APPENDIX C

North City Project Air Modelling Analysis and Health Risk Assessment Report

San Diego's Pure Water Program – North City Project Air Quality Analysis and Health Risk Assessment Report

Dudek

605 Third Street
Encinitas, CA 92024

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Prepared by:

Yorke
ENGINEERING, LLC
www.YorkeEngr.com

Office Locations:
Los Angeles, Orange County, Riverside, Ventura,
San Diego, Fresno, Berkeley, Bakersfield

Tel: (949) 248-8490
Fax: (949) 248-8499

San Diego’s Pure Water Program – North City Project, Air Quality Analysis and HRA Report

Prepared for:

Dudek
605 Third Street
Encinitas, CA 92024

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List of Acronyms and Abbreviations

ADMRT	Air Dispersion and Risk Assessment Tool
AQIA	Air Quality Impact Assessment
CARB	California Air Resources Board
CAS	Chemical Abstracts Service
CEQA	California Environmental Quality Act
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DEM	Digital Elevation Model
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	[United States] Environmental Protection Agency
g	Gram
GHG(s)	Greenhouse Gas(es)
GLC	Ground Level Concentration
HARP2	Hotspots Analysis and Reporting Program, Version 2
HI	Hazard Index
HIA	Acute Hazard Index
HIC	Chronic Hazard Index
hr	Hour
HRA	Health Risk Assessment
ICE	Internal Combustion Engine
IPCC	Intergovernmental Panel on Climate Change
^oK	Degrees Kelvin
K-12	Kindergarten through 12^{th} Grade
km	Kilometer
lb(s)	Pound(s)
LFG	Landfill Gas
m	Meter
MEIR	Maximally Exposed Individual Resident
MEIW	Maximally Exposed Individual Worker
m/s	Meters per Second
MT	Metric Ton
MW	Megawatt
NCWRP	North City Water Reclamation Plant
NEPA	National Environmental Policy Act
N_2O	Nitrous Oxide
NO_x	Oxides of Nitrogen
NSCR	Non-Selective Catalytic Reduction
OEHHA	Office of Environmental Health Hazard Assessment
$PM_{2.5}$	Fine Particulate Matter (Less Than 2.5 Microns in Size)

PM_{10}	Respirable Particulate Matter (Less Than 10 Microns in Size)
PMI	Point of Maximum Impact
SDAPCD	San Diego County Air Pollution Control District
s	Second
SO_x	Sulfur Oxides
TAC	Toxic Air Contaminant
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile Organic Compound
yr	Year
X/Q	Chi over Q – Average Effluent Concentration Normalized by Source Strength (Concentration/Unit Emission Rate)

San Diego's Pure Water Program – North City Project, Air Quality Analysis and HRA Report

1.0 INTRODUCTION

1.1 Pure Water Program North City Project Overview

The City of San Diego (City) is a leader in the potable reuse industry. The City plans to implement a complex water reuse program that addresses both water and wastewater challenges. The City's Pure Water Program is a phased, multi-year program that uses proven technology to produce a safe, reliable, and cost-effective water supply for the City. At full implementation in 2035, the Pure Water Program will provide a third of the City's water supply locally and will reduce the City's ocean wastewater discharges by half.

The first Phase of the City's Pure Water Program is called the North City Project. This project entails the expansion and installation of new power generation capability at the North City Water Reclamation Plant (NCWRP).

1.2 Project Description

The proposed project includes the addition of 15.4 megawatts (MW) of new generation capacity combined with 5 MW of existing power generation capacity at the NCWRP. The new power generation at the NCWRP consists of 6.3 MW of new capacity that uses 100% landfill gas (LFG) as fuel and 9.1 MW of new capacity that uses LFG supplemented with natural gas in 2021, and 3.4 MW of new LFG capacity in 2026.

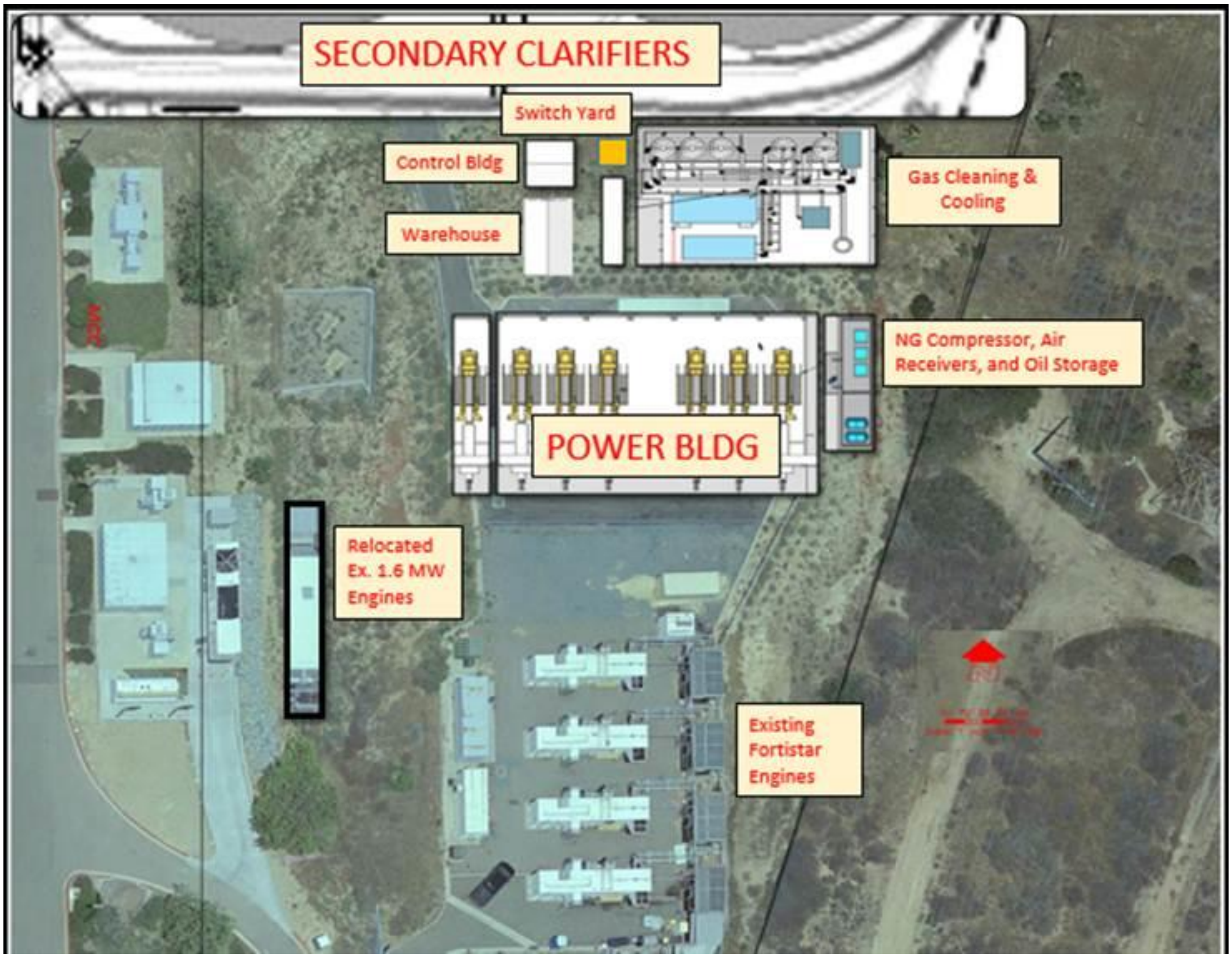
The system includes a total of seven new internal combustion engines (ICEs) and generator units. Each of these are 3.8 MW Caterpillar Model CG260-16 or equivalent ICEs and generator units. All of the ICEs will be downrated in capacity. Three of these units will be dedicated to using 100% LFG and the remainder can operate on mixed gas, i.e., LFG supplemented with natural gas (all engines could run on 100% natural gas). One engine will always be reserved as a backup and will not operate simultaneously with the other engines. Initially, six engines will be installed, with one to be used as a backup. In 2026, the seventh engine will be installed and an existing 5 MW of generation capacity will be taken offline.

The facility layout includes relocation of the City's existing 1.6 MW engine to a new location on-site near the existing emergency power generation equipment at the NCWRP in order to accommodate the layout of the new power generation facility. Figure 1-1 illustrates a preliminary layout for the new and relocated power generation units at the NCWRP.

The expanded power generation facility covers an area of approximately one half acre and is fully contained within the existing NCWRP property. The new power generation units will receive LFG from the City's Miramar Landfill gas collection system via a new 12-inch diameter gas line that will parallel an existing 10-inch gas line that conveys LFG from the landfill to fuel the existing emergency power generation units at the NCWRP.

A new gas compressor station will be added for the additional gas line described above in order to pressurize and convey the LFG from the landfill to the NCWRP. The new compressor station will be sited immediately adjacent to an existing gas compressor station located at the landfill and will be powered by electricity from the grid.

Figure 1-1: Project Plot Plan Showing Source and Building Locations



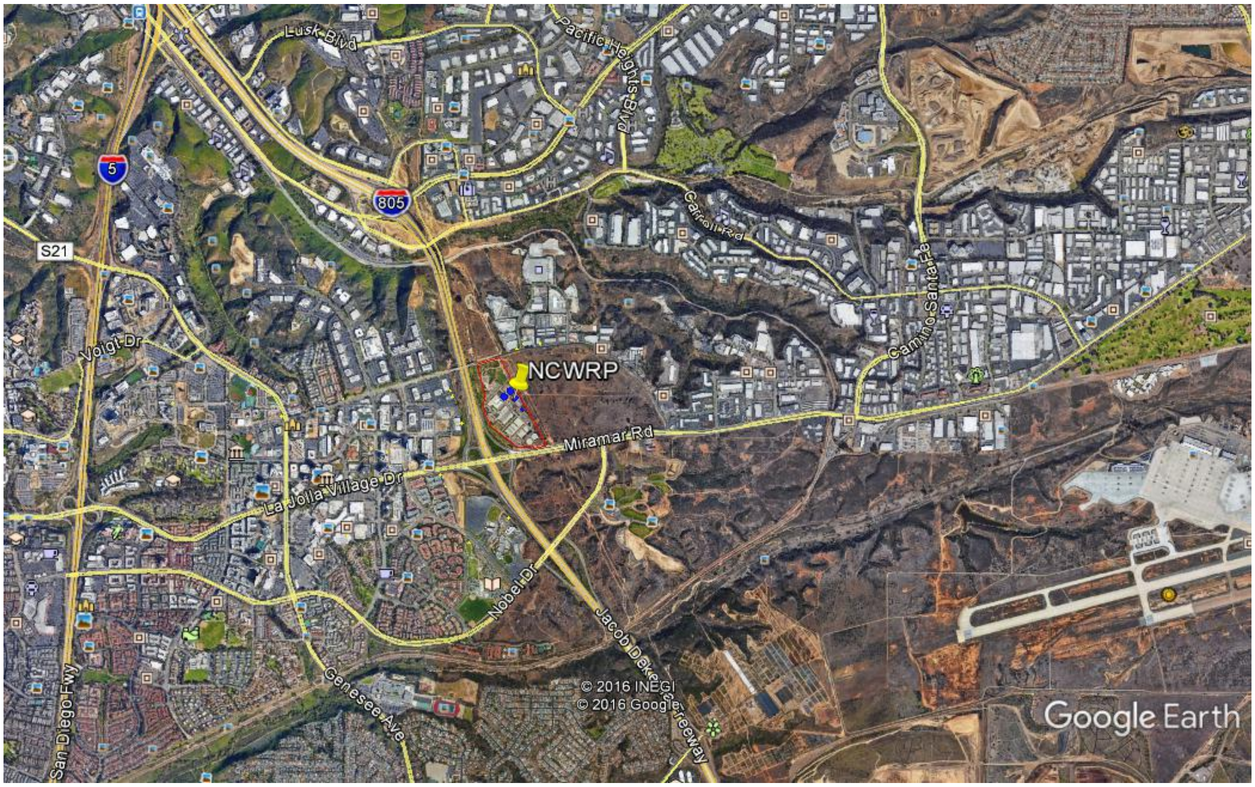
1.3 Project Location

The proposed project will be completely within the existing NCWRP site, which is located at the northeast corner of the intersection of Miramar Road and Interstate 805 in San Diego, CA. Figure 1-2 shows the facility and its immediate surroundings. The site is located in a generally industrial or undeveloped area.

The engines will be placed inside a building located immediately south of the new circular secondary clarifiers and north of the existing emergency power generation facility at the NCWRP. A skid mounted equipment package consisting of a natural gas compressor system, air receivers, and oil storage will be located on the site adjacent to the power generation building. Two additional buildings will be included on the site for control equipment and storage. The facility will also include a gas cleaning and cooling equipment skid and an electrical switch yard.

With respect to air quality and greenhouse gas (GHG) California Environmental Quality Act (CEQA) analyses, the proposed project is within the jurisdiction of the City. It is presumed that the City's requirements related to air quality and GHG impacts under CEQA will also be sufficient for addressing the project's requirements related to the National Environmental Policy Act (NEPA) for the United States Bureau of Reclamation. For air quality permitting, the proposed project is located within the San Diego County Air Pollution Control District (SDAPCD).

Figure 1-2: Project Location Map and Immediate Surroundings



1.4 Report

This Air Quality and GHG Technical Report has been prepared by Yorke Engineering, LLC (Yorke) in support of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) prepared by Dudek for this project. The report discusses the calculation of the emissions of criteria pollutants, toxic air contaminants (TACs), and GHGs due to the operation of the proposed project. It outlines the Health Risk Assessment (HRA) modeling to determine the health impacts due to the TACs. This report addresses the operational emissions calculations and HRA only. Other air quality-related impacts and significance determinations are discussed elsewhere in the Draft EIR/EIS.

2.0 OPERATIONAL EMISSION ESTIMATES

To analyze the air quality impacts from this project, the emission calculations and subsequent HRA examine the simultaneous operation of five ICEs.

Although, ultimately, seven new 3.8 MW Caterpillar Model CG260-16 or equivalent ICEs will be installed, one will always remain as a backup. Additionally, the seventh ICE will not be installed until 2026, at which time 5 MWs of existing generation capacity will be taken offline, more than counterbalancing the emission increase associated with the seventh engine. Therefore, in this analysis, five ICEs are examined, representing the initial installation of six ICEs where one is a backup. The seventh ICE is not examined in this analysis as it will replace a larger and older (more polluting) ICE, thus resulting in a decrease in emissions.

The project also includes the relocation of an existing 1.6 MW engine within the half-acre project site. Since no new emissions are associated with this source, it is not included in this analysis.

Note, emissions related to construction activities are addressed elsewhere in this Draft EIR/EIS.

2.1 Criteria Pollutant Emissions

All of the ICEs can operate on 100% LFG. Three are also designed to run on a combination of LFG and up to 30% natural gas. It is expected that, initially, the ICEs will run on 100% LFG. An engineering evaluation shows that emissions of NO_x are slightly higher when utilizing 100% LFG, as opposed to the combination of LFG and natural gas. In addition, more TACs are emitted from the combustion of the LFG, thus this evaluation examined emissions from all five ICEs combusting 100% LFG at full load.

The LFG will undergo a series of cleanups starting at the compressor station where moisture and large contaminates will be removed, followed by a LFG cleaning and conditioning system on-site at the NCWRP. The gas cleaning equipment is designed to supply clean, dry LFG to the new ICEs.

An oxidation catalyst and Non-Selective Catalyst Reduction (NSCR) post-combustion emission controls will be installed on each of the ICEs to reduce emissions of Carbon Monoxide (CO), volatile organic compounds (VOCs), and Nitrogen Oxides (NO_x).

Based on the expected clean LFG composition, ICE design parameters, and oxidation/NSCR performance, criteria pollutant emissions were estimated. A summary of the criteria pollutant emissions is shown in Table 2-1. Detailed emission calculations are provided in Appendix A.

Table 2-1: Summary of Operational Criteria Pollutant Emissions

Pollutant	Combined Emissions for Five ICEs		
	(lb/hr)	(lb/day)	(tons/yr)
NO_x	5.75	137.9	25.2
CO	4.21	101.1	18.4
VOC	1.04	25.0	4.6
PM_{10}	0.58	13.8	2.5
$PM_{2.5}$	0.58	13.8	2.5
SO_x	0.64	15.3	2.8

2.2 TAC Emissions

As noted in Section 2.1, use of 100% LFG as fuel at full load would be also be worst-case for TAC emissions. Therefore, TAC emissions were estimated based on maximum LFG usage per engine and SDAPCD emission factors for LFG-fired engines (SDAPCD 1999). Detailed emission calculations are provided in Appendix A and a summary of the total project's TAC emissions is presented in Table 2-2.

Rather than using emissions-based significance criteria for TACs, an HRA is typically performed to determine the potential for significant impacts. The modeling and risk assessment methodologies are provided in Section 3.0 and the HRA results are provided in Section 4.0. The HRA results demonstrate that the project's TAC emissions are expected to have less than significant impacts.

Table 2-2: Summary of Operational TAC Emissions

TAC	Chemical Abstracts Service (CAS) ID#	Total TAC Emissions for All Five ICEs (tons/yr)
Methyl Chloroform (1,1,1-Trichloroethane)	71556	4.60E-03
Acrylonitrile	107131	2.42E-02
Benzene	71432	1.09E-02
Carbon Disulfide	75150	3.20E-03
Carbonyl Sulfide	463581	2.09E-03
Chlorobenzene	108907	2.09E-03
Chloroform	67663	2.79E-04
Ethyl Benzene	100414	3.54E-02
Ethylene Dichloride (EDC)	107062	2.92E-03
Formaldehyde	50000	1.88E-01
Hexane	110543	4.09E-02
Hydrochloric Acid	7647010	1.03E+01
Hydrogen Sulfide	7783064	8.75E-02
Methyl Ethyl Ketone (2-Butanone)	78933	3.70E-02
Methyl Isobutyl Ketone (Hexone)	108101	1.35E-02
Methyl Chloride (Chloromethane)	74873	8.79E-02
Perchloroethylene (Tetrachloroethene)	127184	4.47E-02
Toluene	108883	2.62E-01
Trichloroethylene	79016	2.67E-02
Vinyl Chloride	75014	3.31E-02
Vinylidene Chloride	75354	1.39E-03
Xylenes (Mixed)	1330207	9.29E-02

2.3 GHG Emissions

Project GHG emissions were estimated for two cases, specifically:

1. Five ICEs using 100% LFG; and
2. Two ICEs using 100% LFG and three ICEs using 70% LFG and 30% natural gas.

Emissions were based on maximum landfill or natural gas usage per engine and the Intergovernmental Panel on Climate Change (IPCC) emission factors for landfill and natural gas combustion (IPCC 2006). Detailed emission calculations for both cases are provided in Appendix A.

The LFG to be used in the project is generated at the nearby Miramar Landfill and is currently being emitted from the surface of the landfill or flared. This LFG is a biogenic source of GHGs, i.e., GHG emissions related to nature's carbon cycle from the biological decomposition of waste in the landfill. Biogenic GHG emissions associated with the LFG already occur and can be considered baseline conditions, and are not an impact generated by the project. Therefore, non-biogenic GHG emissions from the combustion of natural gas in Case 2 generate the maximum project-related new GHG emissions. The amount of supplemental natural gas combusted per engine will fluctuate. Thus, these emissions are a conservative estimate. In actual practices, GHG emissions are expected to be significantly lower.

For completeness, both biogenic and non-biogenic GHG emissions associated with Case 2 are presented in Table 2-3 and broken down by the specific greenhouse gas and summed in terms of carbon dioxide equivalents (CO_2e) in metric tons (MT) per year. Furthermore, note that only the non-biogenic GHG emissions are considered to be an impact associated with the proposed project.

Table 2-3: Summary of Operational GHG Emissions

Greenhouse Gas	Biogenic Emissions from Two 100% LFG ICEs and Three 70% LFG ICEs (MT/yr)	Non-Biogenic Emissions from Three 30% Natural Gas ICEs (MT/yr)	Total Project Emissions (MT/yr)
Carbon Dioxide (CO_2)	76,370	30,889	107,259
Methane (CH_4)	6.99	2.85	9.85
Nitrous Oxide (N_2O)	0.14	0.06	0.20
Total CO_2e	76,586	30,978	107,564

Notes:

1) This table presents Case 2 GHG emissions.
2) Biogenic GHG emissions are from two ICEs operating on 100% LFG and the portion due to combustion associated with LFG in three of the ICEs when combusting a blend of fuels that use 70% LFG.
3) Non-biogenic GHG emissions reflect the portion due to combustion associated with natural gas in three of the ICEs when combusting a blend of fuels that use 30% natural gas.

3.0 MODELING AND RISK ASSESSMENT METHODOLOGIES

This section of the report discusses the methodology and model inputs that were used to develop the air dispersion modeling and subsequent HRA. The results of the modeling are provided in Section 4.0.

To assess the potential human health risks posed by the project's TAC emissions, an HRA was conducted following the methodologies outlined in the Office of Environmental Health Hazard Assessment (OEHHA) Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA 2015) and SDAPCD Supplemental Guidelines for Submission of Air Toxics "Hot Spots" Program Health Risk Assessments (HRAs) (SDAPCD 2015).

3.1 Air Dispersion Modeling Methodologies

Air dispersion models calculate the atmospheric transport and fate of pollutants from the emission source. The models calculate the concentration of selected pollutants at specific downwind ground level points, such as residential or off-site workplace receptors. The transformation (fate) of an airborne pollutant, its movement with the prevailing winds (transport), its crosswind and vertical movement due to atmospheric turbulence (dispersion), and its removal due to dry and wet deposition are influenced by the pollutant's physical and chemical properties and by meteorological and environmental conditions. Factors, such as distance from the source to the receptor, meteorological conditions, intervening land use and terrain, pollutant release characteristics, and background pollutant concentrations, affect the predicted air concentration of an air pollutant. Air dispersion models take all of these factors into consideration when calculating downwind ground level pollutant concentrations.

The operation of the project will result in the emissions of TACs. Thus, a refined HRA using air dispersion modeling was performed using the United States Environmental Protection Agency's (EPA's) AERMOD modeling system (computer software) to assess the health risk impacts of the project's operational emissions. AERMOD is a steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including the treatment of both surface and elevated sources, building downwash, and simple and complex terrain. Appendix B provides the AERMOD input file. Principal parameters of this modeling include:

- Model Version Selection: The air dispersion model used for the HRA was AERMOD Version 16216r. The modeling files were setup in the Lakes Environmental Software implementation/user interface, AERMOD View™ Version 9.2.0, although AERMOD was run independently to utilize the newest version. AERMOD was run with all sources emitting unit emissions [1 gram per second (g/s)] to obtain the "X/Q" values for the 1-hour and period averaging time option per receptor. X/Q is a dispersion factor that is the average effluent concentration normalized by source strength and is used as a way to simplify the representation of emissions from many sources for input into the Hotspots Analysis and Reporting Program, version 2 (HARP2).
- Model Options: The modeling included the use of all standard regulatory default options, including the use of rural dispersion parameters and elevated terrain.

- Coordinate System: All geographical coordinates referenced in this section and appendices are in the Universal Transverse Mercator (UTM) coordinate system with the WGS84 Datum, zone 11.
- Meteorological Data: AERMOD-specific meteorological data for the Miramar Marine Corps Station #722931 were used for the dispersion modeling. The 5-year meteorological dataset from 2009 through early 2014 was obtained from the Air Quality Planning and Science Division of the California Air Resources Board (CARB) in a preprocessed format suitable for use in AERMOD and HARP2 modeling (CARB 2015).
- Elevation Data: Digital elevation data were imported into AERMOD and elevations were assigned to receptors, buildings, and emission sources, as necessary. Digital elevation data were obtained through the AERMOD View™ WebGIS import feature in the United States Geological Survey's (USGS') Digital Elevation Model (DEM 7.5) format, with a resolution of 1 degree.
- Receptors: Model results were obtained at various locations around the facility. These receptor locations were identified as the facility boundary, a grid network of receptors to establish the impact area and area where the maximum impact would occur, and discrete receptors that were positioned at specific locations of concern, namely the nearest residences, worker, and sensitive receptors.

  The facility boundary was established from an aerial map. Receptors were placed every 50 meters (m) along the fenceline. Grid receptors were placed every 100 m out to 1 kilometer (km), then every 250 m out to 2 km to ensure impacts were below the appropriate CEQA thresholds at all locations off-site.

  Based on SDAPCD HRA guidance (SDAPCD 2015), sensitive receptors include schools [kindergarten through grade 12 (K-12)], day care centers, nursing homes, retirement homes, health clinics, hospitals, playgrounds, and athletic facilities within 2 km of the facility. Discrete Cartesian receptors were used to evaluate the location of the maximally exposed residence, sensitive, and off-site workplace. A list of the sensitive and residential receptors within two km of the facilities is provided in Table 3-1. The AERMOD input file presented in Appendix B only includes the sensitive receptors for brevity, but all receptors were included in the modeling assessment. A series of receptors were placed along the worker locations to the west and northeast of the project. Figure 3-1 shows the locations of the discrete receptors, with the property line identified in red.
- Emission Sources and Release Parameters: The exhaust stacks from the LFG ICEs were modeled as individual point sources. Each emission source was sited using the plot plan provided, Figure 1-1, and incorporated into AERMOD as shown in red on Figure 3-2. The release parameters for the ICEs are shown in Table 3-2 and were calculated from data provided in the engineering evaluation of the engines for 100% load case. There are six engines, with one as a backup. Thus, no more than five engines will operate simultaneously. The western most five engines were included in the HRA since the closest receptors are to the west of the project.
- On-Site Buildings: For the operational scenario, a total of seven on-site buildings close to the emission sources were included in the modeling using best available dimensional data. Buildings less than 20 feet or greater than 250 feet from the new sources were not included

in the assessment. Building downwash effects were assessed using BPIP/PRIME. The buildings included in AERMOD are shown in blue on Figure 3-2.

Table 3-1: Nearby Sensitive and Residential Receptors

Name	UTM Easting (m)	UTM Northing (m)	Distance to Receptor from the Power Units (km)
Torah High School	480727.2	3636989	1.2
La Jolla Country Day	479941.9	3637767	1.6
Childtime	480393.8	3636961	1.5
UCSD Hospital	479201.2	3637859	2.3
Bright Daycare	480662.0	3637527	0.9
Nobel Recreation Center Park	481221.6	3636913	1.0
Resident 1	481019.9	3637371	0.7
Resident 2	481054.5	3637291	0.8
Resident 3	480556.9	3637550	1.0
Resident 4	480367.3	3637887	1.2

Figure 3-1: Facility with Discrete Receptors

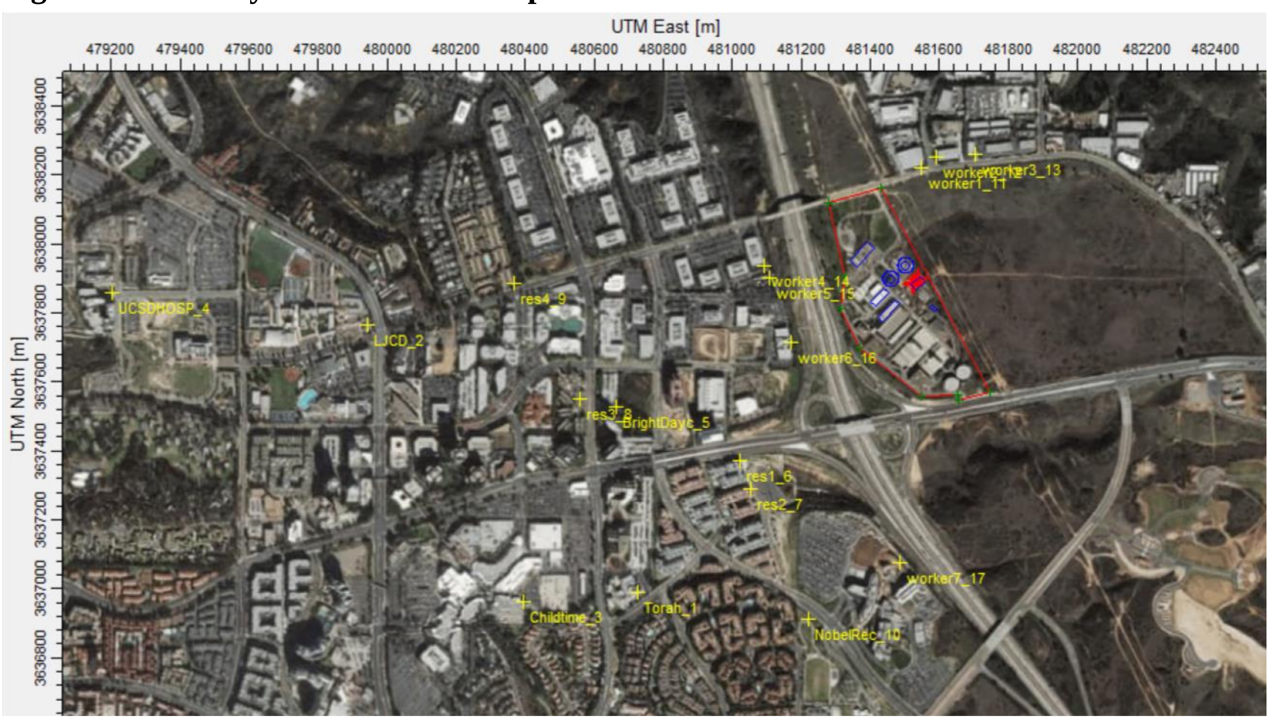
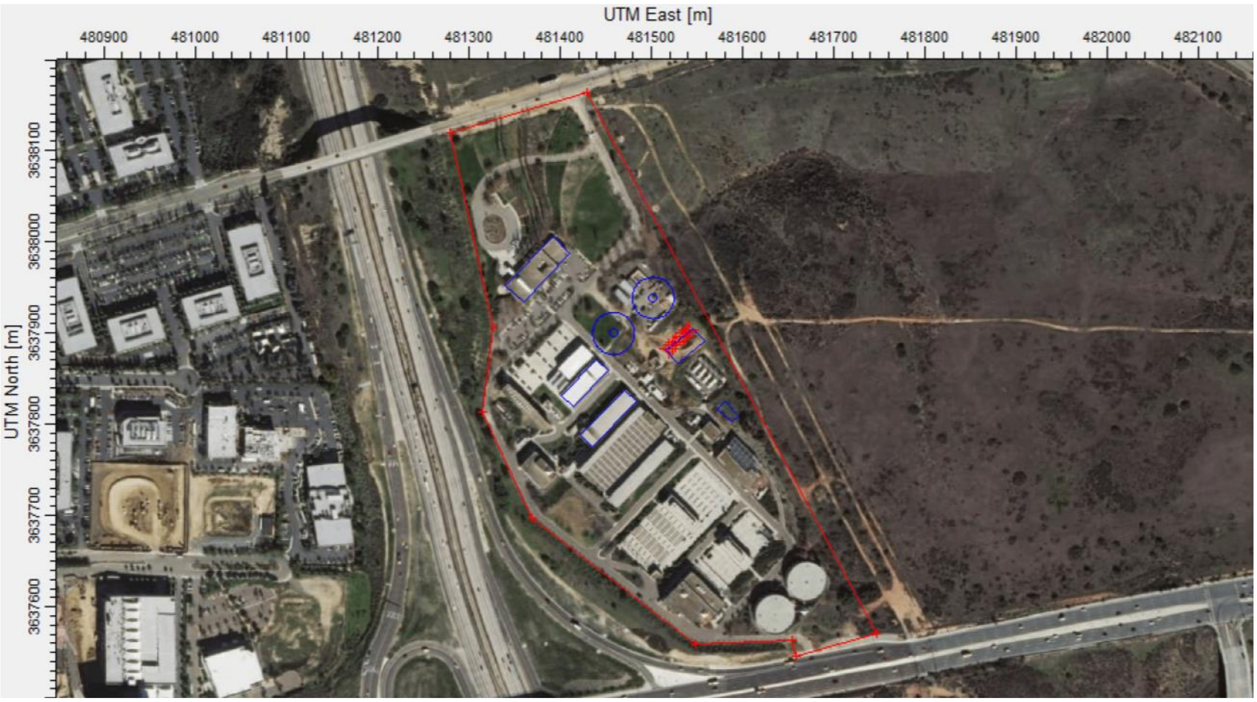


Table 3-2: Operational Source Modeling Characteristics

Stack IDs	Description	Stack Height (m)	Stack Diameter (m)	Stack Flowrate (m/s)	Stack Temp (°K)	UTM x (m)	UTM y (m)
STCK1	LFG ICE	16.764	0.914	17.17	809.26	481,518	3,637,882
STCK2	LFG ICE	16.764	0.914	17.17	809.26	481,523	3,637,886
STCK3	LFG ICE	16.764	0.914	17.17	809.26	481,527	3,637,890
STCK4	LFG ICE	16.764	0.914	17.17	809.26	481,534	3,637,896
STCK5	LFG ICE	16.764	0.914	17.17	809.26	481,539	3,637,900

Figure 3-2: Project Boundary and Source and Building Locations in AERMOD



3.2 HRA Methodologies

The HRA followed the OEHHA and SDAPCD Tier 1 techniques to calculate the health risk impacts at all receptors, including the nearby residential, sensitive, and off-site worker receptors. The health risk calculations were performed using the HARP2 Air Dispersion and Risk Assessment Tool (ADMRT, version 17023). The X/Q values that were determined for each source using AERMOD were imported into HARP2 and used in conjunction with hourly and period (annual) emissions to determine the Ground Level Concentrations (GLCs) for each pollutant. The GLCs are then used to estimate the long-term cancer health risk to an individual and the non-cancer chronic and acute health indices.

The Point of Maximum Impact (PMI), the Maximally Exposed Individual Resident (MEIR), the Maximally Exposed Individual Worker (MEIW), and the maximum impact at a sensitive receptor were calculated for cancer risk and non-cancer chronic and acute health indices. The point of maximum impact is a location within the modeling grid where the model calculates the highest (worst-case) health risk. The point of maximum impact may or may not be a habitable location.

A description of the health risk indices in the HARP2 output is provided below.

3.2.1 Cancer Risk

Cancer risk is the estimated probability of an exposed individual potentially contracting cancer as a result of exposure to TACs over a period of 30 years for residential receptor locations and 25 years for off-site worker receptor locations. Sensitive receptors, such as schools, hospitals, convalescent homes, and day-care centers, were evaluated the same as residences. The OEHHA Derived Method was used to calculate the cancer risk.

All receptors were assessed for a 30-year cancer risk with a "fraction of time at home" selected for the 3rd trimester through 70 years. Mandatory minimum pathways of inhalation, soil ingestion, dermal absorption, and mother's milk were selected.

To assess the 25-year cancer risk to workers, all receptors were included in the worker run, but the results only examined the seven worker receptors. Worker pathways of inhalation, soil ingestion, and dermal absorption were selected, and no worker adjustment factor was enabled as the project may operate continuously.

3.2.2 Chronic Hazard Risk

Some TACs increase non-cancer health risk due to long-term (chronic) exposures. The Chronic Hazard Index (HIC) is the sum of the individual substance chronic hazard indices for all TACs affecting the same target organ system. The HIC estimates for all receptor types used the OEHHA Derived Method, which uses high-end exposure parameters for inhalation and the next top two exposure pathways and mean exposure parameters for the remaining pathways for non-cancer risk estimates.

3.2.3 Acute Hazard Risk

Some TACs increase non-cancer health risk due to short-term (acute) exposures. The Acute Hazard Index (HIA) is the sum of the individual substance acute hazard indices for all TACs affecting the same target organ system. Acute risk is calculated from a 1-hour exposure.

3.2.4 Cancer Burden

Cancer burden is the estimated increase in the occurrence of cancer cases in a population subject to a cancer risk of greater than or equal to one in one million (1.0×10^{-6}) based on a 70-year exposure to TACs. The cancer burden is determined for the population located within the zone of impact, which is defined as the area within the one in one million cancer risk isopleth for a 70-year exposure. HARP2 is able to generate an isopleth, a line of a constant value, showing the area exposed to a cancer risk above one in one million. Then, the population within this area is determined. If no one lives within this area, there is no cancer burden.

Appendix C presents three HARP model summary files that outline the parameters used in the HRA, specifically the project summary that outlines the emission rates and risk exposure levels used, the 30-year residential cancer risk summary, and the 25-year worker cancer risk summary.

4.0 HRA RESULTS

Table 4-1 summarizes the HRA results. Appendix C presents a breakdown of the results by risk and pollutant. The HRA methodology provides conservative results, thus overpredicting risks. To determine if the incremental increase of TAC emissions from a project would cause a significant impact the following thresholds are applied:

- Cancer risk ≥ 10 in 1 million;
- HIC and HIA ≥ 1.0; and
- Cancer burden > 1 excess cancer cases (in areas where cancer risk ≥ 1 in 1 million).

Table 4-1 shows the results of the HRA at the PMI, the highest predicted cancer risk from all receptors, at the MEIR, MEIW, and maximum sensitive receptor. The cancer burden is 0 as there is no population in the area where the cancer risk is greater than 1 in a million. Table 4-1 shows that at all receptor types, the predicted health risks are less than the significance thresholds. Thus, the project's operational TAC impact would be **less than significant**.

Table 4-1: HRA Results

Impact Parameter	Receptor Type	Health Risk Impact	Significance Threshold	Significant (Yes/No)
Cancer Risk	PMI	1.16 in a million	10 in a million	No
	MEIR	0.09 in a million	10 in a million	No
	MEIW	0.02 in a million	10 in a million	No
	Maximum Sensitive Receptor	0.08 in a million	10 in a million	No
HIC	PMI	0.056	1	No
	MEIR	0.004	1	No
	MEIW	0.010	1	No
	Maximum Sensitive Receptor	0.004	1	No
HIA	PMI	0.013	1	No
	MEIR	0.002	1	No
	MEIW	0.003	1	No
	Maximum Sensitive Receptor	0.001	1	No
Cancer Burden		0	1	No

5.0 REFERENCES

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APPENDIX A – OPERATIONAL EMISSION CALCULATIONS

Yorke ENGINEERING, LLC
www.YorkeEngr.com

NCWRP IC engines - Criteria Pollutant Emissions
Caterpillar Model CG260-16 IC or equivalent ICE

Number of new engines at NCWRP
operating on 100% landfill gas 5 with 1 backup, plus 1 installed in 2026, at which point 4 old engines will be retired
at full load each engine uses 1060 scf/min landfill gas
63600 scf/hr

NCWRP IC engines on landfill gas emissions

Pollutant	Emissions per Engine						
	uncontrolled emissions (ppm)	**uncontrolled emissions (lb/hr)**	**control efficiency**	**controlled emissions (ppm)**	**controlled emission factor (lb/mmscf)**	**controlled emissions (lb/hr)**	**controlled emissions (ton/yr)**
NO_x	91.46	11.49	90%	9.146	18.066	1.149	5.03
CO	164.1	12.57	93.3%	10.995	13.242	0.842	3.69
VOC	17.28	0.758	72.5%	4.752	3.278	0.208	0.91
PM_{10}		0.115	0%		1.808	0.115	0.50
$PM_{2.5}$		0.115	0%		1.808	0.115	0.50
SO_x					2.000	0.127	0.56

Pollutant	Combined Emissions for 5 Engines		
	(lb/hr)	**(lb/day)**	**(ton/yr)**
NO_x	5.75	137.9	25.2
CO	4.21	101.1	18.4
VOC	1.04	25.0	4.6
PM_{10}	0.58	13.8	2.5
$PM_{2.5}$	0.58	13.8	2.5
SO_x	0.64	15.3	2.8

Reference: LFG emissions from - Technical Memorandum: Pure Water - North City Suite of Projects Power Generation Alternatives Evaluation,
Dec 2015. File: TO7_Power Gen Alt Analysis_TM.PDF
Control efficiency from Oxidation/NCSR performance metrics
Sulfur emission factor based on 2014_NCWRP_Em Inventory Report.pdf

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NCWRP IC engines on landfill gas TAC emissions

Engines operating on 100% landfill gas 5

At full load each engine uses 63600 scf/hr LFG

Pollutant	HARP Pollutant	CAS	TAC emission factor (lbs/mmscf LFG burned)	TAC emissions per engine (lb/hr)	TAC emissions per engine (lb/yr)	Total TAC emissions for all 5 engines (ton/yr)
Methyl chloroform {1,1,1-Trichloroethane}	1,1,1-TCA	71556	0.0033	2.10E-04	1.84E+00	4.60E-03
Acrylonitrile	Acrylonitrile	107131	0.0174	1.11E-03	9.69E+00	2.42E-02
Benzene	Benzene	71432	0.0078	4.96E-04	4.35E+00	1.09E-02
Carbon Disulfide	CS2	75150	0.0023	1.46E-04	1.28E+00	3.20E-03
Carbonyl Sulfide	CarbonylSulfide	463581	0.0015	9.54E-05	8.36E-01	2.09E-03
Chlorobenzene	Chlorobenzn	108907	0.0015	9.54E-05	8.36E-01	2.09E-03
Chloroform	Chloroform	67663	0.0002	1.27E-05	1.11E-01	2.79E-04
Ethyl Benzene	Ethyl Benzene	100414	0.0254	1.62E-03	1.42E+01	3.54E-02
Ethylene dichloride {EDC}	EDC	107062	0.0021	1.34E-04	1.17E+00	2.92E-03
Formaldehyde	Formaldehyde	50000	0.135	8.59E-03	7.52E+01	1.88E-01
Hexane	Hexane	110543	0.0294	1.87E-03	1.64E+01	4.09E-02
Hydrochloric Acid	HCl	7647010	7.43	4.73E-01	4.14E+03	1.03E+01
Hydrogen Sulfide	H2S	7783064	0.0628	3.99E-03	3.50E+01	8.75E-02
Methyl Ethyl Ketone {2-Butanone}	MEK	78933	0.0266	1.69E-03	1.48E+01	3.70E-02
Methyl Isobutyl Ketone {Hexone}	MIBK	108101	0.0097	6.17E-04	5.40E+00	1.35E-02
Methyl Chloride {Chloromethane}	Methyl Chloride	74873	0.0631	4.01E-03	3.52E+01	8.79E-02
Perchloroethylene {Tetrachloroethene}	Perc	127184	0.0321	2.04E-03	1.79E+01	4.47E-02
Toluene	Toluene	108883	0.1881	1.20E-02	1.05E+02	2.62E-01
Trichloroethylene	TCE	79016	0.0192	1.22E-03	1.07E+01	2.67E-02
Vinyl Chloride	Vinyl Chloride	75014	0.0238	1.51E-03	1.33E+01	3.31E-02
Vinylidene Chloride	Vinylid Chlorid	75354	0.001	6.36E-05	5.57E-01	1.39E-03
Xylenes (mixed)	Xylenes	1330207	0.0667	4.24E-03	3.72E+01	9.29E-02

Source: SDAPCD Emission factors for ENGINE, LANDFILL GAS FIRED

Acetone, chlorofluorocarbons, and dimethyl sulfide not include as there are no health risk factors for the substances.

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NCWRP IC engines - GHG Emissions

Case 1

Engines operating on 100% landfill gas 5

At full load each engine uses 63600 scf/hr LFG

Greenhouse Gas	IPCC LFG (kg/TJ)	IPCC LFG (lb/mmscf)	Global Warming Potential	Annual GHG emissions per engine (MT/yr)	Total Annual GHG emissions for all 5 engines (MT/yr)
CO_2	54,600	73,686	1	18,627	93,134
CH_4	5	6.75	25	1.71	213
N_2O	0.1	0.13	298	0.03	51
CO_2e					93,398

LFG HHV heating value (Btu/scf) 581.9 from design analysis

TJ = Terra Joule = 10^{12} Joules

1 Btu = 1054.2 Joule

Emission factors - 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2 stationary Combustion, commercial/institutional sources

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NCWRP IC engines - GHG Emissions

Case 2

Engines operating on 100% landfill gas	2			
Engines operating on landfill gas/natural gas	3	70% LFG	30%	natural gas
At full load each engine uses	63600	scf/hr LFG		
At full load each engine uses	519449	Btu/min NG		
	28802	scf/hr NG		

Greenhouse Gas	IPCC LFG (kg/TJ)	IPCC LFG (lb/mmscf)	Global Warming Potential	Annual GHG emissions per 100% LFG engine (MT/yr)	Emissions for 2 100% LFG engines and 3 70% LFG engines (MT/yr)
CO_2	54,600	73,686	1	18,627	76,370
CH_4	5	6.75	25	1.71	6.99
N_2O	0.1	0.13	298	0.03	0.14
CO_2e					76,586

Greenhouse Gas	IPCC LFG (kg/TJ)	IPCC LFG (lb/mmscf)	Global Warming Potential	Annual GHG emissions per 30% NG engine (MT/yr)	Emissions for 3 30% NG engines (MT/yr)
CO_2	54,100	135,774	1	10,296	30,889
CH_4	5	13	25	0.95	2.85
N_2O	0.1	0.25	298	0.02	0.06
CO_2e					30,978

Greenhouse Gas	Total Project Emissions (MT/yr)
CO_2	107,259
CH_4	9.85
N_2O	0.20
CO_2e	107,564

LFG HHV heating value (Btu/scf)	581.9	from design analysis
NG HHV heating value (Btu/scf)	1082.1	from design analysis
TJ = Terra Joule = 10^{12} Joules		
1 Btu =	1054.2	Joule

Emission factors - 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2 stationary Combustion, commercial/institutional sources

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NCWRP IC engines

Caterpillar Model CG260-16 IC or equivalent ICE

Landfill Gas Stack Parameters

Stack Temperature (F)	Stack Height (ft)	Stack diameter (ft)	Stack exit velocity (ft/s)
997	55	3	56.3

Reference: Technical Memorandum: Pure Water - North City Suite of Projects Power Generation Alternatives Evaluation, Dec 2015. File: TO7_Power Gen Alt Analysis_TM.PDF

Stack parameters calculated from data provided in design analysis for 100% load case

Stack Parameters used in dispersion modeling

Stack Temperature (K)	Stack Height (m)	Stack diameter (m)	Stack exit velocity (m/s)
809.26	16.76	0.91	17.17

Stack exhaust temperature and exit velocity were the lower of either LFG or natural gas

Stack exit velocity calculations for LFG

assumed or standard data			
MWs = molecular wt of stack gas	29	kg/(kg-mole)	
Pressure (actual) =	1013.25	mb	
Pressure (actual) =	101325	Pa	= 1 atm
assume that the stack gas has the same density as air.			
density of air (kg/m3)	1.275	at 0C and 1000mb	
R	8.31E+03	Pa m3/(K kg-mole)	
Stack data			
O2 content	6.9	%	
Water vapor fraction	0.15	assumed	
Ts = stack temp	997	F	
	809.26	K	
Stack diameter	3.00	ft	
Stack diameter	0.91	m	
stack exhaust Flow	39075	lb/hr	

convert from mass flow to volume flow using the following equation

Vol flow (acfm) = mass flow (lb/hr) x kg/2.2046lb x R Ts / MWs P x hr/60min x (ft/.3048m)^3

stack exhaust volume	23888	acfm = actual cubic feet per minute
stack exhaust volume	40585.3	m3/hr
Stack exit velocity	17.167	m/s

APPENDIX B – AERMOD INPUT FILE

```
**
***************************************
**
** AERMOD Input Produced by:
** AERMOD View Ver. 9.2.0
** Lakes Environmental Software Inc.
** Date: 2/13/2017
** File: C:\Lakes\AERMOD View\NCWRP\NCWRP.ADI
**
***************************************
**
**
***************************************
** AERMOD Control Pathway
***************************************
**
**
CO STARTING
   TITLEONE NCWRP new IC engines
   MODELOPT DFAULT CONC
   AVERTIME 1 PERIOD
   POLLUTID OTHER
   RUNORNOT RUN
   ERRORFIL NCWRP.err
CO FINISHED
**
***************************************
** AERMOD Source Pathway
***************************************
**
**
SO STARTING
** Source Location **
** Source ID - Type - X Coord. - Y Coord. **
   LOCATION STCK6        POINT      481541.494  3637902.367      110.300
   LOCATION STCK5        POINT      481538.601  3637899.686      110.300
   LOCATION STCK4        POINT      481534.430  3637895.880      110.300
   LOCATION STCK3        POINT      481526.910  3637889.540      110.300
   LOCATION STCK2        POINT      481522.740  3637886.000      110.300
   LOCATION STCK1        POINT      481518.390  3637882.380      110.300
** Source Parameters **
   SRCPARAM STCK6              1.0    16.764   809.260  17.17000     0.914

   SRCPARAM STCK5              1.0    16.764   809.260  17.17000     0.914

   SRCPARAM STCK4              1.0    16.764   809.260  17.17000     0.914

   SRCPARAM STCK3              1.0    16.764   809.260  17.17000     0.914
```

```
   SRCPARAM STCK2              1.0    16.764   809.260  17.17000     0.914

   SRCPARAM STCK1              1.0    16.764   809.260  17.17000     0.914


** Building Downwash **
   BUILDHGT STCK6            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK6            7.62      7.62      7.62      7.62     10.67     10.67
   BUILDHGT STCK6           10.67     10.67     10.67     10.67      7.62      7.62
   BUILDHGT STCK6            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK6            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK6            7.62      7.62      7.62      7.62      7.62      7.62

   BUILDHGT STCK5            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK5            7.62      7.62      7.62      7.62     10.67     10.67
   BUILDHGT STCK5           10.67     10.67     10.67     10.67      7.62      7.62
   BUILDHGT STCK5            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK5            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK5            7.62      7.62      7.62      7.62      7.62      7.62

   BUILDHGT STCK4            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK4            7.62      7.62      7.62      7.62      7.62     10.67
   BUILDHGT STCK4           10.67     10.67     10.67     10.67     10.67      7.62
   BUILDHGT STCK4            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK4            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK4            7.62      7.62      7.62      7.62      7.62      7.62

   BUILDHGT STCK3            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK3            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK3           10.67     10.67     10.67     10.67     10.67     10.67
   BUILDHGT STCK3            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK3            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK3            7.62      7.62      7.62      7.62      7.62      7.62

   BUILDHGT STCK2            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK2            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK2           10.67     10.67     10.67     10.67     10.67     10.67
   BUILDHGT STCK2            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK2            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK2            7.62      7.62      7.62      7.62      7.62      7.62

   BUILDHGT STCK1            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK1            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK1            7.62     10.67     10.67     10.67     10.67     10.67
   BUILDHGT STCK1           10.67      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK1            7.62      7.62      7.62      7.62      7.62      7.62
   BUILDHGT STCK1            7.62      7.62      7.62      7.62      7.62      7.62
```

```
BUILDWID STCK6            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK6            30.76    35.05    38.27    40.33    42.96    44.16
BUILDWID STCK6            45.55    45.55    44.16    42.96    43.39    42.11
BUILDWID STCK6            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK6            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK6            39.10    39.38    42.01    43.36    43.39    42.11

BUILDWID STCK5            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK5            30.76    35.05    38.27    40.33    42.96    44.16
BUILDWID STCK5            45.55    45.55    44.16    42.96    43.39    42.11
BUILDWID STCK5            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK5            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK5            39.10    39.38    42.01    43.36    43.39    42.11

BUILDWID STCK4            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK4            30.76    35.05    38.27    40.33    41.17    44.16
BUILDWID STCK4            45.55    45.55    44.16    42.96    45.03    42.11
BUILDWID STCK4            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK4            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK4            39.10    39.38    42.01    43.36    43.39    42.11

BUILDWID STCK3            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK3            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK3            45.55    45.55    44.16    42.96    45.03    45.72
BUILDWID STCK3            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK3            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK3            39.10    39.38    42.01    43.36    43.39    42.11

BUILDWID STCK2            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK2            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK2            45.55    45.55    44.16    42.96    45.03    45.72
BUILDWID STCK2            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK2            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK2            39.10    39.38    42.01    43.36    43.39    42.11

BUILDWID STCK1            39.55    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK1            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK1            39.10    45.55    44.16    42.96    45.03    45.72
BUILDWID STCK1            45.03    35.78    30.93    25.14    19.53    25.53
BUILDWID STCK1            30.76    35.05    38.27    40.33    41.17    40.75
BUILDWID STCK1            39.10    39.38    42.01    43.36    43.39    42.11

BUILDLEN STCK6            40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK6            43.36    43.39    42.11    39.55    42.96    44.16
BUILDLEN STCK6            45.55    45.55    44.16    42.96    35.05    38.27
BUILDLEN STCK6            40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK6            43.36    43.39    42.11    39.55    35.78    30.93
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BUILDLEN STCK6           25.14    19.53    25.53    30.76    35.05    38.27

BUILDLEN STCK5           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK5           43.36    43.39    42.11    39.55    42.96    44.16
BUILDLEN STCK5           45.55    45.55    44.16    42.96    35.05    38.27
BUILDLEN STCK5           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK5           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK5           25.14    19.53    25.53    30.76    35.05    38.27

BUILDLEN STCK4           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK4           43.36    43.39    42.11    39.55    35.78    44.16
BUILDLEN STCK4           45.55    45.55    44.16    42.96    45.03    38.27
BUILDLEN STCK4           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK4           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK4           25.14    19.53    25.53    30.76    35.05    38.27

BUILDLEN STCK3           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK3           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK3           45.55    45.55    44.16    42.96    45.03    45.72
BUILDLEN STCK3           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK3           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK3           25.14    19.53    25.53    30.76    35.05    38.27

BUILDLEN STCK2           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK2           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK2           45.55    45.55    44.16    42.96    45.03    45.72
BUILDLEN STCK2           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK2           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK2           25.14    19.53    25.53    30.76    35.05    38.27

BUILDLEN STCK1           40.33    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK1           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK1           25.14    45.55    44.16    42.96    45.03    45.72
BUILDLEN STCK1           45.03    41.17    40.75    39.10    39.38    42.01
BUILDLEN STCK1           43.36    43.39    42.11    39.55    35.78    30.93
BUILDLEN STCK1           25.14    19.53    25.53    30.76    35.05    38.27

XBADJ    STCK6          -37.23   -37.55   -36.73   -34.80   -33.35   -32.65
XBADJ    STCK6          -30.95   -28.31   -24.81   -20.56   -70.87   -74.21
XBADJ    STCK6          -76.06   -75.59   -72.82   -68.60    -1.82    -2.50
XBADJ    STCK6           -3.11    -3.62    -4.02    -4.30    -6.03    -9.36
XBADJ    STCK6          -12.41   -15.09   -17.30   -18.99   -20.10   -20.60
XBADJ    STCK6          -20.48   -20.00   -25.22   -29.68   -33.23   -35.77

XBADJ    STCK5          -34.08   -34.04   -32.97   -30.89   -29.42   -28.80
XBADJ    STCK5          -27.32   -25.00   -21.92   -18.18   -69.07   -73.05
XBADJ    STCK5          -75.57   -75.78   -73.70   -70.13    -3.96    -5.18
XBADJ    STCK5           -6.25    -7.12    -7.79    -8.21    -9.96   -13.21
```

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XBADJ    STCK5          -16.04   -18.40   -20.19   -21.37   -21.90   -21.77
XBADJ    STCK5          -20.97   -19.81   -24.35   -28.15   -31.09   -33.09

XBADJ    STCK4          -29.61   -29.04   -27.58   -25.29   -23.77   -23.29
XBADJ    STCK4          -22.09   -20.23   -17.75   -14.73   -11.27   -71.35
XBADJ    STCK4          -74.82   -76.02   -74.91   -72.29   -69.75    -8.99
XBADJ    STCK4          -10.72   -12.13   -13.17   -13.81   -15.61   -18.72
XBADJ    STCK4          -21.27   -23.17   -24.36   -24.81   -24.52   -23.47
XBADJ    STCK4          -21.71   -19.57   -23.13   -25.99   -28.06   -29.28

XBADJ    STCK3          -22.06   -20.51   -18.33   -15.60   -13.94   -13.60
XBADJ    STCK3          -12.86   -11.72   -10.23    -8.43    -6.37    -4.11
XBADJ    STCK3          -73.14   -76.05   -76.65   -75.67   -74.69   -71.44
XBADJ    STCK3          -18.27   -20.66   -22.42   -23.50   -25.44   -28.40
XBADJ    STCK3          -30.50   -31.67   -31.88   -31.12   -29.41   -26.81
XBADJ    STCK3          -23.40   -19.55   -21.40   -22.61   -23.12   -22.94

XBADJ    STCK2          -17.85   -15.75   -13.18   -10.21    -8.47    -8.22
XBADJ    STCK2           -7.73    -7.00    -6.06    -4.93    -3.66    -2.27
XBADJ    STCK2          -72.22   -76.08   -77.63   -77.57   -77.45   -74.98
XBADJ    STCK2          -22.48   -25.41   -27.57   -28.89   -30.91   -33.79
XBADJ    STCK2          -35.63   -36.39   -36.05   -34.61   -32.12   -28.66
XBADJ    STCK2          -24.32   -19.52   -20.42   -20.71   -20.36   -19.40

XBADJ    STCK1          -13.53   -10.86    -7.87    -4.64    -2.81    -2.65
XBADJ    STCK1           -2.40    -2.09    -1.71    -1.28    -0.81    -0.32
XBADJ    STCK1            0.19   -76.05   -78.59   -79.49   -80.26   -78.60
XBADJ    STCK1          -74.55   -30.30   -32.88   -34.46   -36.57   -39.36
XBADJ    STCK1          -40.96   -41.31   -40.40   -38.27   -34.97   -30.61
XBADJ    STCK1          -25.32   -19.54   -19.46   -18.79   -17.55   -15.78

YBADJ    STCK6            0.78    -2.21    -5.14    -7.91   -10.24   -12.46
YBADJ    STCK6          -14.30   -15.71   -16.63   -17.06    20.07    11.19
YBADJ    STCK6            1.96    -7.32   -16.38   -24.94    -6.61    -3.75
YBADJ    STCK6           -0.78     2.21     5.14     7.91    10.24    12.46
YBADJ    STCK6           14.30    15.71    16.63    17.06    16.97    16.36
YBADJ    STCK6           15.25    13.66    11.64     9.27     6.61     3.75

YBADJ    STCK5           -1.60    -4.01    -6.30    -8.40   -10.04   -11.58
YBADJ    STCK5          -12.77   -13.57   -13.95   -13.92    23.57    14.95
YBADJ    STCK5            5.88    -3.38   -12.54   -21.31    -3.30    -0.86
YBADJ    STCK5            1.60     4.01     6.30     8.40    10.04    11.58
YBADJ    STCK5           12.77    13.57    13.95    13.92    13.46    12.59
YBADJ    STCK5           11.34     9.73     7.80     5.64     3.30     0.86

YBADJ    STCK4           -5.04    -6.63    -8.01    -9.15    -9.80   -10.37
YBADJ    STCK4          -10.61   -10.54   -10.15    -9.44    -8.45    20.34
YBADJ    STCK4           11.47     2.26    -7.02   -16.08   -24.66     3.31
```

```
   YBADJ    STCK4           5.04     6.63     8.01     9.15     9.80    10.37
   YBADJ    STCK4          10.61    10.54    10.14     9.44     8.45     7.21
   YBADJ    STCK4           5.74     4.08     2.28     0.41    -1.47    -3.31

   YBADJ    STCK3         -11.35   -11.52   -11.35   -10.83    -9.78    -8.64
   YBADJ    STCK3          -7.23    -5.60    -3.80    -1.89     0.08     2.04
   YBADJ    STCK3          21.16    12.10     2.66    -6.85   -16.15   -24.97
   YBADJ    STCK3          11.35    11.52    11.35    10.83     9.78     8.64
   YBADJ    STCK3           7.23     5.60     3.80     1.89    -0.08    -2.04
   YBADJ    STCK3          -3.95    -5.75    -7.40    -8.82    -9.97   -10.83

   YBADJ    STCK2         -14.84   -14.23   -13.19   -11.75    -9.75    -7.65
   YBADJ    STCK2          -5.33    -2.84    -0.26     2.32     4.83     7.20
   YBADJ    STCK2          26.56    17.57     8.04    -1.72   -11.43   -20.80
   YBADJ    STCK2          14.84    14.23    13.19    11.75     9.75     7.65
   YBADJ    STCK2           5.33     2.84     0.26    -2.32    -4.83    -7.20
   YBADJ    STCK2          -9.34   -11.22   -12.78   -13.95   -14.70   -14.99

   YBADJ    STCK1         -18.49   -17.08   -15.15   -12.76    -9.77    -6.69
   YBADJ    STCK1          -3.41    -0.03     3.36     6.64     9.72    12.51
   YBADJ    STCK1          14.91    23.23    13.62     3.61    -6.52   -16.45
   YBADJ    STCK1         -25.88    17.08    15.15    12.76     9.77     6.69
   YBADJ    STCK1           3.41     0.03    -3.36    -6.64    -9.72   -12.51
   YBADJ    STCK1         -14.91   -16.88   -18.36   -19.28   -19.61   -19.34

   SRCGROUP STCK1    STCK1
   SRCGROUP STCK2    STCK2
   SRCGROUP STCK3    STCK3
   SRCGROUP STCK4    STCK4
   SRCGROUP STCK5    STCK5
   SRCGROUP STCK6    STCK6
SO FINISHED
**
****************************************
** AERMOD Receptor Pathway
****************************************
**
**
RE STARTING
RE ELEVUNIT METERS
   DISCCART     480727.25   3636988.55      96.28     122.50
   DISCCART     479941.89   3637766.72     110.84     110.84
   DISCCART     480393.77   3636960.77     117.54     117.54
   DISCCART     479201.15   3637858.96     107.53     107.53
   DISCCART     480661.99   3637527.31     106.02     128.00
   DISCCART     481019.87   3637371.39     106.64     118.40
   DISCCART     481054.47   3637291.13      88.38     119.00
   DISCCART     480556.85   3637550.04     116.51     128.00
```

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   DISCCART     480367.26   3637886.90     127.55     127.55
   DISCCART     481221.63   3636912.82      98.01      98.01
RE FINISHED
**
****************************************
** AERMOD Meteorology Pathway
****************************************
**
**
ME STARTING
   SURFFILE 722931.SFC
   PROFFILE 722931.PFL
   SURFDATA 93107 2009
   UAIRDATA 3190 2009
   PROFBASE 145.4 METERS
ME FINISHED
**
****************************************
** AERMOD Output Pathway
****************************************
**
**
OU STARTING
   RECTABLE ALLAVE 1ST
   RECTABLE 1 1ST
** Auto-Generated Plotfiles
   PLOTFILE 1 STCK1 1ST 1HRSTCK1.PLT 31
   PLOTFILE 1 STCK2 1ST 1HRSTCK2.PLT 32
   PLOTFILE 1 STCK3 1ST 1HRSTCK3.PLT 33
   PLOTFILE 1 STCK4 1ST 1HRSTCK4.PLT 34
   PLOTFILE 1 STCK5 1ST 1HRSTCK5.PLT 35
   PLOTFILE 1 STCK6 1ST 1HRSTCK6.PLT 36
   PLOTFILE PERIOD STCK1 PESTCK1.PLT 37
   PLOTFILE PERIOD STCK2 PESTCK2.PLT 38
   PLOTFILE PERIOD STCK3 PESTCK3.PLT 39
   PLOTFILE PERIOD STCK4 PESTCK4.PLT 40
   PLOTFILE PERIOD STCK5 PESTCK5.PLT 41
   PLOTFILE PERIOD STCK6 PESTCK6.PLT 42
   SUMMFILE NCWRP.sum
OU FINISHED
**
****************************************
** Project Parameters
****************************************
** PROJCTN  CoordinateSystemUTM
** DESCPTN  UTM: Universal Transverse Mercator
** DATUM    World Geodetic System 1984
** DTMRGN   Global Definition
```

```
** UNITS    m
** ZONE     11
** ZONEINX  0
**
```

APPENDIX C – HARP2 SUMMARY OUTPUTS

Maximum Cancer Risk by Pollutant at PMI, MEIR, MEIW, and Sensitive Receptor

NCWRP New LFG IC Engines

Pollutant CAS	Pollutant	Point of Maximum Impact (PMI)		Maximum Exposed Individual Resident (MEIR)		Maximum Exposed Individual Worker (MEIW)		Maximum Sensitive Receptor	
		receptor #	754	receptor #	8	receptor #	11	receptor #	5
		Cancer Risk	Contribution (%)	Cancer Risk	Contribution (%)	Cancer Risk	Contribution (%)	Cancer Risk	Contribution (%)
-	ALL	1.16E-06	100%	8.77E-08	100%	1.89E-08	100%	7.55E-08	100%
71556	1,1,1-TCA	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
107131	Acrylonitrile	7.04E-07	60.78%	5.33E-08	60.79%	1.15E-08	60.78%	4.59E-08	60.79%
71432	Benzene	3.15E-08	2.72%	2.39E-09	2.72%	5.14E-10	2.72%	2.06E-09	2.72%
75150	CS2	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
463581	CarbonylSulfide	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
108907	Chlorobenzn	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
67663	Chloroform	1.54E-10	0.01%	1.16E-11	0.01%	2.50E-12	0.01%	1.00E-11	0.01%
100414	Ethyl Benzene	8.94E-09	0.77%	6.77E-10	0.77%	1.46E-10	0.77%	5.83E-10	0.77%
107062	EDC	6.11E-09	0.53%	4.63E-10	0.53%	9.96E-11	0.53%	3.99E-10	0.53%
50000	Formaldehyde	1.15E-07	9.90%	8.68E-09	9.90%	1.87E-09	9.90%	7.48E-09	9.90%
110543	Hexane	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
7647010	HCl	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
7783064	H2S	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
78933	MEK	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
108101	MIBK	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
74873	Methyl Chloride	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
127184	Perc	2.73E-08	2.35%	2.06E-09	2.35%	4.44E-10	2.35%	1.78E-09	2.35%
108883	Toluene	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
79016	TCE	5.43E-09	0.47%	4.12E-10	0.47%	8.85E-11	0.47%	3.55E-10	0.47%
75014	Vinyl Chloride	2.60E-07	22.45%	1.97E-08	22.45%	4.23E-09	22.45%	1.70E-08	22.45%
75354	Vinylid Chlorid	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
1330207	Xylenes	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%

Maximum Chronic Risk by Pollutant at PMI, MEIR, MEIW, and Sensitive Receptor

NCWRP New LFG IC Engines

Pollutant CAS	Pollutant	Point of Maximum Impact (PMI)		Maximum Exposed Individual Resident (MEIR)		Maximum Exposed Individual Worker (MEIW)		Maximum Sensitive Receptor	
		receptor #	754	receptor #	8	receptor #	11	receptor #	5
		Chronic Hazard Index	Contribution (%)	Chronic Hazard Index	Contribution (%)	Chronic Hazard Index	Contribution (%)	Chronic Hazard Index	Contribution (%)
-	ALL	5.55E-02	100%	4.21E-03	100%	9.96E-03	100%	3.62E-03	100%
71556	1,1,1-TCA	2.15E-07	0.00%	1.63E-08	0.00%	3.86E-08	0.00%	1.40E-08	0.00%
107131	Acrylonitrile	2.27E-04	0.41%	1.72E-05	0.41%	4.07E-05	0.41%	1.48E-05	0.41%
71432	Benzene	1.70E-04	0.31%	1.28E-05	0.31%	3.04E-05	0.31%	1.11E-05	0.31%
75150	CS2	1.88E-07	0.00%	1.42E-08	0.00%	3.37E-08	0.00%	1.22E-08	0.00%
463581	CarbonylSulfide	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
108907	Chlorobenzn	9.78E-08	0.00%	7.41E-09	0.00%	1.76E-08	0.00%	6.38E-09	0.00%
67663	Chloroform	4.35E-08	0.00%	3.29E-09	0.00%	7.80E-09	0.00%	2.84E-09	0.00%
100414	Ethyl Benzene	8.28E-07	0.00%	6.28E-08	0.00%	1.49E-07	0.00%	5.40E-08	0.00%
107062	EDC	3.42E-07	0.00%	2.59E-08	0.00%	6.15E-08	0.00%	2.23E-08	0.00%
50000	Formaldehyde	9.78E-04	1.76%	7.41E-05	1.76%	1.76E-04	1.76%	6.38E-05	1.76%
110543	Hexane	2.74E-07	0.00%	2.08E-08	0.00%	4.92E-08	0.00%	1.79E-08	0.00%
7647010	HCl	5.39E-02	97.01%	4.08E-03	97.01%	9.66E-03	97.01%	3.51E-03	97.01%
7783064	H2S	4.10E-04	0.74%	3.10E-05	0.74%	7.35E-05	0.74%	2.67E-05	0.74%
78933	MEK	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
108101	MIBK	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
74873	Methyl Chloride	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
127184	Perc	5.98E-05	0.11%	4.53E-06	0.11%	1.07E-05	0.11%	3.90E-06	0.11%
108883	Toluene	4.09E-05	0.07%	3.10E-06	0.07%	7.34E-06	0.07%	2.67E-06	0.07%
79016	TCE	2.09E-06	0.00%	1.58E-07	0.00%	3.75E-07	0.00%	1.36E-07	0.00%
75014	Vinyl Chloride	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
75354	Vinylid Chlorid	9.32E-07	0.00%	7.06E-08	0.00%	1.67E-07	0.00%	6.08E-08	0.00%
1330207	Xylenes	6.22E-06	0.01%	4.71E-07	0.01%	1.12E-06	0.01%	4.05E-07	0.01%

Maximum Acute Risk by Pollutant at PMI, MEIR, MEIW, and Sensitive Receptor

NCWRP New LFG IC Engines

Pollutant CAS	Pollutant	Point of Maximum Impact (PMI)		Maximum Exposed Individual Resident (MEIR)		Maximum Exposed Individual Worker (MEIW)		Maximum Sensitive Receptor	
		receptor #	1468	receptor #	6	receptor #	11	receptor #	5
		Acute Hazard Index	Contribution (%)	Acute Hazard Index	Contribution (%)	Acute Hazard Index	Contribution (%)	Acute Hazard Index	Contribution (%)
-	ALL	1.28E-02	100%	1.54E-03	100%	3.40E-03	100%	1.18E-03	100%
71556	1,1,1-TCA	1.04E-07	0.00%	1.24E-08	0.00%	2.75E-08	0.00%	9.55E-09	0.00%
107131	Acrylonitrile	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
71432	Benzene	6.16E-04	4.81%	7.40E-05	4.81%	1.64E-04	4.81%	5.69E-05	4.81%
75150	CS2	7.92E-07	0.01%	9.50E-08	0.01%	2.10E-07	0.01%	7.30E-08	0.01%
463581	CarbonylSulfide	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
108907	Chlorobenzn	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
67663	Chloroform	2.84E-06	0.02%	3.41E-07	0.02%	7.55E-07	0.02%	2.63E-07	0.02%
100414	Ethyl Benzene	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
107062	EDC	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
50000	Formaldehyde	5.24E-03	40.88%	6.29E-04	40.88%	1.39E-03	40.88%	4.83E-04	40.88%
110543	Hexane	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
7647010	HCl	7.55E-03	58.92%	9.06E-04	58.92%	2.00E-03	58.92%	6.97E-04	58.92%
7783064	H2S	3.19E-03	24.90%	3.83E-04	24.90%	8.47E-04	24.90%	2.94E-04	24.90%
78933	MEK	4.37E-06	0.03%	5.24E-07	0.03%	1.16E-06	0.03%	4.03E-07	0.03%
108101	MIBK	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
74873	Methyl Chloride	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
127184	Perc	3.42E-06	0.03%	4.11E-07	0.03%	9.09E-07	0.03%	3.16E-07	0.03%
108883	Toluene	1.08E-05	0.08%	1.30E-06	0.08%	2.88E-06	0.08%	1.00E-06	0.08%
79016	TCE	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
75014	Vinyl Chloride	2.82E-07	0.00%	3.39E-08	0.00%	7.49E-08	0.00%	2.60E-08	0.00%
75354	Vinylid Chlorid	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%	0.00E+00	0.00%
1330207	Xylenes	6.47E-06	0.05%	7.76E-07	0.05%	1.72E-06	0.05%	5.97E-07	0.05%

HARP Model Summary Files

HARP Project Summary Report 2/13/2017 1:26:43 PM

PROJECT INFORMATION
HARP Version: 17023
Project Name: NCWRP
Project Output Directory: C:\HARP2\projects\NCWRP\NCWRP
HARP Database: NA

FACILITY INFORMATION
Origin
X (m):0
Y (m):0
Zone:1
No. of Sources:0
No. of Buildings:0

EMISSION INVENTORY
No. of Pollutants:110
No. of Background Pollutants:0

Emissions

ScrID	StkID	ProID	PolID	PolAbbrev	Multi	Annual Ems (lbs/yr)	MaxHr Ems (lbs/hr)	MWAF
1	0	0	107131	Acrylonitrile	1	9.6941664	0.00110664	1
1	0	0	71432	Benzene	1	4.3456608	0.00049608	1
1	0	0	75150	CS2	1	1.2814128	0.00014628	1
1	0	0	463581	CarbonylSulfide	1	0.835704	9.54E-05	1
1	0	0	108907	Chlorobenzn	1	0.835704	9.54E-05	1
1	0	0	67663	Chloroform	1	0.1114272	1.272E-05	1
1	0	0	100414	Ethyl Benzene	1	14.1512544	0.00161544	1
1	0	0	107062	EDC	1	1.1699856	0.00013356	1
1	0	0	50000	Formaldehyde	1	75.21336	0.008586	1
1	0	0	110543	Hexane	1	16.3797984	0.00186984	1
1	0	0	7647010	HCl	1	4139.52048	0.472548	1
1	0	0	7783064	H2S	1	34.9881408	0.00399408	1
1	0	0	78933	MEK	1	14.8198176	0.00169176	1
1	0	0	108101	MIBK	1	5.4042192	0.00061692	1
1	0	0	74873	Methyl Chloride	1	35.1552816	0.00401316	1
1	0	0	127184	Perc	1	17.8840656	0.00204156	1
1	0	0	108883	Toluene	1	104.7972816	0.01196316	1
1	0	0	79016	TCE	1	10.6970112	0.00122112	1
1	0	0	75014	Vinyl Chloride	1	13.2598368	0.00151368	1
1	0	0	75354	Vinylid Chlorid	1	0.557136	6.36E-05	1
1	0	0	1330207	Xylenes	1	37.1609712	0.00424212	1
2	0	0	71556	1,1,1-TCA	1	1.8385488	0.00020988	1
2	0	0	107131	Acrylonitrile	1	9.6941664	0.00110664	1
2	0	0	71432	Benzene	1	4.3456608	0.00049608	1
2	0	0	75150	CS2	1	1.2814128	0.00014628	1
2	0	0	463581	CarbonylSulfide	1	0.835704	9.54E-05	1
2	0	0	108907	Chlorobenzn	1	0.835704	9.54E-05	1
2	0	0	67663	Chloroform	1	0.1114272	1.272E-05	1
2	0	0	100414	Ethyl Benzene	1	14.1512544	0.00161544	1

2	0	0	107062	EDC	1	1.1699856	0.00013356	1
2	0	0	50000	Formaldehyde	1	75.21336	0.008586	1
2	0	0	110543	Hexane	1	16.3797984	0.00186984	1
2	0	0	7647010	HCl	1	4139.52048	0.472548	1
2	0	0	7783064	H2S	1	34.9881408	0.00399408	1
2	0	0	78933	MEK	1	14.8198176	0.00169176	1
2	0	0	108101	MIBK	1	5.4042192	0.00061692	1
2	0	0	74873	Methyl Chloride	1	35.1552816	0.00401316	1
2	0	0	127184	Perc	1	17.8840656	0.00204156	1
2	0	0	108883	Toluene	1	104.7972816	0.01196316	1
2	0	0	79016	TCE	1	10.6970112	0.00122112	1
2	0	0	75014	Vinyl Chloride	1	13.2598368	0.00151368	1
2	0	0	75354	Vinylid Chlorid	1	0.557136	6.36E-05	1
3	0	0	71556	1,1,1-TCA	1	1.8385488	0.00020988	1
3	0	0	107131	Acrylonitrile	1	9.6941664	0.00110664	1
3	0	0	71432	Benzene	1	4.3456608	0.00049608	1
3	0	0	75150	CS2	1	1.2814128	0.00014628	1
3	0	0	463581	CarbonylSulfide	1	0.835704	9.54E-05	1
3	0	0	108907	Chlorobenzn	1	0.835704	9.54E-05	1
3	0	0	67663	Chloroform	1	0.1114272	1.272E-05	1
3	0	0	100414	Ethyl Benzene	1	14.1512544	0.00161544	1
3	0	0	107062	EDC	1	1.1699856	0.00013356	1
3	0	0	50000	Formaldehyde	1	75.21336	0.008586	1
3	0	0	110543	Hexane	1	16.3797984	0.00186984	1
3	0	0	7647010	HCl	1	4139.52048	0.472548	1
3	0	0	7783064	H2S	1	34.9881408	0.00399408	1
3	0	0	78933	MEK	1	14.8198176	0.00169176	1
3	0	0	108101	MIBK	1	5.4042192	0.00061692	1
3	0	0	74873	Methyl Chloride	1	35.1552816	0.00401316	1
3	0	0	127184	Perc	1	17.8840656	0.00204156	1
3	0	0	108883	Toluene	1	104.7972816	0.01196316	1
3	0	0	79016	TCE	1	10.6970112	0.00122112	1
3	0	0	75014	Vinyl Chloride	1	13.2598368	0.00151368	1
3	0	0	75354	Vinylid Chlorid	1	0.557136	6.36E-05	1
3	0	0	1330207	Xylenes	1	37.1609712	0.00424212	1
4	0	0	71556	1,1,1-TCA	1	1.8385488	0.00020988	1
4	0	0	107131	Acrylonitrile	1	9.6941664	0.00110664	1
4	0	0	71432	Benzene	1	4.3456608	0.00049608	1
4	0	0	75150	CS2	1	1.2814128	0.00014628	1
4	0	0	463581	CarbonylSulfide	1	0.835704	9.54E-05	1

4	0	0	108907	Chlorobenzn	1	0.835704	9.54E-05	1
4	0	0	67663	Chloroform	1	0.1114272	1.272E-05	1
4	0	0	100414	Ethyl Benzene	1	14.1512544	0.00161544	1
4	0	0	107062	EDC	1	1.1699856	0.00013356	1
4	0	0	50000	Formaldehyde	1	75.21336	0.008586	1
4	0	0	110543	Hexane	1	16.3797984	0.00186984	1
4	0	0	7647010	HCl	1	4139.52048	0.472548	1
4	0	0	7783064	H2S	1	34.9881408	0.00399408	1
4	0	0	78933	MEK	1	14.8198176	0.00169176	1
4	0	0	108101	MIBK	1	5.4042192	0.00061692	1
4	0	0	74873	Methyl Chloride	1	35.1552816	0.00401316	1
4	0	0	127184	Perc	1	17.8840656	0.00204156	1
4	0	0	108883	Toluene	1	104.7972816	0.01196316	1
4	0	0	79016	TCE	1	10.6970112	0.00122112	1
4	0	0	75014	Vinyl Chloride	1	13.2598368	0.00151368	1
4	0	0	75354	Vinylid Chlorid	1	0.557136	6.36E-05	1
4	0	0	1330207	Xylenes	1	37.1609712	0.00424212	1
5	0	0	71556	1,1,1-TCA	1	1.8385488	0.00020988	1
5	0	0	107131	Acrylonitrile	1	9.6941664	0.00110664	1
5	0	0	71432	Benzene	1	4.3456608	0.00049608	1
5	0	0	75150	CS2	1	1.2814128	0.00014628	1
5	0	0	463581	CarbonylSulfide	1	0.835704	9.54E-05	1
5	0	0	108907	Chlorobenzn	1	0.835704	9.54E-05	1
5	0	0	67663	Chloroform	1	0.1114272	1.272E-05	1
5	0	0	100414	Ethyl Benzene	1	14.1512544	0.00161544	1
5	0	0	107062	EDC	1	1.1699856	0.00013356	1
5	0	0	50000	Formaldehyde	1	75.21336	0.008586	1
5	0	0	110543	Hexane	1	16.3797984	0.00186984	1
5	0	0	7647010	HCl	1	4139.52048	0.472548	1
5	0	0	7783064	H2S	1	34.9881408	0.00399408	1
5	0	0	78933	MEK	1	14.8198176	0.00169176	1
5	0	0	108101	MIBK	1	5.4042192	0.00061692	1
5	0	0	74873	Methyl Chloride	1	35.1552816	0.00401316	1
5	0	0	127184	Perc	1	17.8840656	0.00204156	1
5	0	0	108883	Toluene	1	104.7972816	0.01196316	1
5	0	0	79016	TCE	1	10.6970112	0.00122112	1
5	0	0	75014	Vinyl Chloride	1	13.2598368	0.00151368	1
5	0	0	75354	Vinylid Chlorid	1	0.557136	6.36E-05	1
5	0	0	1330207	Xylenes	1	37.1609712	0.00424212	1
1	0	0	71556	1,1,1-TCA	1	1.8385488	0.00020988	1
2	0	0	1330207	Xylenes	1	37.1609712	0.00424212	1

Background

PolID	PolAbbrev	Conc (ug/m^3)	MWAF

Ground level concentration files (\glc\)

100414MAXHR.txt
100414PER.txt
107062MAXHR.txt
107062PER.txt
107131MAXHR.txt
107131PER.txt
108101MAXHR.txt
108101PER.txt
108883MAXHR.txt
108883PER.txt
108907MAXHR.txt
108907PER.txt
110543MAXHR.txt
110543PER.txt
127184MAXHR.txt
127184PER.txt
1330207MAXHR.txt
1330207PER.txt
463581MAXHR.txt
463581PER.txt
50000MAXHR.txt
50000PER.txt
67663MAXHR.txt
67663PER.txt
71432MAXHR.txt
71432PER.txt
71556MAXHR.txt
71556PER.txt
74873MAXHR.txt
74873PER.txt
75014MAXHR.txt
75014PER.txt
75150MAXHR.txt
75150PER.txt
75354MAXHR.txt
75354PER.txt
7647010MAXHR.txt
7647010PER.txt
7783064MAXHR.txt
7783064PER.txt
78933MAXHR.txt
78933PER.txt
79016MAXHR.txt
79016PER.txt

POLLUTANT HEALTH INFORMATION
Health Database: C:\HARP2\Tables\HEALTH1.mdb
Health Table Version: HEALTH16088
Official: True

PolID	PolAbbrev	InhCancer	OralCancer	AcuteREL	InhChronicREL	OralChronicREL	InhChronic8HRREL
107131	Acrylonitrile	1			5		
71432	Benzene	0.1		27	3		3
75150	CS2			6200	800		
463581	CarbonylSulfide						
108907	Chlorobenzn				1000		
67663	Chloroform	0.019		150	300		
100414	Ethyl Benzene	0.0087			2000		
107062	EDC	0.072			400		
50000	Formaldehyde	0.021		55	9		9
110543	Hexane				7000		
7647010	HCl			2100	9		
7783064	H2S			42	10		
78933	MEK			13000			
108101	MIBK						
74873	Methyl Chloride						
127184	Perc	0.021		20000	35		
108883	Toluene			37000	300		
79016	TCE	0.007			600		
75014	Vinyl Chloride	0.27		180000			
75354	Vinylid Chlorid				70		
1330207	Xylenes			22000	700		

71556	1,1,1-TCA	68000	1000

AIR DISPERSION MODELING INFORMATION
All executables were obtained from USEPA's Support Center for Regulatory Atmospheric Modeling website (http://www.epa.gov/scram001/)
AERMOD: 15181
AERMAP: 11103
BPIPPRM: 04274
AERPLOT: 13329

METEOROLOGICAL INFORMATION
Version:
Surface File:
Profile File:
Surface Station:
Upper Station:
On-Site Station:

LIST OF AIR DISPERSION FILES
AERMOD Input File:
AERMOD Output File:
AERMOD Error File:
Plotfile list
____
1HRSTCK1.PLT
1HRSTCK2.PLT
1HRSTCK3.PLT
1HRSTCK4.PLT
1HRSTCK5.PLT
PESTCK1.PLT
PESTCK2.PLT
PESTCK3.PLT
PESTCK4.PLT
PESTCK5.PLT

LIST OF RISK ASSESSMENT FILES
Health risk analysis files (\hra\)
____
5.NCWRPGLCList.csv
5.NCWRPHRAInput.hra
5.NCWRPPathwayRec.csv
5.NCWRPPolDB.csv
NCWRPCancerRisk.csv
NCWRPCancerRiskSumByRec.csv
NCWRPGLCList.csv
NCWRPHRAInput.hra
NCWRPNCAcuteRisk.csv
NCWRPNCAcuteRiskSumByRec.csv
NCWRPNCChronicRisk.csv
NCWRPNCChronicRiskSumByRec.csv
NCWRPOutput.txt
NCWRPPathwayRec.csv
NCWRPPolDB.csv

Spatial averaging files (\sa\)
____

HARP2 - HRACalc (dated 17023) 2/13/2017 1:34:43 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
****
RISK SCENARIO SETTINGS

Receptor Type: Resident
Scenario: All
Calculation Method: Derived

****
EXPOSURE DURATION PARAMETERS FOR CANCER

Start Age: -0.25
Total Exposure Duration: 30

Exposure Duration Bin Distribution
3rd Trimester Bin: 0.25
0<2 Years Bin: 2
2<9 Years Bin: 0
2<16 Years Bin: 14
16<30 Years Bin: 14
16 to 70 Years Bin: 0

****
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments. The remaining pathways are only used for cancer and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: True
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

****
INHALATION

Daily breathing rate: LongTerm24HR

Worker Adjustment Factors
Worker adjustment factors enabled: NO

Fraction at time at home
3rd Trimester to 16 years: ON
16 years to 70 years: ON

****
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.02
Soil mixing depth (m): 0.01
Dermal climate: Mixed

****
TIER 2 SETTINGS
Tier2 not used.

****

Calculating cancer risk
Cancer risk breakdown by pollutant and receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPCancerRisk.csv
Cancer risk total by receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPCancerRiskSumByRec.csv
Cancer risk total by receptor and source saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\CancerRiskSumByRec.csv
Calculating chronic risk
Chronic risk breakdown by pollutant and receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPNCChronicRisk.csv
Chronic risk total by receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPNCChronicRiskSumByRec.csv
Chronic risk total by receptor and source saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPNCChronicRiskSumByRecBySrc.csv
Calculating acute risk
Acute risk breakdown by pollutant and receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPNCAcuteRisk.csv
Acute risk total by receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPNCAcuteRiskSumByRec.csv
Acute risk total by receptor and source saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRPNCAcuteRiskSumByRecBySrc.csv
HRA ran successfully

HARP2 - HRACalc (dated 17023) 2/13/2017 1:31:22 PM - Output Log

GLCs loaded successfully
Pollutants loaded successfully
Pathway receptors loaded successfully
****
RISK SCENARIO SETTINGS

Receptor Type: Worker
Scenario: All
Calculation Method: Derived

****
EXPOSURE DURATION PARAMETERS FOR CANCER

Start Age: 16
Total Exposure Duration: 25

Exposure Duration Bin Distribution
3rd Trimester Bin: 0
0<2 Years Bin: 0
2<9 Years Bin: 0
2<16 Years Bin: 0
16<30 Years Bin: 0
16 to 70 Years Bin: 25

****
PATHWAYS ENABLED

NOTE: Inhalation is always enabled and used for all assessments. The remaining pathways are only used for cancer and noncancer chronic assessments.

Inhalation: True
Soil: True
Dermal: True
Mother's milk: False
Water: False
Fish: False
Homegrown crops: False
Beef: False
Dairy: False
Pig: False
Chicken: False
Egg: False

****
INHALATION

Daily breathing rate: Moderate8HR

Worker Adjustment Factors
Worker adjustment factors enabled: NO

Fraction at time at home
3rd Trimester to 16 years: OFF
16 years to 70 years: OFF

****
SOIL & DERMAL PATHWAY SETTINGS

Deposition rate (m/s): 0.02
Soil mixing depth (m): 0.01
Dermal climate: Mixed

****
TIER 2 SETTINGS
Tier2 not used.

****

Calculating cancer risk
Cancer risk breakdown by pollutant and receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerCancerRisk.csv
Cancer risk total by receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerCancerRiskSumByRec.csv
Cancer risk total by receptor and source saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\CancerRiskSumByRec.csv
Calculating chronic risk
Chronic risk breakdown by pollutant and receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerNCChronicRisk.csv
Chronic risk total by receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerNCChronicRiskSumByRec.csv
Chronic risk total by receptor and source saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerNCChronicRiskSumByRecBySrc.csv
Calculating acute risk
Acute risk breakdown by pollutant and receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerNCAcuteRisk.csv
Acute risk total by receptor saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerNCAcuteRiskSumByRec.csv
Acute risk total by receptor and source saved to:
C:\HARP2\projects\NCWRP\NCWRP\hra\NCWRP-workerNCAcuteRiskSumByRecBySrc.csv
HRA ran successfully