	RFI-12-31	1.00E+04	0.7 - 2.7
12-A	RFI-12-35 *	1.00E+04	NA
09-A	RFI-09-02	6.90E+03	0.4 - 2
09-A	RFI-09-16	3.80E+03	1 - 3
09-A	RFI-09-56	2.65E+03	2 - 4
09-A	RFI-09-15	2.20E+03	1.9 - 3.9
02-C	RFI-02-03	2.00E+03	0.9 - 2
29-A	RFI-29-01	1.50E+03	0.6 - 2
09-A	RFI-09-18	1.40E+03	1 - 3
09-B	RFI-09-44	1.20E+03	0.7 - 2.7

Notes:

1. Only locations with lead concentrations greater than the industrial screening criterion (900 mg/kg) are shown.
2. The site-specific background concentration for lead (93.5 mg/kg) was not subtracted from concentrations presented here.
3. Locations marked with an asterisk (*) were not analyzed for lead. Concentrations at these locations were assigned by surrogate to the nearest location which was analyzed for lead. NA indicates that since no lead sample was collected, no depth interval is applicable.

**TABLE 6-7
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR ROUTINE WORKER EXPOSURE TO SOIL AND GROUNDWATER
 BY VAPOR INTRUSION**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Parcel	Soil Vapor Intrusion			Groundwater Vapor Intrusion		
		Vapor Intrusion Occupational Contribution from Soil	Routine Worker Soil Vapor Intrusion Risk	Routine Worker Soil Vapor Intrusion HI	Vapor Intrusion Occupational Contribution from GW	Routine Worker GW Vapor Intrusion Risk	Routine Worker GW Vapor Intrusion HI
03-1	--	2E-04	4E-06	2E-02	6E-06	5E-08	5E-04
05-1	--	8E-05	4E-06	3E-02	3E-06	3E-09	3E-04
05-2	--	5E-07	6E-11	1E-03	1E-05	8E-08	3E-04
05-3	--	1E-05	5E-07	7E-03	2E-07	8E-09	9E-05
05-4	--	3E-07	3E-16	5E-03	3E-12	NA	1E-09
05-5	--	1E-04	2E-06	1E-02	1E-06	2E-10	2E-04
05-6	--	1E-05	4E-07	5E-03	1E-05	1E-07	9E-04
07-1	--	4E-04	2E-06	7E-02	2E-06	9E-09	2E-04
07-2	--	NA	3E-11	4E-08	NA	NA	NA
07-3	--	1E-05	1E-06	4E-03	9E-09	3E-10	8E-06
10-1	--	2E-04	9E-07	5E-02	4E-06	2E-08	3E-03
10-2	--	3E-04	8E-06	3E-01	5E-05	2E-07	5E-03
10-3	--	4E-04	2E-06	1E-01	3E-04	2E-06	2E-02
10-4	--	NA	NA	NA	2E-06	1E-08	1E-04
21-1	--	3E-05	3E-07	4E-02	2E-09	2E-11	8E-08
36-1	--	5E-01	3E-03	7E+01	2E-04	1E-06	1E-02
36-2	--	2E-05	4E-08	1E-03	7E-04	5E-06	5E-02
36-3	--	4E-03	2E-05	1E+00	1E-03	6E-06	9E-02
36-4	--	3E-05	NA	1E-02	5E-08	1E-09	1E-04
36-5	--	4E-06	7E-08	3E-03	8E-06	6E-08	8E-04
38-1	--	1E-05	2E-07	6E-03	1E-06	8E-10	1E-04
55-1	--	5E-05	1E-06	4E-02	2E-05	1E-07	9E-03
65-1	--	1E-06	9E-08	1E-04	1E-07	1E-08	4E-04
81-1	--	4E-04	2E-06	1E-01	7E-06	3E-08	2E-04
81-2	--	4E-01	3E-05	2E+02	2E-06	3E-09	2E-04
81-3	--	8E-04	3E-05	2E-01	4E-05	2E-07	2E-03
81-4	--	3E-06	3E-07	8E-04	5E-08	7E-09	2E-05
81-5	--	4E-05	9E-07	6E-03	NA	NA	NA
83/84-1	--	2E-03	1E-05	2E-01	2E-07	2E-09	2E-05
83/84-2	--	3E-03	2E-05	3E-01	2E-06	4E-10	3E-04
83/84-3	--	2E-04	1E-09	2E-02	5E-09	4E-10	7E-06
83/84-4	--	8E-04	6E-06	6E-01	3E-09	NA	2E-05
83/84-5	--	3E-07	2E-10	8E-04	NA	NA	NA
83/84-6	--	2E-06	1E-07	2E-04	NA	NA	NA
83/84-7	--	2E-07	1E-09	6E-05	1E-04	6E-07	1E-02
85-1	--	4E-04	2E-05	2E-01	1E-06	5E-08	4E-04
86-1	--	4E-04	1E-05	9E-02	2E-04	2E-06	1E-02
Former Aeration Lagoons	--	5E-06	4E-08	3E-04	2E-11	NA	2E-09
02-A	1	NA	1E-12	NA	NA	NA	NA
02-B	1	7E-05	1E-07	1E-02	3E-07	3E-10	1E-04
02-C	1	NA	2E-13	3E-08	NA	NA	NA
02-D	1	2E-06	2E-09	2E-03	NA	NA	NA
02-E	1	1E-04	5E-07	2E-02	7E-08	5E-09	NA
02-F	1	6E-05	1E-11	4E-03	1E-06	3E-09	1E-04
04-A	1	2E-05	6E-07	2E-02	NA	NA	NA
04-B	1	1E-06	1E-07	1E-03	NA	NA	NA
04-C	1	4E-06	3E-07	5E-05	NA	NA	NA
04-D	1	NA	NA	NA	6E-07	7E-09	4E-04
09-A	3	7E-04	2E-05	9E-02	3E-06	8E-08	4E-04
09-B	3	1E-03	7E-06	2E-01	2E-04	1E-06	2E-02
12-A	1	4E-04	3E-06	2E-01	9E-07	3E-09	1E-03
12-B	1	1E-05	7E-08	1E-02	3E-08	2E-09	2E-08
12-C	1	8E-06	2E-07	4E-03	NA	NA	NA
12-D	1	4E-06	5E-07	2E-03	NA	NA	NA
16-A	1	6E-06	1E-07	3E-03	2E-09	NA	1E-06
16-B	1	8E-06	3E-07	2E-03	NA	NA	NA

See Notes on Page 2.

US EPA ARCHIVE DOCUMENT

**TABLE 6-7
BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR ROUTINE WORKER EXPOSURE TO SOIL AND GROUNDWATER
BY VAPOR INTRUSION**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Parcel	Soil Vapor Intrusion			Groundwater Vapor Intrusion		
		Vapor Intrusion Occupational Contribution from Soil	Routine Worker Soil Vapor Intrusion Risk	Routine Worker Soil Vapor Intrusion HI	Vapor Intrusion Occupational Contribution from GW	Routine Worker GW Vapor Intrusion Risk	Routine Worker GW Vapor Intrusion HI
16-C	1	2E-03	1E-05	4E-01	3E-05	2E-07	3E-03
16-D	1	5E-06	1E-07	3E-03	NA	NA	NA
17-A	2	2E-04	1E-06	9E-02	4E-09	NA	1E-06
23-A	1	2E-05	3E-07	4E-03	6E-09	2E-13	2E-06
29-A	1	6E-06	8E-11	1E-03	NA	NA	NA
40-A	1	2E-03	1E-05	4E-01	9E-04	5E-06	8E-02
40-B	1	1E-05	7E-07	3E-03	4E-06	5E-08	9E-04
40-C	1	3E-04	2E-06	3E-02	2E-06	4E-08	1E-04
40-D	1	3E-05	3E-06	1E-02	4E-06	2E-08	5E-04
44-A	1	2E-05	3E-07	9E-03	3E-07	2E-08	1E-08
84-A	2	6E-05	2E-06	6E-02	6E-05	4E-07	4E-03
84-B	2	3E-08	3E-11	3E-04	NA	NA	NA
84-C	2	6E-07	3E-11	1E-04	NA	NA	NA
84-D	2	1E-04	9E-06	4E-02	3E-04	2E-06	2E-02
94-A	2	6E-07	8E-17	1E-03	NA	NA	NA
94-B	2	3E-06	6E-11	3E-04	3E-06	3E-07	3E-04
94-C	2	5E-06	3E-08	4E-03	NA	NA	NA
94-D	2	2E-06	3E-07	2E-07	2E-09	2E-10	NA
94-E	2	4E-06	3E-11	3E-03	NA	NA	NA
Former Admin Building	6	7E-06	7E-08	3E-04	1E-05	9E-08	1E-03
Build 94 Parking Lot	2	5E-06	1E-07	2E-04	4E-09	1E-11	NA
FEP	4	5E-06	2E-07	1E-02	NA	NA	NA
Harriet Street Area	7	6E-04	3E-06	4E-01	7E-06	4E-08	5E-04

Notes:

1. Values highlighted in bold are above the USEPA risk limits of 10⁻⁴ or 1 for cancer risk and HI, respectively.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI .
3. NA indicates that the medium was not sampled in that AOI, or that chemicals with risk- or occupational-based volatilization criteria were all non-detect.
4. Parcels at the Southend are defined in Section 6.5.2.1 of the RFI Phase II Report and shown on Figure 6-1.

US EPA ARCHIVE DOCUMENT

**TABLE 6-8
ESTIMATED INDOOR AIR CONTRIBUTION AND BOUNDING CUMULATIVE
CANCER RISK AND HI FOR ROUTINE WORKER EXPOSURE TO LNAPL BY
VAPOR INTRUSION**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Routine Worker NAPL Vapor Intrusion Risk	Routine Worker NAPL Vapor Intrusion HI	Vapor Intrusion Occupational Contribution from NAPL
02-B	NA	5E-09	NA
03-1	3E-08	6E-04	5E-06
05-1	7E-09	4E-04	4E-07
05-5	3E-10	NA	4E-09
09-B	3E-05	6E-01	6E-03
10-1	NA	8E-09	NA
10-4	3E-07	8E-03	5E-05
12-A	5E-09	6E-04	5E-07
12-B	1E-08	8E-04	2E-06
12-C	1E-08	2E-04	2E-06
16-C	3E-07	3E-02	5E-06
23-A	3E-09	5E-05	6E-07
36-1	1E-04	2E+00	2E-02
36-2	NA	9E-03	7E-07
36-5	3E-08	2E-03	3E-06
40-A	5E-07	6E-03	8E-05
81-2	NA	9E-06	2E-08
83/84-2	4E-08	8E-04	5E-06
83/84-4	1E-07	1E-03	3E-05
85-1	1E-09	2E-04	2E-07
86-1	3E-09	6E-04	7E-07

Notes:

1. The criteria are Michigan OSHA threshold limit values (TLVs), OSHA permissible exposure limits (PELs) for chemicals without Michigan OSHA TLVs, or ACGIH TLVs for chemicals without Michigan OSHA TLVs or PELs. The criteria for 1,2,4-Trichlorobenzene are from the MDEQ Remediation and Redevelopment Division, Part 201/213 Acceptable Indoor Air Concentrations, 2003.
2. NA indicates that chemicals with the relevant toxicity values or occupational limits that could potentially volatilize were all non-detect.

US EPA ARCHIVE DOCUMENT

**TABLE 6-9
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR
 MAINTENANCE WORKER EXPOSURE TO GROUNDWATER**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Maintenance Worker GW Contact Risk	Maintenance Worker GW Contact HI
GM-North	03-1	2E-07	1E-02
GM-North	05-1	4E-08	2E-03
GM-North	05-2	1E-07	5E-03
GM-North	05-3	7E-08	2E-03
GM-North	05-4	8E-10	1E-04
GM-North	05-5	5E-08	2E-03
GM-North	05-6	2E-07	7E-03
GM-North	07-1	2E-08	1E-03
GM-North	07-3	2E-09	4E-04
GM-North	10-1	5E-08	3E-02
GM-North	10-2	5E-07	3E-02
GM-North	10-3	3E-06	6E-02
GM-North	10-4	5E-08	2E-03
GM-North	21-1	2E-06	3E-03
GM-North	36-1	3E-06	7E-02
GM-North	36-2	1E-05	3E-01
GM-North	36-3	1E-05	5E-01
GM-North	36-4	5E-09	8E-04
GM-North	36-5	1E-07	6E-03
GM-North	38-1	6E-09	2E-03
GM-North	55-1	6E-07	1E+00
GM-North	65-1	2E-08	3E-03
GM-North	81-1	1E-07	3E-03
GM-North	81-2	2E-07	3E-03
GM-North	81-3	4E-07	1E-02
GM-North	81-4	1E-08	3E-04
GM-North	83/84-1	9E-09	5E-04
GM-North	83/84-2	6E-09	6E-03
GM-North	83/84-3	3E-08	3E-03
GM-North	83/84-4	8E-08	2E-02
GM-North	83/84-5	2E-09	2E-04
GM-North	83/84-7	1E-06	7E-02
GM-North	85-1	9E-08	5E-03
GM-North	86-1	3E-06	1E-01
GM-North	Former Aeration Lagoons	2E-08	4E-04
GM-South	02-B	5E-10	8E-03
GM-South	02-E	2E-07	3E-02
GM-South	02-F	1E-07	2E-02
GM-South	04-D	2E-07	2E-02
GM-South	09-A	2E-07	2E-02
GM-South	09-B	4E-06	3E-01
GM-South	12-A	5E-08	5E-02
GM-South	12-B	7E-08	1E-02
GM-South	16-A	5E-09	6E-04
GM-South	16-C	5E-07	2E-02
GM-South	17-A	2E-08	6E-04
GM-South	23-A	3E-08	4E-04
GM-South	40-A	1E-05	5E-01
GM-South	40-B	8E-08	6E-03
GM-South	40-C	7E-08	3E-03
GM-South	40-D	2E-07	3E-02
GM-South	44-A	8E-07	1E-01
GM-South	84-A	7E-07	2E-02
GM-South	84-D	4E-06	1E-01
GM-South	94-B	4E-07	7E-03
GM-South	94-D	1E-09	1E-04

See Notes on Page 2.

US EPA ARCHIVE DOCUMENT

**TABLE 6-9
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR
 MAINTENANCE WORKER EXPOSURE TO GROUNDWATER**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Maintenance Worker GW Contact Risk	Maintenance Worker GW Contact HI
GM-South	Former Admin Building	2E-07	7E-03
GM-South	Build 94 Parking Lot	6E-10	1E-06
GM-South	FEP	3E-07	3E-04
GM-South	Harriet Street Area	1E-07	3E-03

Notes:

1. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI.
3. Only AOIs where constituents were detected in groundwater are shown.

**TABLE 6-10
BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR MAINTENANCE WORKER EXPOSURE TO SMEAR ZONE SOIL AND LNAPL**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Smear Zone Soil				LNAPL			Smear Zone Soil				LNAPL			
	Ingestion	Dermal Contact	Vapor Inhalation	Total	Dermal Contact	Vapor Inhalation	Total	Ingestion	Dermal Contact	Vapor Inhalation	Total	Dermal Contact	Vapor Inhalation	Total	
	Maintenance Worker Risk							Maintenance Worker HI							
02-B	NA	NA	NA	NA	NA	NA	NA	5E-06	2E-06	7E-06	1E-05	2E-05	1E-07	2E-05	
03-1	2E-07	1E-07	2E-08	3E-07	2E-07	4E-07	6E-07	6E-05	2E-05	4E-03	4E-03	5E-04	2E-02	2E-02	
05-1	5E-09	2E-09	8E-09	2E-08	2E-09	8E-08	9E-08	9E-04	4E-04	7E-05	1E-03	3E-04	1E-02	1E-02	
05-5	9E-08	4E-08	1E-07	3E-07	3E-08	2E-09	3E-08	2E-02	7E-03	NA	2E-02	5E-03	NA	5E-03	
09-B	2E-08	2E-10	6E-06	6E-06	2E-06	4E-04	5E-04	1E-03	1E-04	5E-01	5E-01	9E-02	2E+01	2E+01	
10-1	7E-10	7E-11	NA	7E-10	4E-07	NA	4E-07	2E-05	3E-06	9E-06	3E-05	1E-01	2E-07	1E-01	
10-4	7E-09	7E-10	5E-08	6E-08	4E-06	4E-06	8E-06	2E-04	2E-05	3E-02	3E-02	1E+00	2E-01	1E+00	
12-A	3E-09	3E-10	4E-10	4E-09	2E-06	1E-07	2E-06	3E-04	8E-05	2E-02	2E-02	2E-01	2E-02	3E-01	
12-B	1E-09	1E-10	7E-10	2E-09	7E-07	3E-07	9E-07	3E-04	8E-05	2E-02	2E-02	1E+00	3E-02	1E+00	
12-C	6E-09	3E-09	1E-08	2E-08	2E-07	2E-07	3E-07	1E-03	5E-04	1E-04	2E-03	1E-01	6E-03	1E-01	
16-C	6E-08	2E-08	1E-07	2E-07	3E-06	5E-06	9E-06	6E-03	2E-03	7E-01	7E-01	2E-01	1E+00	1E+00	
23-A	3E-09	8E-10	6E-10	4E-09	3E-07	5E-08	3E-07	2E-04	5E-05	2E-03	2E-03	4E-01	2E-03	4E-01	
36-1	5E-08	6E-11	2E-05	2E-05	4E-06	1E-03	1E-03	4E-03	2E-04	1E+00	1E+00	3E-01	5E+01	6E+01	
36-2	1E-09	1E-10	NA	1E-09	6E-07	NA	6E-07	3E-05	5E-06	2E-04	2E-04	2E-01	3E-01	4E-01	
36-5	6E-11	5E-12	3E-09	3E-09	3E-08	4E-07	5E-07	1E-04	5E-05	1E-02	1E-02	9E-02	5E-02	1E-01	
40-A	2E-10	NA	8E-08	8E-08	2E-08	6E-06	6E-06	7E-06	NA	2E-03	3E-03	6E-04	2E-01	2E-01	
81-2	NA	NA	NA	NA	NA	NA	NA	4E-06	2E-06	2E-05	3E-05	3E-05	4E-04	5E-04	
83/84-2	4E-08	2E-08	5E-08	1E-07	4E-07	6E-07	1E-06	6E-03	3E-03	1E-02	2E-02	1E-01	2E-02	2E-01	
83/84-4	2E-09	2E-10	2E-09	4E-09	1E-06	2E-06	4E-06	5E-05	4E-06	1E-04	2E-04	3E-01	4E-02	3E-01	
85-1	2E-09	6E-10	2E-09	4E-09	3E-07	2E-08	4E-07	3E-04	1E-04	5E-03	5E-03	1E-01	5E-03	1E-01	
86-1	5E-09	2E-09	7E-09	1E-08	7E-07	1E-07	8E-07	8E-04	3E-04	1E-02	1E-02	4E-01	3E-02	4E-01	
Outfall 004	NA	NA	NA	NA	2E-06	9E-09	2E-06	NA	NA	NA	NA	1E-01	1E-01	2E-01	
Storm Sewer (SS)	NA	NA	NA	NA	9E-08	NA	9E-08	NA	NA	NA	NA	2E-01	3E-05	2E-01	

Notes:

1. NA = Risks were not calculated due to a lack of exposure or toxicity information for detected chemicals in the AOI.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations for LNAPL and estimated residual soil concentrations in each AOI.
3. Values highlighted in bold are above the USEPA risk limits of 10⁻⁴ or 1 for cancer risk and HI, respectively.

**TABLE 6-11
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR
 MAINTENANCE WORKER EXPOSURE TO BASEMENT, TUNNEL, AND
 SEWER WATER**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Matrix	Maintenance Worker Contact Risk	Maintenance Worker Contact HI
12-A	Basement Water	7E-08	1E-02
23-A	Basement Water	5E-05	5E-02
36-3	Basement Water	1E-06	6E-02
40-D	Tunnel Water	5E-07	4E-02
SS	Storm Sewer Water	2E-06	3E-01

Notes:

1. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI.

**TABLE 6-12
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR REDEVELOPMENT
 CONSTRUCTION WORKER AND RESIDENT EXPOSURE TO SOIL AT THE SOUTHEND**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Parcel	Redevelopment Construction Worker Soil Contact Risk	Redevelopment Construction Worker Soil Contact HI	Resident Soil Contact Risk	Resident Soil Contact HI
02-A	1	2E-08	6E-02	9E-07	1E-01
02-B	1	5E-07	6E-01	2E-05	2E-01
02-C	1	2E-06	2E-01	2E-06	5E-01
02-D	1	2E-06	2E-02	1E-04	1E-02
02-E	1	2E-07	8E-02	1E-05	7E-02
02-F	1	1E-07	2E-01	2E-06	5E-02
04-A	1	6E-07	7E-03	3E-05	1E-02
04-B	1	2E-07	2E-01	1E-05	3E-02
04-C	1	5E-08	8E-03	2E-06	4E-02
09-A	3	3E-05	7E+00	1E-03	3E+00
09-B	3	9E-06	3E+00	4E-04	3E+00
12-A	1	4E-06	4E+00	1E-04	3E+00
12-B	1	5E-07	1E+00	8E-06	2E-01
12-C	1	2E-08	1E-02	7E-08	2E-03
12-D	1	2E-07	2E-01	7E-06	3E-02
16-A	1	4E-07	7E-02	2E-05	1E-01
16-B	1	2E-08	3E-02	5E-08	3E-02
16-C	1	4E-06	1E+00	1E-04	6E-01
16-D	1	1E-08	1E-01	5E-08	3E-02
17-A	2	5E-07	2E-01	2E-05	2E-01
23-A	1	2E-07	3E-02	9E-06	1E-02
29-A	1	1E-06	2E-01	6E-06	3E-01
40-A	1	1E-05	1E+00	8E-04	7E-01
40-B	1	4E-07	2E-02	2E-05	5E-02
40-C	1	2E-07	5E-01	7E-06	6E-02
40-D	1	3E-07	4E-02	9E-06	1E-01
44-A	1	2E-06	3E+00	3E-05	6E-01
84-A	2	8E-07	2E-01	3E-05	2E-01
84-B	2	2E-07	9E-03	9E-06	4E-02
84-C	2	6E-07	4E-02	3E-05	2E-01
84-D	2	7E-07	3E-01	1E-05	1E-01
86-1	1	1E-05	3E+00	6E-04	4E+00
94-A	2	4E-07	6E-01	2E-05	2E-01
94-B	2	9E-08	1E-02	5E-06	6E-03
94-C	2	2E-07	2E-01	4E-06	7E-02
94-D	2	5E-08	8E-03	2E-06	8E-03
94-E	2	2E-07	1E-02	1E-05	6E-02
Former Admin Building	6	2E-07	1E-01	1E-05	1E-01
Build 94 Parking Lot	2	1E-06	4E-01	4E-05	2E+00
FEP	4	2E-06	8E-02	8E-05	2E-02
Harriet Street	7	9E-07	1E+00	3E-05	1E+00

Notes:

- Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI .
- Only AOIs where constituents were detected in soil are shown.
- Parcels at the Southend are defined in Section 6.5.2.1 of the RFI Phase II Report and shown on Figure 6-1.
- Values highlighted in bold are above the USEPA risk limits of 10⁻⁴ or 1 for cancer risk and HI, respectively.
- Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
- AOI 86-1 is part of the Northend, but contains nine soil locations on Parcel 1 in the Southend. The cumulative risk and HI for the redevelopment construction worker and resident at AOI 86-1 is based on concentrations detected in the Parcel 1 locations.
- Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.

US EPA ARCHIVE DOCUMENT

**TABLE 6-13
SOUTHEND LOCATIONS WITH UNACCEPTABLE BOUNDING CUMULATIVE CANCER RISK OR HI FOR
REDEVELOPMENT WORKER SOIL CONTACT**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Parcel	AOI	Location	Estimates of Bounding Risks		Area-Weighted Estimates of Risks	
			Redevelopment Worker Soil Contact Risk	Redevelopment Worker Soil Contact HI	Redevelopment Worker Soil Contact Risk	Redevelopment Worker Soil Contact HI
3	09-A	RFI-09-04	1E-06	6E+00	8E-07	9E-01
3	09-A	RFI-09-49	9E-07	2E+00	8E-07	9E-01
3	09-A	RFI-09-25	9E-07	2E+00	8E-07	9E-01
3	09-A	RFI-09-24	8E-07	2E+00	8E-07	9E-01
1	44-A	RFI-44-05	5E-06	3E+00	4E-06	6E-01
1	86-1	RFI-86-01	3E-06	2E+00	2E-06	9E-01

Notes:

1. Parcels at the Southend are defined in Section 6.5.2.1 of the Revised RFI Phase II Report and shown on Figure 6-1.
2. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
3. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
4. Lead is evaluated in Section 6.5.2.1 of the Revised RFI Phase II Report and shown on Table 6-5.

**TABLE 6-14
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR
 REDEVELOPMENT CONSTRUCTION WORKER EXPOSURE TO
 GROUNDWATER AT THE SOUTHEND**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Area	AOI	Redevelopment Worker GW Contact Risk	Redevelopment Worker GW Contact HI
GM-South	02-B	5E-11	7E-03
GM-South	02-E	2E-08	1E-02
GM-South	02-F	1E-08	8E-03
GM-South	04-D	2E-08	1E-02
GM-South	09-A	2E-08	9E-03
GM-South	09-B	4E-07	2E-01
GM-South	12-A	5E-09	5E-02
GM-South	12-B	7E-09	5E-03
GM-South	16-A	5E-10	3E-04
GM-South	16-C	5E-08	1E-02
GM-South	17-A	2E-09	2E-04
GM-South	23-A	3E-09	4E-04
GM-South	40-A	1E-06	3E-01
GM-South	40-B	8E-09	2E-03
GM-South	40-C	7E-09	2E-03
GM-South	40-D	2E-08	1E-02
GM-South	44-A	8E-08	5E-02
GM-South	84-A	7E-08	7E-03
GM-South	84-D	4E-07	8E-02
GM-South	94-B	4E-08	6E-03
GM-South	94-D	1E-10	6E-05
GM-South	Former Admin Building	2E-08	4E-03
GM-South	Build 94 Parking Lot	6E-11	1E-06
GM-South	Harriet Street Area	1E-08	2E-03

Notes:

1. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI.

**TABLE 6-15
BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR REDEVELOPMENT CONSTRUCTION WORKER EXPOSURE TO
SMEAR ZONE SOIL AND LNAPL AT THE SOUTHEND**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Smear Zone Soil				LNAPL			Smear Zone Soil				LNAPL		
	Ingestion	Dermal Contact	Vapor Inhalation	Total	Dermal Contact	Vapor Inhalation	Total	Ingestion	Dermal Contact	Vapor Inhalation	Total	Dermal Contact	Vapor Inhalation	Total
	Redevelopment Construction Worker Risk							Redevelopment Construction Worker HI						
02-B	NA	NA	NA	NA	NA	NA	NA	5E-07	2E-07	4E-07	1E-06	2E-07	2E-09	2E-07
09-B	2E-09	2E-11	4E-07	4E-07	2E-07	9E-06	9E-06	9E-04	9E-05	3E-01	3E-01	5E-03	3E+00	3E+00
12-A	3E-10	3E-11	2E-11	4E-10	2E-07	3E-09	2E-07	2E-04	6E-05	1E-02	1E-02	1E-02	4E-03	2E-02
12-B	1E-10	1E-11	5E-11	2E-10	7E-08	5E-09	7E-08	2E-04	7E-05	1E-02	1E-02	2E-02	6E-03	3E-02
12-C	6E-10	3E-10	6E-10	1E-09	2E-08	3E-09	2E-08	4E-04	2E-04	6E-05	6E-04	4E-03	7E-04	4E-03
16-C	6E-09	2E-09	8E-09	2E-08	3E-07	1E-07	4E-07	5E-03	2E-03	4E-01	5E-01	9E-03	2E-01	2E-01
23-A	3E-10	8E-11	4E-11	4E-10	3E-08	9E-10	3E-08	1E-04	2E-05	1E-03	1E-03	2E-02	2E-04	2E-02
40-A	2E-11	NA	5E-09	5E-09	2E-09	1E-07	1E-07	7E-06	NA	8E-04	8E-04	6E-05	2E-02	2E-02

Notes:

1. NA = Risks were not calculated due to a lack of exposure or toxicity information for detected chemicals in the AOI.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations for LNAPL and estimated residual soil concentrations in each AOI.
3. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.

**TABLE 6-16
SOUTHEND LOCATIONS WITH UNACCEPTABLE BOUNDING CUMULATIVE CANCER RISK OR
HI FOR RESIDENTIAL SOIL CONTACT**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Parcel	AOI	Location	Estimates of Bounding Risks for Surface Soil Concentrations		Area-Weighted Estimates of Risks for Surface Soil Concentrations	
			Residential Soil Contact Risk	Residential Soil Contact HI	Residential Soil Contact Risk	Residential Soil Contact HI
2	Build 94 Parking Lot	BD 94 EP-02	7E-05	2E+00	NA	NA
2	Build 94 Parking Lot	EP 94-02A	7E-05	2E+00	NA	NA
3	09-A	RFI-09-02	1E-04	2E+00	NA	NA
3	09-A	RFI-09-03	1E-03	8E-01	1E-04	1E+00
3	09-B	RFI-09-05	1E-04	3E+00	5E-05	2E-01
3	09-A	RFI-09-19	2E-04	7E-01	1E-04	1E+00
3	09-A	RFI-09-38	1E-04	2E+00	NA	NA
3	09-A	RFI-09-39	2E-04	7E-02	1E-04	1E+00
3	09-B	RFI-09-45	3E-04	5E-01	NA	NA
3	09-B	RFI-09-45R	2E-04	9E-02	NA	NA
1	12-A	RFI-12-31	2E-05	2E+00	2E-05	1E+00
1	12-A	RFI-12-35	2E-05	2E+00	2E-05	1E+00
1	40-A	RFI-40-12	8E-04	8E-01	1E-04	3E-01
1	40-A	RFI-40-16	2E-04	4E-01	1E-04	3E-01
1	40-A	RFI-40-17	2E-04	4E-01	1E-04	3E-01
1	86-1	RFI-86-07	3E-04	2E+00	NA	NA
1	86-1	RFI-86-12	1E-04	2E+00	NA	NA
1	86-1	RFI-86-17	5E-04	3E+00	NA	NA

Notes:

1. Parcels at the Southend are defined in Section 6.5.2.1 of the RFI Phase II Report and shown on Figure 6-1.
2. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
3. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
4. Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.
5. NA indicates that area-weighted risks were not calculated for that location because its Thiessen polygon (or nearby group of Thiessen polygons with similar risk estimates) was 1/2 acre or larger.

US EPA ARCHIVE DOCUMENT

**TABLE 6-17
SOUTHEND LOCATIONS WITH LEAD CONCENTRATIONS IN SHALLOW
SOIL GREATER THAN RESIDENTIAL CRITERION**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Location	Lead Concentration (mg/kg)	Depth Interval (feet)
09-A	RFI-09-01	1.20E+05	1 - 3
09-A	RFI-09-01R *	1.20E+05	NA
12-A	RFI-12-31	1.00E+04	0.7 - 2.7
12-A	RFI-12-35 *	1.00E+04	NA
09-A	RFI-09-02	6.90E+03	0.4 - 2
09-A	RFI-09-16	3.80E+03	1 - 3
09-A	RFI-09-15	2.20E+03	1.9 - 3.9
02-C	RFI-02-03	2.00E+03	0.9 - 2
29-A	RFI-29-01	1.50E+03	0.6 - 2
09-A	RFI-09-18	1.40E+03	1 - 3
09-B	RFI-09-44	1.20E+03	0.7 - 2.7
12-A	RFI-12-33	8.50E+02	1 - 2
02-A	RFI-02-01	7.70E+02	1 - 2
12-A	RFI-12-30	7.30E+02	0.7 - 2.7
84-A	RFI-84-01	6.00E+02	0.5 - 2
02-B	RFI-02-22	5.74E+02	0 - 3
09-B	RFI-09-10	5.30E+02	0.8 - 2
40-A	RFI-40-09	4.90E+02	0.7 - 2.7
29-A	RFI-29-03	4.70E+02	1 - 3
12-B	RFI-12-11D	4.60E+02	1.1 - 3.1
12-B	RFI-12-14 *	4.60E+02	NA
09-B	RFI-09-45	4.40E+02	0.5 - 2.5
09-B	RFI-09-45R *	4.40E+02	NA
09-A	RFI-09-36R	4.30E+02	0.3 - 2.3
84-A	RFI-84-06	4.30E+02	0.9 - 2
09-A	RFI-09-39	4.20E+02	0.5 - 2.5

Notes:

1. Only locations with shallow lead concentrations greater than the residential screening criterion (400 mg/kg) are shown.
2. The background concentration of lead is 93.5 mg/kg, and was not subtracted from presented concentrations.
3. Locations marked with an asterisk (*) were not analyzed for lead. Concentrations at these locations were assigned by surrogate to the nearest location which was analyzed for lead. NA indicates that since no lead sample was collected, no depth interval is applicable.
4. The area-weighted average lead concentration for a 1/2 acre lot centered on RFI-40-09 is 190 mg/kg, which is less than the residential screening criterion.

**TABLE 6-18
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR RESIDENTIAL
 EXPOSURE TO SOIL AND GROUNDWATER BY VAPOR INTRUSION AT THE SOUTHEND**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Parcel	Soil Vapor Intrusion		GW Vapor Intrusion	
		Residential Soil Vapor Intrusion Risk	Residential Soil Vapor Intrusion HI	Residential GW Vapor Intrusion Risk	Residential GW Vapor Intrusion HI
02-A	1	4E-12	NA	NA	NA
02-B	1	3E-07	3E-02	5E-10	2E-04
02-C	1	7E-13	8E-08	NA	NA
02-D	1	6E-09	5E-03	NA	NA
02-E	1	9E-07	4E-02	1E-08	NA
02-F	1	4E-11	9E-03	7E-09	2E-04
04-A	1	1E-06	2E-02	NA	NA
04-B	1	2E-07	3E-03	NA	NA
04-C	1	5E-07	1E-04	NA	NA
04-D	1	NA	NA	1E-08	6E-04
09-A	3	3E-05	2E-01	1E-07	6E-04
09-B	3	1E-05	4E-01	3E-06	4E-02
12-A	1	5E-06	5E-01	6E-09	2E-03
12-B	1	2E-07	3E-02	4E-09	4E-08
12-C	1	6E-07	1E-02	NA	NA
12-D	1	7E-07	3E-03	NA	NA
16-A	1	4E-07	8E-03	NA	2E-06
16-B	1	4E-07	4E-03	NA	NA
16-C	1	2E-05	7E-01	4E-07	4E-03
16-D	1	4E-07	8E-03	NA	NA
17-A	2	3E-06	2E-01	NA	3E-06
23-A	1	6E-07	7E-03	6E-13	4E-06
29-A	1	2E-10	3E-03	NA	NA
40-A	1	2E-05	7E-01	1E-05	1E-01
40-B	1	1E-06	4E-03	1E-07	2E-03
40-C	1	4E-06	5E-02	8E-08	2E-04
40-D	1	6E-06	2E-02	4E-08	9E-04
44-A	1	7E-07	2E-02	5E-08	3E-08
84-A	2	5E-06	9E-02	7E-07	7E-03
84-B	2	8E-11	7E-04	NA	NA
84-C	2	9E-11	2E-04	NA	NA
84-D	2	2E-05	6E-02	4E-06	3E-02
86-1	1	8E-06	3E-01	3E-06	2E-02
94-A	2	2E-16	3E-03	NA	NA
94-B	2	2E-10	7E-04	5E-07	5E-04
94-C	2	6E-08	9E-03	NA	NA
94-D	2	6E-07	5E-07	4E-10	NA
94-E	2	1E-10	7E-03	NA	NA
Former Admin Building	6	2E-07	6E-04	2E-07	2E-03
uild 94 Parking Lot	2	3E-07	5E-04	4E-11	NA
FEP	4	4E-07	2E-02	NA	NA
Harriet Street	7	6E-06	8E-01	9E-08	9E-04

Notes:

1. Only AOIs at the Southend are shown. AOI 86-1 is part of the Northend, but contains nine soil locations on Parcel 1 in the Southend. The cumulative soil risk and HI at AOI 86-1 is based on concentrations detected in the Parcel 1 locations.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI.
3. NA indicates that the medium was not sampled in that AOI, or that chemicals with risk-based volatilization criteria were all non-detect.
4. Parcels at the Southend are defined in Section 6.5.2.1 of the RFI Phase II Report and shown on Figure 6-1.

US EPA ARCHIVE DOCUMENT

TABLE 6-19
ESTIMATED RESIDENTIAL CANCER RISK AND HI FROM
LNAPL VOLATILIZATION TO INDOOR AIR AT THE SOUTHEND

RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN

AOI	Residential NAPL Vapor Intrusion Risk	Residential NAPL Vapor Intrusion HI
02-B	NA	1E-08
09-B	1E-04	1E+00
12-A	1E-08	1E-03
12-B	3E-08	2E-03
12-C	3E-08	4E-04
16-C	8E-07	6E-02
23-A	1E-08	1E-04
40-A	1E-06	1E-02

Note:

1. NA indicates that chemicals with the relevant toxicity values that could potentially volatilize were all non-detect.

**TABLE 6-20
RECREATIONAL SOIL CONTACT RISK AND HI AT SOUTHEND LOCATIONS WITH
UNACCEPTABLE RESIDENTIAL BOUNDING RISK ESTIMATES**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Parcel	AOI	Location	Recreator Soil Contact Risk	Recreator Soil Contact HI
2	Build 94 Parking Lot	BD 94 EP-02	9E-06	3E-01
2	Build 94 Parking Lot	EP 94-02A	9E-06	2E-01
3	09-A	RFI-09-02	2E-05	3E-01
3	09-A	RFI-09-03	2E-04	1E-01
3	09-B	RFI-09-05	1E-05	4E-01
3	09-A	RFI-09-19	3E-05	8E-02
3	09-A	RFI-09-38	1E-05	3E-01
3	09-A	RFI-09-39	2E-05	9E-03
3	09-B	RFI-09-45	4E-05	6E-02
3	09-B	RFI-09-45R	3E-05	1E-02
1	12-A	RFI-12-31	3E-06	3E-01
1	12-A	RFI-12-35	3E-06	3E-01
1	40-A	RFI-40-12	9E-05	1E-01
1	40-A	RFI-40-16	3E-05	5E-02
1	40-A	RFI-40-17	2E-05	5E-02
1	86-1	RFI-86-07	4E-05	3E-01
1	86-1	RFI-86-12	2E-05	2E-01
1	86-1	RFI-86-17	6E-05	3E-01

Notes:

1. Parcels at the Southend are defined in Section 6.5.2.1 of the Revised RFI Phase II Report and shown on Figure 6-1.
2. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
3. Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
4. Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.

**TABLE 6-21
 BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR
 RESIDENTIAL EXPOSURE TO GROUNDWATER BY VAPOR INTRUSION
 AT AREAS DOWNGRADIENT OF THE NORTHEAST**

**RFI PHASE II REPORT
 GENERAL MOTORS CORPORATION
 NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	GW Vapor Intrusion	
	Residential GW Vapor Intrusion Risk	Residential GW Vapor Intrusion HI
03-1	9E-08	1E-03
05-1	6E-09	4E-04
05-2	2E-07	6E-04
05-3	2E-08	2E-04
05-4	NA	3E-09
05-5	5E-10	2E-04
05-6	2E-07	2E-03
07-1	2E-08	3E-04
07-2	NA	NA
07-3	6E-10	1E-05
10-1	3E-08	5E-03
10-2	5E-07	8E-03
10-3	3E-06	3E-02
10-4	2E-08	2E-04
21-1	5E-11	2E-07
36-1	2E-06	2E-02
36-2	9E-06	9E-02
36-3	1E-05	2E-01
36-4	3E-09	2E-04
36-5	1E-07	1E-03
38-1	1E-09	2E-04
55-1	3E-07	2E-02
65-1	3E-08	8E-04
81-1	6E-08	4E-04
81-2	6E-09	4E-04
81-3	4E-07	4E-03
81-4	1E-08	2E-05
81-5	NA	NA
83/84-1	3E-09	3E-05
83/84-2	8E-10	5E-04
83/84-3	8E-10	1E-05
83/84-4	NA	5E-05
83/84-5	NA	NA
83/84-6	NA	NA
83/84-7	1E-06	2E-02
85-1	1E-07	7E-04
86-1	3E-06	2E-02
Aeration Lagoon	NA	6E-09

Notes:

1. Only AOIs at the Northeast are shown.
2. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI.
3. NA indicates that the medium was not sampled in that AOI, or that chemicals with risk-based volatilization criteria were all non-detect.

US EPA ARCHIVE DOCUMENT

**TABLE 6-22
ESTIMATED SURFACE WATER CONCENTRATIONS RESULTING FROM GROUNDWATER MIGRATION AND OUTFALL DISCHARGE TO FLINT RIVER**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

Chem Group	Chemical	CASRN	River Concentration Due to Groundwater Discharges (mg/L)	River Concentration Due to Sewer Outfall Discharges (mg/L)	Sum of River Concentrations from Outfall and Groundwater Discharges (mg/L)	MDEQ Cancer-Based Drinking Water Quality Standard (mg/L)	Ratio of Discharge Conc to MDEQ Cancer-Based Drinking WQS	MDEQ Non-Cancer-Based Drinking Water Quality Standard (mg/L)	Ratio of Discharge Conc to MDEQ Non-Cancer-Based Drinking WQS	Federal AWQC: Water + Organism (mg/L)	Ratio of Discharge Conc to Federal AWQC: Water + Organism	MDEQ Part 201 Residential Drinking Water Criteria (mg/L)	Ratio of Discharge Conc to Part 201 DW Criteria
VOC	Benzene	71-43-2	4.9E-04		4.9E-04	1.2E-02	4.1E-02	1.9E-02	2.6E-02	2.2E-03	2.2E-01	5.0E-03	9.8E-02
VOC	Chloroethane	75-00-3		3.2E-07	3.2E-07							4.3E-01	7.4E-07
VOC	1,1-Dichloroethane	75-34-3		4.8E-06	4.8E-06							8.8E-01	5.4E-06
VOC	cis-1,2-Dichloroethene	156-59-2		1.1E-05	1.1E-05							7.0E-02	1.6E-04
VOC	trans-1,2-Dichloroethene	156-60-5		1.0E-06	1.0E-06					1.4E-01	7.3E-06	1.0E-01	1.0E-05
VOC	1,1,1-Trichloroethane	71-55-6		2.3E-07	2.3E-07							2.0E-01	1.1E-06
VOC	Trichloroethene	79-01-6	3.8E-04	9.5E-06	3.9E-04	2.9E-02	1.4E-02			2.5E-03	1.6E-01	5.0E-03	7.9E-02
VOC	Vinyl Chloride	75-01-4		1.3E-05	1.3E-05					2.5E-05	5.4E-01	2.0E-03	6.7E-03
VOC	Xylenes (total)	1330-20-7	2.3E-05		2.3E-05							1.0E+01	2.3E-06
SVOC	bis(2-Ethylhexyl)phthalate	117-81-7	2.3E-04		2.3E-04					1.2E-03	1.9E-01	6.0E-03	3.9E-02
SVOC	Di-n-butylphthalate	84-74-2	5.2E-06		5.2E-06					2.0E+00	2.6E-06	8.8E-01	5.9E-06
SVOC	3,3'-Dichlorobenzidine	91-94-1	3.2E-06		3.2E-06					2.1E-05	1.5E-01	1.1E-03	2.9E-03
P/PCB	PCBs	1336-36-3		2.5E-05	2.5E-05	2.6E-08	9.8E+02			6.4E-08	4.0E+02	5.0E-04	5.1E-02
INORG	Cyanide (total)	57-12-5	2.9E-05		2.9E-05			6.0E-01	4.8E-05	1.4E-01	2.1E-04	2.0E-01	1.4E-04
INORG	Mercury	7439-97-6	4.9E-08		4.9E-08			1.8E+00	2.7E-08			2.0E-03	2.4E-05
INORG	Selenium	7782-49-2	3.0E-06		3.0E-06					1.7E-01	1.7E-05	5.0E-02	5.9E-05
INORG	Silver	7440-22-4	1.8E-07		1.8E-07							3.4E-02	5.4E-06

Notes:

1. Ratios greater than 1.0 are highlighted in bold.
2. The sum of groundwater discharge concentrations and the sum of sewer outfall discharge concentrations are calculated in Appendix F and discussed in Section 6.5.2.6.
3. The Michigan Water Quality Standard and Federal AWQC for PCBs are below the analytical Target Detection Limit (TDL) of 0.2 ug/L.

**TABLE 6-23
SENSITIVITY ANALYSIS ON BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX
FOR MAINTENANCE WORKER EXPOSURE TO SOIL AND GROUNDWATER AT THE
NORTHEND**

**RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN**

AOI	Maintenance Worker Soil Contact Risk	Maintenance Worker Soil Contact HI	Maintenance Worker GW Contact Risk	Maintenance Worker GW Contact HI
03-1	7E-07	2E+00	6E-08	2E-02
05-1	2E-07	8E-01	6E-09	1E-02
05-2	2E-09	2E-04	8E-08	1E-02
05-3	2E-08	5E-02	1E-08	1E-03
05-4	5E-09	6E-05	8E-11	1E-04
05-5	5E-08	3E-01	5E-09	6E-03
05-6	1E-07	1E-02	1E-07	1E-02
07-1	1E-07	2E-01	9E-09	2E-03
07-2	4E-10	5E-06	NA	NA
07-3	5E-08	9E-02	5E-10	5E-04
10-1	2E-06	1E+00	4E-08	3E-02
10-2	4E-07	5E-01	3E-07	1E-01
10-3	2E-07	8E-01	1E-06	2E-01
10-4	NA	NA	2E-08	7E-03
21-1	7E-08	4E-01	2E-07	3E-03
36-1	1E-05	8E+00	1E-06	3E-01
36-2	1E-06	3E-01	8E-06	1E+00
36-3	6E-08	2E-01	1E-05	2E+00
36-4	1E-07	8E-03	2E-09	7E-04
36-5	2E-07	1E-01	6E-08	1E-02
38-1	8E-09	6E-02	1E-09	5E-03
55-1	2E-07	4E-01	4E-07	4E-01
65-1	7E-10	2E-05	1E-08	3E-03
81-1	7E-07	4E-01	4E-08	7E-03
81-2	1E-06	3E+00	2E-08	9E-03
81-3	2E-07	2E-01	2E-07	3E-02
81-4	1E-08	2E-04	6E-09	5E-04
81-5	8E-09	2E-01	NA	NA
83/84-1	4E-08	1E-02	3E-09	6E-04
83/84-2	8E-06	2E+00	1E-09	2E-02
83/84-3	3E-08	5E-02	4E-09	2E-03
83/84-4	4E-07	3E-01	8E-09	2E-02
83/84-5	6E-09	2E-04	2E-10	1E-04
83/84-6	8E-08	9E-03	NA	NA
83/84-7	1E-09	1E-04	7E-07	5E-01
85-1	6E-08	4E-02	6E-08	2E-02
86-1	6E-07	1E+00	2E-06	5E-01
Former Aeration Lagoons	8E-08	3E-01	2E-09	1E-04

Notes:

- Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations in each AOI.
- Only AOIs where constituents were detected in soil or groundwater are shown.
- Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.
- Cumulative cancer risks and HIs are based on the following exposure pathways: ingestion, dermal contact, and inhalation.
- NA indicates that the medium was not sampled in that AOI, or that no compounds were detected above background levels.
- Risks are based on an exposure duration of 1 year and exposure frequencies of 45 days for the vapor inhalation route, and 5 days for the ingestion and dermal routes. All other exposure factors are those used for the maintenance worker.
- Lead is evaluated in Section 6.5.2.1 of the RFI Phase II Report and shown on Table 6-5.

US EPA ARCHIVE DOCUMENT

TABLE 6-24
SENSITIVITY ANALYSIS ON BOUNDING CUMULATIVE CANCER RISK AND HAZARD INDEX FOR
MAINTENANCE WORKER EXPOSURE TO SMEAR ZONE SOIL AND LNAPL AT THE NORTHEND

RFI PHASE II REPORT
GENERAL MOTORS CORPORATION
NAO FLINT OPERATIONS SITE - FLINT, MICHIGAN

AOI	Smear Zone Soil				LNAPL			Smear Zone Soil				LNAPL		
	Ingestion	Dermal Contact	Vapor Inhalation	Total	Dermal Contact	Vapor Inhalation	Total	Ingestion	Dermal Contact	Vapor Inhalation	Total	Dermal Contact	Vapor Inhalation	Total
	Maintenance Worker Risk							Maintenance Worker HI						
03-1	2E-08	1E-08	1E-08	5E-08	2E-08	4E-07	4E-07	4E-05	1E-05	4E-02	4E-02	5E-04	1E-01	1E-01
05-1	5E-10	2E-10	8E-09	9E-09	2E-10	8E-08	8E-08	4E-04	2E-04	2E-04	7E-04	1E-04	5E-02	5E-02
05-5	9E-09	4E-09	1E-07	1E-07	3E-09	2E-09	4E-09	6E-03	3E-03	NA	9E-03	2E-03	NA	2E-03
10-1	7E-11	7E-12	NA	7E-11	4E-08	NA	4E-08	3E-06	3E-07	9E-06	1E-05	3E-02	2E-07	3E-02
10-4	7E-10	7E-11	5E-08	5E-08	4E-07	3E-06	4E-06	2E-05	1E-06	3E-01	3E-01	2E-01	2E+00	2E+00
36-1	5E-09	6E-12	2E-05	2E-05	4E-07	1E-03	1E-03	2E-03	1E-04	8E+00	8E+00	2E-01	3E+02	3E+02
36-2	1E-10	1E-11	NA	1E-10	6E-08	NA	6E-08	5E-06	4E-07	4E-04	4E-04	7E-02	3E-01	3E-01
36-5	6E-12	5E-13	3E-09	3E-09	3E-09	4E-07	4E-07	1E-04	4E-05	1E-01	1E-01	2E-02	3E-01	3E-01
81-2	NA	NA	NA	NA	NA	NA	NA	4E-07	2E-07	1E-04	1E-04	3E-06	4E-03	4E-03
83/84-2	4E-09	2E-09	5E-08	6E-08	4E-08	5E-07	6E-07	3E-03	1E-03	1E-01	1E-01	4E-02	2E-01	2E-01
83/84-4	2E-10	2E-11	2E-09	2E-09	1E-07	2E-06	2E-06	2E-05	3E-07	4E-04	4E-04	2E-01	3E-01	5E-01
85-1	2E-10	6E-11	2E-09	2E-09	3E-08	2E-08	5E-08	1E-04	5E-05	4E-02	4E-02	3E-02	5E-02	8E-02
86-1	5E-10	2E-10	6E-09	7E-09	7E-08	1E-07	2E-07	4E-04	2E-04	1E-01	1E-01	2E-01	2E-01	3E-01

Notes:

1. Only LNAPL plumes in the Northend are shown.
2. NA = Risks were not calculated due to a lack of exposure or toxicity information for detected chemicals in the AOI.
3. Cumulative cancer risks and HIs are upper-bound estimates based on the maximum detected concentrations for LNAPL and estimated residual soil concentrations in each AOI.
4. Risks are based on an exposure duration of 1 year and exposure frequencies of 45 days for the vapor inhalation route, and 5 days for the ingestion and dermal routes. All other exposure factors are those used for the maintenance worker.
5. Values highlighted in bold are above the USEPA risk limits of 10^{-4} or 1 for cancer risk and HI, respectively.