Prepared for
Sterigenics US, LLC
Facility ID's 126191 and 126197
Vernon, California

Project Number
1690027195

Facility Submittals
December 6, 2022
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RULE 1402 AIR TOXICS HEALTH RISK ASSESSMENT - REVISED

STERIGENICS U.S., LLC
VERNON, CALIFORNIA

Modified by
South Coast AQMD

Modification Date
June 11, 2024

Executive Table: Required modifications made by South Coast AQMD

Section/Page	Modifications	Reason for modification
Throughout Document	Update verbiage to reflect one facility with multiple operations/buildings.	South Coast AQMD previously determined the Sterigenics Vernon operations to be contiguous and a single HRA needed.
	Update with results of modeling performed by South Coast AQMD staff	These changes were made to align the document with the modeling method required by South Coast AQMD and the results of said modeling.
Table ES-1	Update the annual average emissions and maximum one-hour emissions for Ethylene Oxide.	Update the report to show estimates derived from U.S.EPA methodology.
Table ES-2	Update the exposure pathways for certain compounds	This change was made to align the document with OEHHA Guidelines.
Section 2.2	Include additional monitoring data from South Coast AQMD EtO monitoring near the facility and in Central Los Angeles	This change was made in an effort to be transparent with the data available at the time of modification.
Section 2.5.1	• Update percentage of EtO usage that enters the scrubber from 95% to 93.36%. • Update fugitive emissions factor. • Clarify that 5% of emissions going to the abators are from process emissions.	The changes were made to align the document with U.S. EPA methodologies.
Section 2.6	• Remove language stating that the Willowbrook study will be used to estimate fugitive emissions. • Add language explaining that the U.S. EPA method for estimating fugitive emissions will be used. • Add a table that lists the industry average percentages of EtO usage per emission source group.	The changes were made to align the document with U.S. EPA methodologies.
	Update description of fugitive volume sources and allocation of emissions.	This change was made to align the document with the modeling method performed by South Coast AQMD.
Section 3.6	Update receptor totals.	These changes were made to align the document with the modeling method performed by South Coast AQMD and ensure all sensitive receptors and census receptors within the zone of impact were evaluated.
Section 4.3.1	Update cancer risk equation	This change was made to reflect the most up-to-date guidance from OEHHA.
Section 6.1	• Remove language regarding the Willowbrook study. • Add language explaining that the U.S. EPA method for estimating fugitive emissions will be used for the ATIR.	The changes were made to align the document with U.S. EPA methodologies.

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DEFINITIONS

Acute Health Impacts: non-cancer health impacts for short-term, one-hour peak exposures to potential Facility emissions. Acute Reference Exposure Levels (RELs), which are used to calculate acute non-cancer hazards, are developed so as to represent "an exposure that is not likely to cause adverse health effects in a human population, included sensitive subgroups, exposed to that concentration … for the specified exposure duration on an intermittent basis" (OEHHA 2015).

Chronic Health Impacts: non-cancer health impacts from long-term exposure to potential Facility emissions. Chronic RELs, which are used to calculate chronic non-cancer hazards, are developed so as to represent the level "at or below which no adverse health effects are anticipated following long-term exposure. Long-term exposure for these purposes has been defined as 12% of a lifetime, or about eight years for humans." (OEHHA 2015)

8-hour Chronic Health Impacts: non-cancer health impacts from exposures that occur on a recurrent basis but only during a portion of each day. The 8-hour RELs are designed to protect against periodic exposure that could occur as often as daily and may share characteristics of both acute and chronic exposure. These RELs were developed because of concerns that applying the chronic REL in some cases was overly conservative. 8-hour RELs are "concentrations at or below which adverse health effects are not likely to occur in the general human population with intermittent exposures of eight hours per day, up to 7 days per week." (OEHHA 2015)

Cancer Health Impacts: carcinogenic risks estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to carcinogens potentially present in Facility emissions (USEPA 1989). Cancer inhalation and oral potency factors, which are used to calculate cancer risk, are "expressed as the upper bound of probability of developing cancer assuming continuous lifetime exposure to a substance at a dose of one milligram per kilogram of body weight. It is assumed in cancer risk assessments that risk is directly proportional to dose and that there is no threshold for carcinogenesis. The derivation of carcinogenic inhalation and oral cancer potency factors takes into account the available information on pharmacokinetics and on the mechanism of carcinogenic action. These values are generally the 95% upper confidence limit (UCL) on the dose-response slope." (OEHHA 2015)

ACRONYMS AND ABBREVIATIONS

AB:	Assembly Bill
ARB:	(California) Air Resources Board
AER:	Annual Emission Reporting
AERMOD:	American Meteorological Society/Environmental Protection Agency regulatory air dispersion model
AERMAP:	AMS/EPA Regulatory Model Terrain Pre-processor
ADMRT:	Air Dispersion Modeling and Risk Tool
ATIR:	Air Toxic Inventory Report
BPIPPRIME:	Building Profile Input Program PRIME
Cal/EPA:	California Environmental Protection Agency
CELA:	Central Los Angeles
CPF:	Cancer Potency Factor
EARP:	Early Action Reduction Plan
EtO:	Ethylene Oxide
GLC:	Ground-Level Concentration
HARP:	Hotspots Analysis and Reporting Program
HI:	Hazard Index
HQ:	Hazard Quotient
HRA:	Health Risk Assessment
MICR:	Maximum Individual Cancer Risk
MEIR:	Maximally Exposed Individual Resident
MEIW:	Maximally Exposed Individual Worker
MEISR:	Maximally Exposed Individual Sensitive Receptor
MSDS:	Material Safety Data Sheet
NED:	National Elevation Dataset
OEHHA:	Office of Environmental Health Hazard Assessment
PMI:	Point of Maximum Impact
P/O:	Permit to Operate
REL:	Reference Exposure Levels
RRP:	Risk Reduction Plan
South Coast AQMD:	South Coast Air Quality Management District
SCR:	Selective Catalytic Reduction
SNCR:	Selective Non-Catalytic Reduction
TAC:	Toxic Air Contaminant
USEPA:	United States Environmental Protection Agency
USGS:	United States Geological Survey
UTM:	Universal Transverse Mercator
WGS:	World Geodetic System

LIST OF UNITS

µg:	microgram
g:	gram
hr:	hour
L:	liter
Kg:	kilogram
km:	kilometer
m:	meter
m^3:	cubic meter
mg:	milligram
s:	second
yr:	year

EXECUTIVE SUMMARY

In accordance with the California Air Toxics "Hot Spots" Act (AB2588) and South Coast AQMD Rule 1402, this report presents the human health risk assessment (HRA) for the Sterigenics U.S., LLC (Sterigenics) facility, located at 4801-63 E. 50th Street and 4900 S. Gifford Ave, Vernon, California (South Coast Air Quality Management District [South Coast AQMD] Facility ID 126191 and Facility ID 126197) based on the 2021 Air Toxic Contaminants (TACs) emission inventory. The South Coast AQMD designated Sterigenics Vernon as a Potentially High-Risk Level Facility. Per the Rule 1402 requirements for Potentially High-Risk Level Facilities and the South Coast AQMD's letter dated on June 7, 2022, Sterigenics was required to prepare an Early Action Reduction Plan (EARP), an Air Toxic Inventory Report (ATIR), HRA, and Risk Reduction Plan (RRP).

Sterigenics previously submitted an AB2588 HRA to South Coast AQMD on December 6, 2022 (referred hereinafter as the "Original 2021 HRA"). In response to the review comments on the Original 2021 HRA by South Coast AQMD in its letter to Sterigenics dated June 15, 2023, this revised report was prepared based on the operating conditions and combined toxic air contaminant (TAC) emission inventory for calendar year 2021 from the facility. This revised report was then modified by the South Coast AQMD to address deficiencies (referred to hereinafter as "Modified 2021 HRA"). The annual and hour TAC emissions are shown in **Table ES-1**. **Table ES-2** lists the exposure pathway and target organ system for the air toxics emitted from Sterigenics.

This HRA was prepared following the Office of Environmental Health Hazard Assessment (OEHHA) Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessment (OEHHA, 2015), the latest toxicity values published by OEHHA, the South Coast AQMD's Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (South Coast AQMD, 2020), and the United States Environmental Protection Agency (USEPA) Guidelines on Air Quality Models (USEPA, 2005).

Ethylene oxide (EtO) is classified as one of the 188 hazardous air pollutants in the Clean Air Act. In December 2016, U.S. EPA published an updated evaluation of the inhalation carcinogenicity for EtO, which results in an equivalent cancer risk many times higher than estimated by OEHHA. Using the current OEHHA cancer potency factor for EtO, a concentration of 0.26 ppbv is approximately equivalent to a residential lifetime cancer risk of 100 chances in-one-million. Meanwhile, the updated U.S. EPA IRIS carcinogenicity factor is equivalent to over 2,300 in-one-million lifetime cancer risk when exposed continuously to a concentration of 0.26 ppbv. Subsequently, OEHHA released a draft updated cancer inhalation unit risk factor (IUR) for EtO on April 7, 2023, which is much closer to the current IRIS unit risk estimate. OEHHA has not finalized this draft update; as a result this HRA was prepared using OEHHA's current IUR for EtO per OEHHA's guidelines. If OEHHA ultimately finalizes a higher cancer potency value, then the resulting estimated health risks from Sterigenics would be higher. Once finalized, any future HRAs will utilize the updated IUR.

Sterigenics operates a medical sterilization business. This facility sterilizes medical devices such as surgical kits, delivery systems, and COVID test swabs using ethylene oxide (EtO). The Sterigenics facility is subject to South Coast Air Quality Management District (South Coast AQMD or District) rules and regulations, including Rule 1405, "Control of Ethylene Oxide and Chlorofluorocarbon Emissions from Sterilization or Fumigation Processes." Potential onsite sources of emissions include the process emissions from sterilization vacuum chambers, chamber back vents, aeration room, fugitive sources in shipping and other areas, as well as natural gas boilers.

The AB2588 HRA was conducted in four steps:

- The first step in the HRA was to identify the toxic air contaminants (TACs) of concern, sources of those contaminants, and to estimate the emissions from each source. This process is called "hazard identification."
- The second step, called "exposure assessment," was to quantify the amount of TACs that people are exposed to during a specific time period, as well as the total number of people exposed. USEPA AERMOD Executable Version 22112 and the South Coast AQMD selected meteorological station data were used to perform the air dispersion modeling for this Modified 2021 HRA to estimate the ground level air concentrations of the TACs.
- The third step is called "dose-response assessment." Dose is the amount of a chemical that enters the human body (or reaches a target organ); response is the resulting health effect from the level of the dose. The Hot Spots Analysis and Reporting Program (HARP) software was used to perform the calculations for this step as well as for the last step. Exposure pathways evaluated in the HRA include inhalation, dermal absorption, soil ingestion, homegrown produce, and mother's milk for the residential scenario and inhalation, dermal absorption, and soil ingestion for the worker scenario.
- The last step of the risk assessment process is called "risk characterization." Risk characterization ties together the above three processes to describe the type and magnitude of any increased health risks as a result of the exposure to the toxic air emissions from a facility.

AB2588 HRA Results

As summarized in **Table ES-3**, the estimated incremental cancer risk for the maximally exposed individual resident (MEIR) is 40.8 chances in-one-million, and for the maximally exposed individual worker (MEIW) is 77.1 chances in-one-million. The maximally exposed sensitive receptor is Maywood Elementary School, located at 5200 Cudahy Ave, Maywood, CA 90270; this receptor has an estimated cancer risk of 4.9 chances in one million, based on a 30-year residential exposure assumption. Fugitive emissions of ethylene oxide from the facility is the primary contributor to the cancer risk. Detailed discussions on the locations of the Maximum Impact (PMI), MEIR, MEIW, and maximally exposed individual sensitive receptor (MEISR) for cancer and non-cancer risks and 30-year one-in–a-million cancer risk "zone of impact" are all included in Section 5. The excess cancer burden for the total population within the zone of impact is 0.11.

The chronic hazard Index (HIC) is 0.01 at the MEIR, and is 0.15 at the MEIW, not accounting for any background concentrations. The highest HIC among the sensitive receptors is located at Maywood Elementary School but well below 0.01. Ethylene oxide is the primary contributor to the highest HIC. Central Nervous System (CNS) is the primary target organ.

The 8-hr chronic hazard index (HIC) at the PMI, MEIR, and the MEIW are all well below 0.01, not accounting for any background concentrations. The highest 8-hr HIC among the sensitive receptors is also well below 0.01 at Rodas Family Child Care, located at 4034 E 56th St, Maywood, CA 90270. Ethylene oxide is the primary contributor to the highest HIC. Respiratory System is the primary target organ.

The acute hazard index (HIA) at the PMI, MEIR and MEIW are well below 0.01. The highest HIA for the sensitive receptors is also well below 0.01 at Maywood Elementary School. Acrolein and ammonia

emissions from the boilers are the primary contributors to the highest HIA and eyes are the primary target organ.

The South Coast AQMD's public notification thresholds are as follows:

- ≥ 10 chances in-one-million maximum individual (lifetime) cancer risk (MICR), or
- > 1.0 HIA, or
- > 1.0 HIC.

The South Coast AQMD Rule 1402 Action Risk Level for a risk reduction plan are as follows:

- Cancer risk (MICR): 25 chances in-one-million, or
- Cancer burden: 0.5, or
- HIA: 3.0, or
- HIC: 3.0.

South Coast AQMD Rule 1402 also establishes Significant Risk Level:

- MICR of 100 chances in-one-million (1.0 x 10-4), or
- HIA or HIC of five (5.0) for any target organ system at any receptor location.

The AB2588 HRA results based on the 2021 emissions indicate that the MICR cancer risk of 77.1 chances in-one-million exceeds the South Coast AQMD Rule 1402 public notification threshold of 10 chances in-one- million and action risk threshold of 25 chances in-one-million. The HRA results for cancer burden, chronic HI, 8-hr chronic HI and acute HI are all below the Rule 1402 notification and action risk levels. Sterigenics was designed as a Potentially High-Risk Level Facility based on ambient ethylene oxide data; therefore, a risk reduction plan is required, as well as expedited actions based on the significant risk level threshold.

An Early Risk Reduction Plan was submitted on September 2, 2020. A Risk Reduction Plan (RRP) was submitted on December 6, 2022 that showed the results of post-control HRA. Sterigenics has already begun implementing some of the risk reduction measures provided in the EARP and RRP, per the Rule 1402 requirements.

Figure ES-1 at the end of this Executive Summary shows cancer results for the Modified 2021 HRA; ten chances in-one-million and twenty-five chances in-one-million cancer risk isopleths for the HRA results based on the 30-year residential exposure assumptions are presented. One chance in-one-million risk level corresponds to the zone of impact, 10 chances in-one-million risk level corresponds to the public notification level, and 25 chances in-one- million represents the higher risk levels that trigger risk reduction planning.

Figure ES-2 shows the chronic HI results for the Modified 2021 HRA. The 0.5 HI level; corresponds to the zone of impact. There were no receptors with a resulting HI above notification or action risk levels.

Figure ES-3, Figure ES-4, Figure ES-5 show the locations of PMI, MEIR, MEIW, and MEISR for cancer risk/chronic HI, 8-hr chronic HI, and acute HI, respectively.

Table ES-1: TAC Emissions by Source

Source ID	Source Description	Compound		Annual Emissions	Annual Emissions	Hourly Emissions	Hourly Emissions
		CAS # / Emittant ID	Name	lb/year	g/s	lb/hr	g/s
49B1	49th St. Boiler #1	71-43-2	Benzene	1.99E-02	2.87E-07	2.27E-06	2.87E-07
49B1		50-00-0	Formaldehyde	4.23E-02	6.09E-07	4.83E-06	6.09E-07
49B1		1151	Total PAHs [excluding naphthalene]	2.49E-04	3.58E-09	2.84E-08	3.58E-09
49B1		91-20-3	Naphthalene	7.47E-04	1.07E-08	8.53E-08	1.07E-08
49B1		75-07-0	Acetaldehyde	1.07E-02	1.54E-07	1.22E-06	1.54E-07
49B1		107-02-8	Acrolein	6.72E-03	9.67E-08	7.67E-07	9.67E-08
49B1		7664-41-7	Ammonia	7.97E+00	1.15E-04	9.10E-04	1.15E-04
49B1		100-41-4	Ethylbenzene	2.37E-02	3.40E-07	2.70E-06	3.40E-07
49B1		110-54-3	Hexane	1.57E-02	2.26E-07	1.79E-06	2.26E-07
49B1		108-88-3	Toluene	9.11E-02	1.31E-06	1.04E-05	1.31E-06
49B1		1330-20-7	Xylene	6.77E-02	9.74E-07	7.73E-06	9.74E-07
49B2	49th St. Boiler #2	71-43-2	Benzene	1.99E-02	2.87E-07	2.27E-06	2.87E-07
49B2		50-00-0	Formaldehyde	4.23E-02	6.09E-07	4.83E-06	6.09E-07
49B2		1151	Total PAHs [excluding naphthalene]	2.49E-04	3.58E-09	2.84E-08	3.58E-09
49B2		91-20-3	Naphthalene	7.47E-04	1.07E-08	8.53E-08	1.07E-08
49B2		75-07-0	Acetaldehyde	1.07E-02	1.54E-07	1.22E-06	1.54E-07
49B2		107-02-8	Acrolein	6.72E-03	9.67E-08	7.67E-07	9.67E-08
49B2		7664-41-7	Ammonia	7.97E+00	1.15E-04	9.10E-04	1.15E-04
49B2		100-41-4	Ethylbenzene	2.37E-02	3.40E-07	2.70E-06	3.40E-07
49B2		110-54-3	Hexane	1.57E-02	2.26E-07	1.79E-06	2.26E-07
49B2		108-88-3	Toluene	9.11E-02	1.31E-06	1.04E-05	1.31E-06
49B2		1330-20-7	Xylene	6.77E-02	9.74E-07	7.73E-06	9.74E-07
49A	49th St. Abator	71-43-2	Benzene	5.98E-02	8.60E-07	6.82E-06	8.60E-07
49A		50-00-0	Formaldehyde	1.27E-01	1.83E-06	1.45E-05	1.83E-06
49A		1151	Total PAHs [excluding naphthalene]	7.47E-04	1.07E-08	8.53E-08	1.07E-08
49A		91-20-3	Naphthalene	2.24E-03	3.22E-08	2.56E-07	3.22E-08
49A		75-07-0	Acetaldehyde	3.21E-02	4.62E-07	3.67E-06	4.62E-07
49A		107-02-8	Acrolein	2.02E-02	2.90E-07	2.30E-06	2.90E-07
49A		7664-41-7	Ammonia	2.39E+01	3.44E-04	2.73E-03	3.44E-04
49A		100-41-4	Ethylbenzene	7.10E-02	1.02E-06	8.10E-06	1.02E-06
49A		110-54-3	Hexane	4.71E-02	6.77E-07	5.37E-06	6.77E-07
49A		108-88-3	Toluene	2.73E-01	3.93E-06	3.12E-05	3.93E-06

Source ID	Source Description	Compound		Annual Emissions	Annual Emissions	Hourly Emissions	Hourly Emissions
		CAS # / Emittant ID	Name	lb/year	g/s	lb/hr	g/s
49A		1330-20-7	Xylene	2.03E-01	2.92E-06	2.32E-05	2.92E-06
49A		75-21-8	Ethylene oxide	1.59E+01	2.28E-04	1.81E-03	2.28E-04
49S	49th St. Scrubber	75-21-8	Ethylene oxide	2.32E+01	3.34E-04	2.65E-03	3.34E-04
49FUG	49th St. Fugitive Emissions	75-21-8	Ethylene oxide	4.33E+02	6.23E-03	4.94E-02	6.23E-03
50B1	50th St. Boiler #1	71-43-2	Benzene	2.43E-02	3.50E-07	2.78E-06	3.50E-07
50B1		50-00-0	Formaldehyde	5.17E-02	7.44E-07	5.91E-06	7.44E-07
50B1		1151	Total PAHs [excluding naphthalene]	3.04E-04	4.38E-09	3.47E-08	4.38E-09
50B1		91-20-3	Naphthalene	9.13E-04	1.31E-08	1.04E-07	1.31E-08
50B1		75-07-0	Acetaldehyde	1.31E-02	1.88E-07	1.49E-06	1.88E-07
50B1		107-02-8	Acrolein	8.22E-03	1.18E-07	9.38E-07	1.18E-07
50B1		7664-41-7	Ammonia	9.74E+00	1.40E-04	1.11E-03	1.40E-04
50B1		100-41-4	Ethylbenzene	2.89E-02	4.16E-07	3.30E-06	4.16E-07
50B1		110-54-3	Hexane	1.92E-02	2.76E-07	2.19E-06	2.76E-07
50B1		108-88-3	Toluene	1.11E-01	1.60E-06	1.27E-05	1.60E-06
50B1		1330-20-7	Xylene	8.28E-02	1.19E-06	9.45E-06	1.19E-06
50B2	50th St. Boiler #2	71-43-2	Benzene	2.43E-02	3.50E-07	2.78E-06	3.50E-07
50B2		50-00-0	Formaldehyde	5.17E-02	7.44E-07	5.91E-06	7.44E-07
50B2		1151	Total PAHs [excluding naphthalene]	3.04E-04	4.38E-09	3.47E-08	4.38E-09
50B2		91-20-3	Naphthalene	9.13E-04	1.31E-08	1.04E-07	1.31E-08
50B2		75-07-0	Acetaldehyde	1.31E-02	1.88E-07	1.49E-06	1.88E-07
50B2		107-02-8	Acrolein	8.22E-03	1.18E-07	9.38E-07	1.18E-07
50B2		7664-41-7	Ammonia	9.74E+00	1.40E-04	1.11E-03	1.40E-04
50B2		100-41-4	Ethylbenzene	2.89E-02	4.16E-07	3.30E-06	4.16E-07
50B2		110-54-3	Hexane	1.92E-02	2.76E-07	2.19E-06	2.76E-07
50B2		108-88-3	Toluene	1.11E-01	1.60E-06	1.27E-05	1.60E-06
50B2		1330-20-7	Xylene	8.28E-02	1.19E-06	9.45E-06	1.19E-06
50A	50th St. Abator	71-43-2	Benzene	7.30E-02	1.05E-06	8.34E-06	1.05E-06
50A		50-00-0	Formaldehyde	1.55E-01	2.23E-06	1.77E-05	2.23E-06
50A		1151	Total PAHs [excluding naphthalene]	9.13E-04	1.31E-08	1.04E-07	1.31E-08
50A		91-20-3	Naphthalene	2.74E-03	3.94E-08	3.13E-07	3.94E-08
50A		75-07-0	Acetaldehyde	3.93E-02	5.65E-07	4.48E-06	5.65E-07
50A		107-02-8	Acrolein	2.47E-02	3.55E-07	2.81E-06	3.55E-07
50A		7664-41-7	Ammonia	2.92E+01	4.20E-04	3.34E-03	4.20E-04

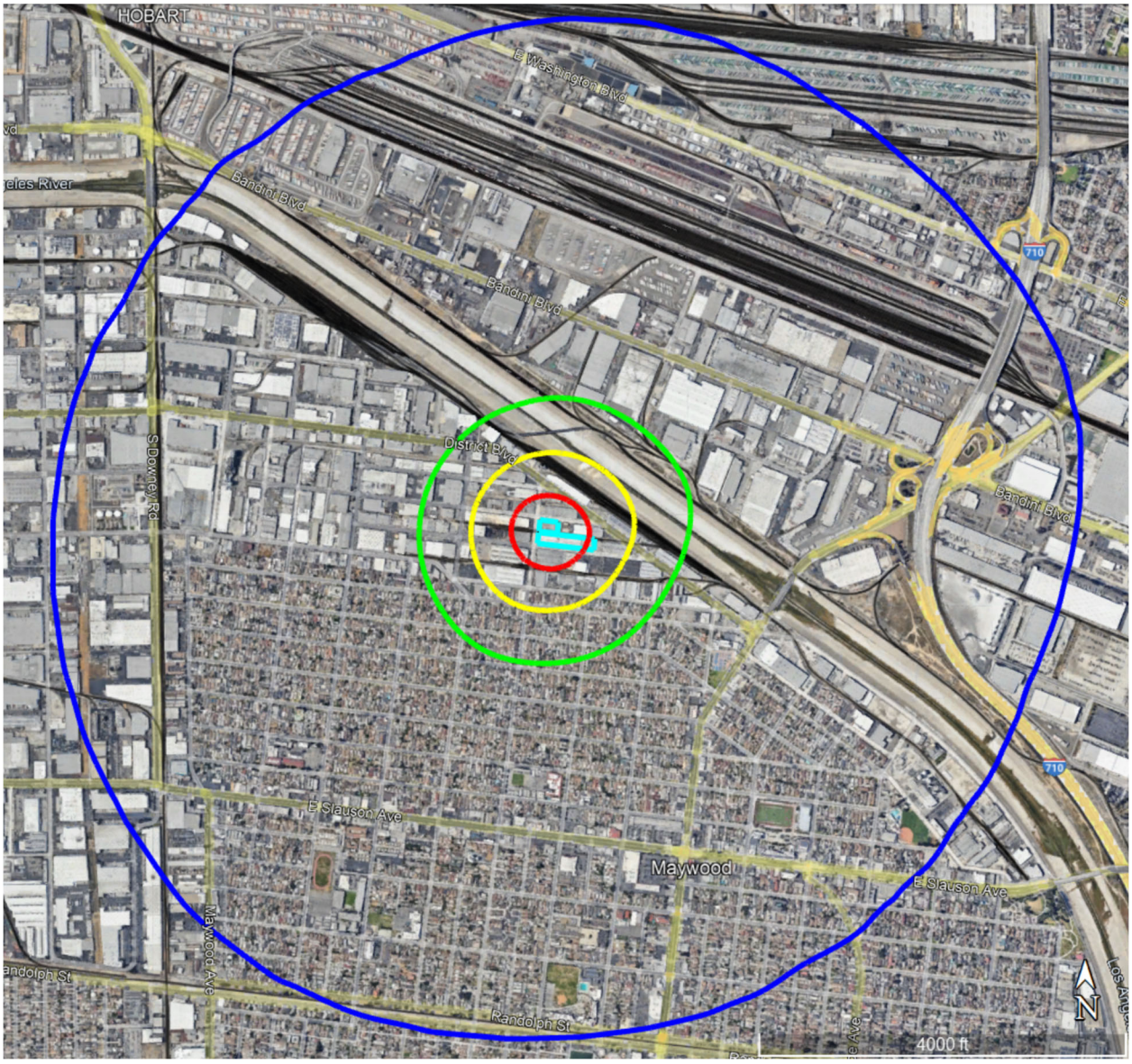
Source ID	Source Description	Compound		Annual Emissions	Annual Emissions	Hourly Emissions	Hourly Emissions
		CAS # / Emittant ID	Name	lb/year	g/s	lb/hr	g/s
50A		100-41-4	Ethylbenzene	8.67E-02	1.25E-06	9.90E-06	1.25E-06
50A		110-54-3	Hexane	5.75E-02	8.27E-07	6.57E-06	8.27E-07
50A		108-88-3	Toluene	3.34E-01	4.81E-06	3.81E-05	4.81E-06
50A		1330-20-7	Xylene	2.48E-01	3.57E-06	2.83E-05	3.57E-06
50A		75-21-8	Ethylene oxide	1.14E+01	1.64E-04	1.30E-03	1.64E-04
50S	50th St. Scrubber	75-21-8	Ethylene oxide	2.30E+01	3.31E-04	2.63E-03	3.31E-04
50FUG	50th St. Fugitive Emissions	75-21-8	Ethylene oxide	3.94E+02	5.67E-03	4.50E-02	5.67E-03

Table ES-2: Exposure Pathway and Target Organ by TAC

Compound	CAS Number / Emittant ID	Pathways					Acute Target Organs						Chronic Target Organs								8-Hr Chronic Target Organs		
		Inhalation	Soil Ingestion	Dermal	Homegrown Produce	Mother's Milk Ingestion	Central Nervous System	Immune System	Reproductive	Respiratory System	Eye	Blood	Central Nervous System	Kidney	GILV	Reproductive	Respiratory System	Eye	Endocrine	Blood	Respiratory System	Eye	Blood
Acetaldehyde	**75-07-0**	X								X	X						X				X		
Acrolein	**107-02-8**	X								X	X						X				X		
Ammonia	**7664-41-7**	X								X	X						X						
Benzene	**71-43-2**	X						X	X			X								X			X
Ethylbenzene	**100-41-4**	X												X	X	X			X				
Ethylene oxide	**75-21-8**	X											X										
Formaldehyde	**50-00-0**	X									X						X				X		
Hexane	**110-54-3**	X											X										
Naphthalene	**91-20-3**	X															X						
Toluene	**108-88-3**	X					X			X	X							X				X	
Total PAHs [excluding naphthalene]	**1151**	X	X	X	X	X																	
Xylene	**1330-20-7**	X					X			X	X		X				X	X					

Table ES-3: Summary of Health Risk

Location	UTM x (m)	UTM y (m)	2021 HRA
Cancer Risk (per million exposed)			
Point of Maximum Impact – Residential Scenario (PMI-R)	390,064.37	3,762,419.30	4760.2
Maximally Exposed Individual Resident (MEIR)	390,045.70	3,762,227.37	40.8
Point of Maximum Impact – Worker Scenario (PMI-W)	390,064.37	3,762,419.30	395.8
Maximally Exposed Individual Worker (MEIW)	390,088.22	3,762,439.24	77.1
Maximally Exposed Individual Sensitive Receptor (MEISR)	390,614.46	3,762,080.69	4.9
Chronic Hazard Index			
Point of Maximum Impact (PMI)	390,064.37	3,762,419.30	0.76
Maximally Exposed Individual Resident (MEIR)	390,045.70	3,762,227.37	0.01
Maximally Exposed Individual Worker (MEIW)	390,088.22	3,762,439.24	0.15
Maximally Exposed Individual Sensitive Receptor (MEISR)	390,614.46	3,762,080.69	<0.01
8-Hour Chronic Hazard Index			
Point of Maximum Impact (PMI)	390,104.07	3,762,417.09	<0.01
Maximally Exposed Individual Resident (MEIR)	390,005.70	3,762,227.37	<0.01
Maximally Exposed Individual Worker (MEIW)	390,105.70	3,762,427.37	<0.01
Maximally Exposed Individual Sensitive Receptor (MEISR)	389,834.55	3,761,771.88	<0.01
Acute Hazard Index			
Point of Maximum Impact (PMI)	390,105.70	3,762,427.37	<0.01
Maximally Exposed Individual Resident (MEIR)	390,045.70	3,762,227.37	<0.01
Maximally Exposed Individual Worker (MEIW)	390,105.70	3,762,427.37	<0.01
Maximally Exposed Individual Sensitive Receptor (MEISR)	390,614.46	3,762,080.69	<0.01



Facility Boundary
1 chance in-one-million Cancer Risk
10 chances in-one-million Cancer Risk
25 chances in-one-million Cancer Risk
100 chances in-one-million Cancer Risk

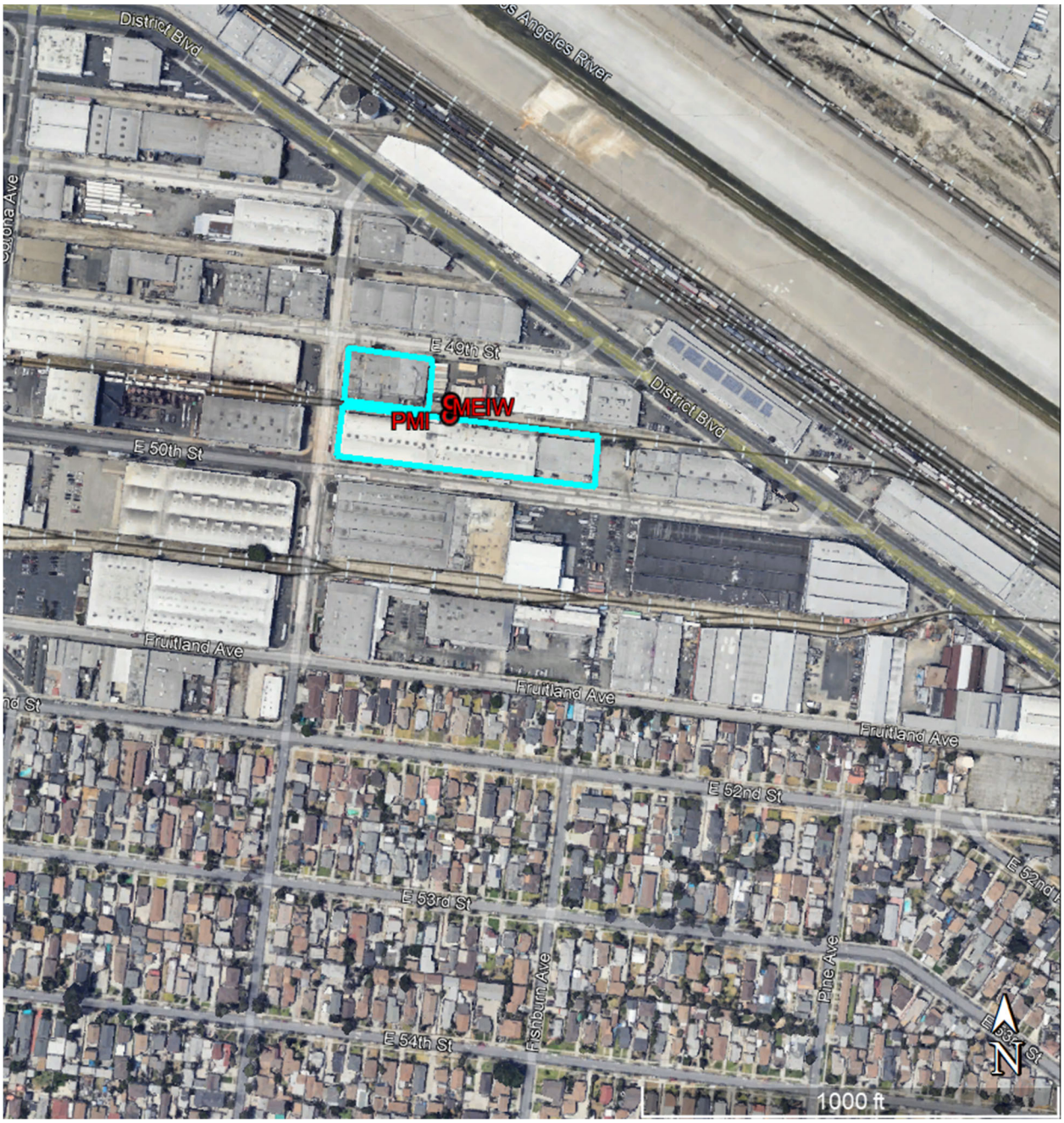
Figure ES-1:
Residential Cancer Risk Isopleths
(30-Year Exposure)

Facility Boundary
0.5 Chronic Hazard Index

Figure ES-2:
Chronic Hazard Index Isopleths

Facility Boundary

Figure ES-3:
Locations of PMI, MEIR, MEIW and MEISR
for Cancer Risk and Chronic Hazard Index



Facility Boundary

Figure ES-4: Location of PMI and MEIW for 8-hour Chronic Hazard Index

Facility Boundary

Figure ES-5:
Locations of PMI, MEIR, MEIW and MEISR
for Acute Hazard Index

HEALTH RISK ASSESSMENT SUMMARY FORM

South Coast Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4182
(909) 396-2000 • www.aqmd.gov

HEALTH RISK ASSESSMENT SUMMARY FORM

(Required in Executive Summary of HRA)

Facility Name : Sterigenics US, LLC
Facility Address: 4801-63 E 50th St, Vernon, CA 90058 and 4900 Gifford Ave, Vernon, CA 90058
Type of Business: Medical Sterilization
SCAQMD ID No.: 126191 and 126197

A. Cancer Risk

(One in a million means one chance in a million of getting cancer from being constantly exposed to a certain level of a chemical over a period of time)

1. Inventory Reporting Year : 2021
2. Maximum Cancer Risk to Receptors : *(Offsite and residence = 30-year exposure, worker = 25-year exposure)*
   a. Offsite 4,760.2 in a million Location: 390064 m E, 3762419 m N
   b. Residence 40.8 in a million Location: 390046 m E, 3762227 m N
   c. Worker 77.1 in a million Location: 390088 m E, 3762439 m N
3. Substances Accounting for 90% of Cancer Risk: Ethylene Oxide
   Processes Accounting for 90% of Cancer Risk: Fugitive Emissions
4. Cancer Burden for a 70-yr exposure: *(Cancer Burden = [cancer risk] x [# of people exposed to specific cancer risk])*
   a. Cancer Burden 0.11
   b. Number of people exposed to >1 per million cancer risk for a 70-yr exposure 28,150
   c. Maximum distance to edge of 70-year, 1 x 10^{-6} cancer risk isopleth (meters) 1,720

B. Hazard Indices

[Long Term Effects (chronic) and Short Term Effects (acute)]
(non-carcinogenic impacts are estimated by comparing calculated concentration to identified Reference Exposure Levels, and expressing this comparison in terms of a "Hazard Index")

1. Maximum Chronic Hazard Indices:
   a. Residence HI: 0.01 Location: 390046 m E, 3762227 m N toxicological endpoint: Central Nervous System
   b. Worker HI : 0.15 Location: 390088 m E, 3762439 m N toxicological endpoint: Central Nervous System
2. Substances Accounting for 90% of Chronic Hazard Index: Ethylene Oxide
3. Maximum 8-hour Chronic Hazard Index:
   8-Hour Chronic HI: 0.00 Location: 390105 m E, 3762427 m N toxicological endpoint: Respiratory System
4. Substances Accounting for 90% of 8-hour Chronic Hazard Index: Acrolein and Formaldehyde
5. Maximum Acute Hazard Index:
   PMI: 0.00 Location: 390106 m E, 3762427 m N toxicological endpoint: Eyes
6. Substances Accounting for 90% of Acute Hazard Index: Acrolein, Ammonia and Formaldehyde

C. Public Notification and Risk Reduction

1. Public Notification Required? X Yes ___ No
   a. If 'Yes', estimated population exposed to risks > 10 in a million for a 30-year exposure, or an HI >1
   1,642
2. Risk Reduction Required? X Yes ___ No

1. INTRODUCTION

1.1 Background

At the direction of the South Coast Air Quality Management District (South Coast AQMD or "the District"), this revised Air Toxics Health Risk Assessment ("Revised 2021 HRA") Report based on 2021 Air Toxic Contaminants (TACs) emission inventory for the Sterigenics U.S., LLC (Sterigenics South Coast AQMD Facility ID 126191 and 126197) is being submitted on behalf of Sterigenics, located at 4801-63 E. 50th Street and 4900 S. Gifford Avenue in Vernon, California. In accordance with the State of California's Air Toxics "Hot Spots" Information Act (AB2588), Sterigenics previously submitted an AB2588 HRA to South Coast AQMD on December 6, 2022 ("Original 2021 HRA"). South Coast AQMD provided comments on the Sterigenics Original 2021 HRA in a comment letter dated on June 15, 2023. In response, this Revised 2021 HRA was prepared to address South Coast AQMD's comments on the Original 2021 HRA. This revised report was then modified by the South Coast AQMD to address deficiencies (referred to hereinafter as "Modified 2021 HRA"). This report follows relevant AB2588 HRA guidance from Office of Environmental Health Hazard Assessment (OEHHA) and South Coast AQMD, and the United States Environmental Protection Agency (USEPA) guidelines for air dispersion modeling.

1.2 Health Risk Assessment Format and Definitions

For the purpose of this AB2588 HRA, acute, chronic, and cancer health impacts are defined as follows:

- Acute risks are non-cancer adverse health impacts, commonly associated with exposures to relatively high concentrations of TACs over short periods of time, from minutes to hours. Acute exposure typically results in headaches, dizziness, nausea, eye/nose/throat irritation, and/or skin rash. Each toxic chemical may affect the body through different mechanisms. Target organs for each TAC have been identified by OEHHA in its guidance document.
- Eight-Hour chronic risks non-cancer adverse health impacts, commonly associated with exposures on a recurrent basis but only during a portion of each day. The target organs due to 8-hour chronic risks that will be analyzed in this HRA may affect the body through different mechanisms and have been identified by OEHHA (OEHHA, 2015).
- Chronic risks are non-cancer adverse health impacts, commonly associated with exposures to relatively low concentrations of TACs over long periods of time, as in several years. Typical symptoms of chronic exposure include persistent respiratory or digestive problems, chronic cough, chest pains, numbness or tingling, loss of smell or taste, etc. As with acute risks, the target organs due to chronic risks that will be analyzed in this HRA may affect the body through different mechanisms and have been identified by OEHHA (OEHHA, 2015).
- Cancer is defined as the abnormal or irregular growth of cells or tissue. There are many triggers that may cause or increase the risk of cancer, including exposure to certain chemicals or TACs. The increased risk of cancer from exposure to a chemical means the additional risk of getting cancer from continuous exposure (i.e., 30 years and 365 days per year) to potentially cancer-causing compounds. Cancer risk is

usually expressed as a probability (e.g., ten excess chances of contracting cancer in one million exposed individuals).

In general, this AB2588 HRA provides conservative estimates of the probabilities for contracting adverse health effects due to the processes occurring at the facility. A "conservative" estimate assumes that the worst-case exposure conditions exist so that the health effects are not underestimated.

1.3 Significance Criteria and Notification Levels

Under AB2588, the operator of a facility must provide notices to all exposed persons if the facility's health risk assessment indicates that there is a significant health risk associated with the air toxic emissions from the facility. The South Coast AQMD's public notification thresholds are as follows:

- Greater than or equal to 10 maximum individual (lifetime) cancer risk (MICR),
- Greater than 1.0 Hazard Index Acute (HIA), or
- Greater than 1.0 Hazard Index Chronic (HIC).

The operator is also required to implement risk reduction measures if the emissions from the facility cause an exceedance of any of the following Action Risk Levels in South Coast AQMD Rule 1402:

- MICR of twenty-five chances in-one-million,
- Cancer burden of 0.5, or
- Total HIA or HIC of three (3.0) for any target organ system at any receptor location.

South Coast AQMD Rule 1402 also establishes significant risk levels; facilities above these levels are required to submit a risk reduction plan, as well as expedited actions to implement the Risk Reduction Plan:

- MICR of 100 chances in-one-million, or
- Total HIA or HIC of five (5.0) for any target organ system at any receptor location.

1.4 Objectives

Consistent with AB2588 requirements, the objective of this HRA report is to estimate potential risks to human populations in the vicinity of the facility that may be exposed to potential operational emissions. At the direction of South Coast AQMD staff, potential operational emissions were modeled based on 2021 Facility operations.

The methodologies used to complete the Modified 2021 HRA are based on the District-approved Office of Environmental Health Hazard Assessment (OEHHA) of Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments ("OEHHA Guidance," OEHHA 2015) as well as the South Coast AQMD Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (AB2588) ("South Coast AQMD Supplemental Guidelines," South Coast AQMD 2020).

As prescribed in the OEHHA Guidance, the Hotspots Analysis Reporting Program (HARP) model was used to estimate the potential impacts to human health in the vicinity of the Facility. Dispersion of potential emissions attributable to the Facility was modeled using the

American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD version 22112). The results from AERMOD were imported into the Risk Analysis module of HARP2, developed by the California Air Resources Board (ARB), to calculate the potential cancer risk[1], potential chronic non-cancer hazard index (HI), and potential acute HI at an array of receptors.

This report includes the sections corresponding to the sections in South Coast AQMD's HRA outline contained in Appendix B of the South Coast AQMD Supplemental Guidelines as follows:

- Table of Contents corresponds to Section I in South Coast AQMD guidelines
- Executive Summary corresponds to Section II in South Coast AQMD guidelines
- Section 2 Hazard Identification corresponds to Section III.A in South Coast AQMD guidelines
- Section 2.1 Facility Location and Process Description corresponds to Section III.B.1 in South Coast AQMD guidelines
- Section 2.3 Quantification of Emissions corresponds to Section III.B.2 in South Coast AQMD guidelines
- Section 3.1 Air Dispersion Modeling corresponds to Section III.B.3 in South Coast AQMD guidelines
- Section 3.3 Source Parameters and Operating Schedule corresponds to III.B.2 in South Coast AQMD guidelines
- Sections 4, 5, 7, and 8 Risk Assessment Procedures correspond to III.C in South Coast AQMD guidelines
- Section 9 References corresponds to III.D in South Coast AQMD guidelines

[1] Cancer risks evaluated in the Modified 2021 HRA refer to the calculated excess theoretical cancer risk due to potential emissions at the Facility, as required by OEHHA and South Coast AQMD guidance documents.

2. HAZARD IDENTIFICATION

2.1 Site Description and Facility Operations

Sterigenics Vernon (Facility ID 126191 and Facility ID 126197) is a sterilization plant located in the city of Vernon at 4801-63 E. 50th Street and 4900 S. Gifford Avenue. Sterigenics operates a medical sterilization business. As a contract sterilization facility, the Vernon facility sterilizes medical devices such as surgical kits, delivery systems, and COVID test swabs using ethylene oxide (EtO). Potential onsite sources of emissions include the vacuum chambers controlled by the scrubbers, backvents and aeration rooms controlled by the catalytic oxidizers, shipping areas, and miscellaneous natural gas sources such as boilers.

While operations are currently permitted under separate facility IDs, South Coast AQMD has determined the operations to be contiguous, and therefore a single HRA has been developed that evaluates the combined health risk impacts associated with TAC emissions from both operations. **Figure 1** shows the facility location and its vicinity. The land use in the immediate vicinity of the facility is primarily industrial or commercial urban area with the nearest residential neighborhood approximately 500 feet to the south. The topography around the facility is generally flat. The facility's layout showing the locations of the various buildings and the emission sources is included as **Figure 2**. As recommended in the South Coast AQMD Supplemental Guidelines and the South Coast AQMD Modeling Guidance for AERMOD (South Coast AQMD, 2022), the urban dispersion option was used with a population of 9,818,605, based on the population of Los Angeles County.[2]

Due to its location in an urbanized area with no drinking water reservoirs within the zone of influence, exposure to TACs from the Facility was estimated for the inhalation, dermal, soil ingestion, home-grown produce, and mother's milk pathways enabled. [3] The input parameters for each pathway are further discussed in Section 4.1.

2.2 Ethylene Oxide Monitoring

South Coast AQMD began ambient monitoring of EtO in the vicinity of the Facility in April 2022[4]. The 24-hour air monitoring results show the combined concentration due to facility emissions and background levels of EtO. The locations of the EtO monitoring sites are depicted on **Figure HI-1** below. Data collected from South Coast AQMD's regional monitor located in Central Los Angeles, well outside the zone of influence of the facility, show that background levels of EtO measured in the ambient air range from 0.01 to 0.17 ppb.

[2] South Coast AQMD Modeling Guidance for AERMOD, available at: http://www.aqmd.gov/home/air-quality/meteorological-data/modeling-guidance. Accessed: November 2022.

[3] Home-grown produce and mother's milk pathways are only applicable to potential residential exposures.

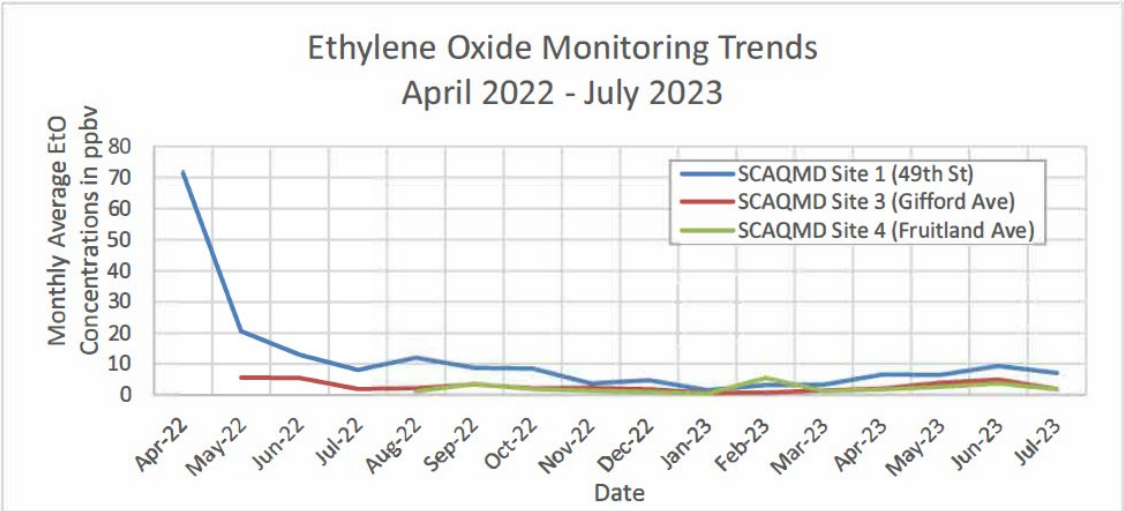
[4] Available at: http://www.aqmd.gov/home/news-events/community-investigations/sterigenics. Accessed: November 2022.

Figure HI-1: Map of South Coast AQMD's EtO Monitoring Sites

Sterigenics has undergone significant and sustainable operational and procedural changes to reduce both point source and potential fugitive EtO emissions and corresponding concentrations. This trend can be seen in **Figure HI-2** below, which shows average monthly results at the monitors, beginning in April 2022. As shown in the figure below, EtO concentrations measured in July 2023 at the 49th St location have dropped by 90% on average since 2022.

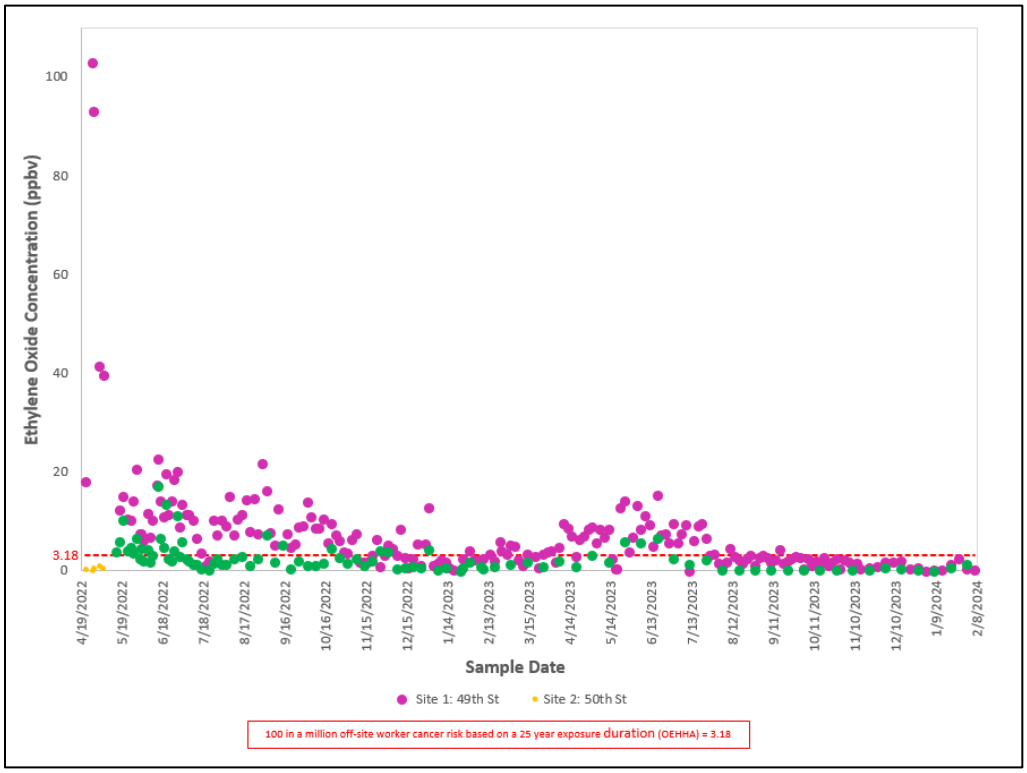
Further, as part of the EARP, Sterigenics has performed routine fenceline monitoring and will take necessary actions when elevated EtO concentrations are detected to protect public health.

Figure HI-2: EtO Monthly Monitoring Trends



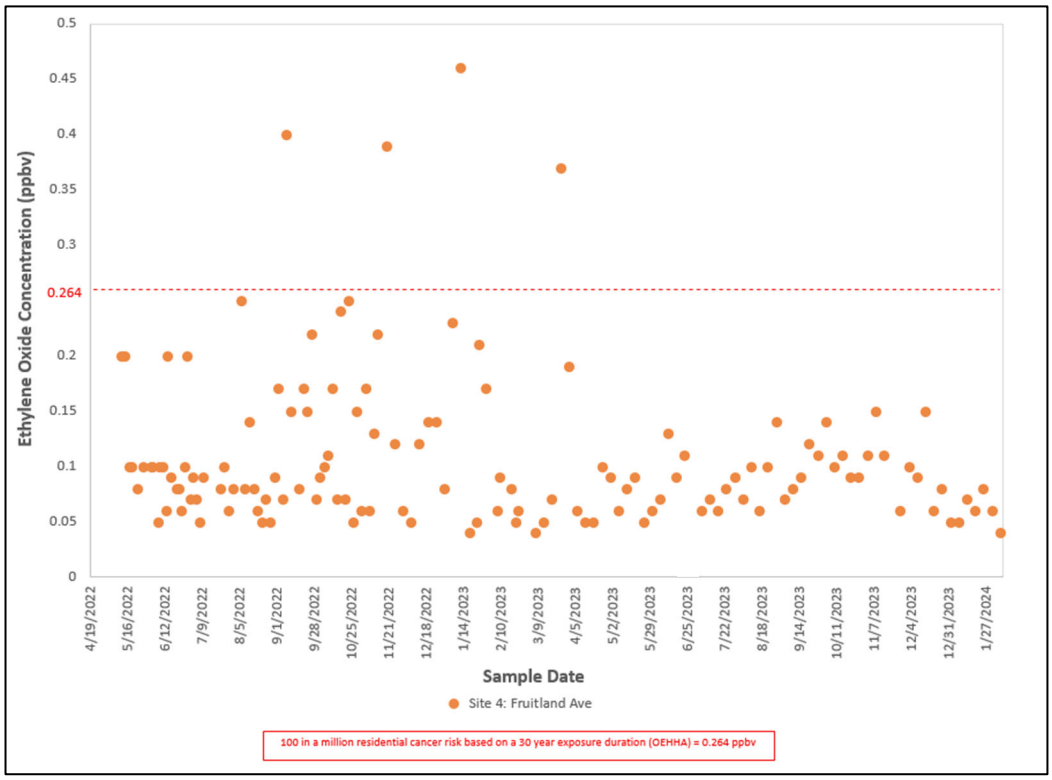
The monitored levels around Sterigenics, although trending downward, did at times exceed South Coast AQMD's Significant Risk threshold of 100 chances in-one-million. For off-site workers, cancer risks of 100 chances in-one-million would correspond to exposure to EtO levels of 3.18 parts per billion (ppb) consistently over a 25-year period. As depicted in **Figure HI-3** below, the monitored levels around Sterigenics in non-residential areas exceed the significant risk threshold even after changes were made to operations and procedures in an effort to reduce emissions of EtO. For reference, the dashed red bar in the figure represents 3.18 ppb.

Figure HI-3: South Coast AQMD's EtO Monitoring Results for Non-Residents



For nearby residents, cancer risks of 100 chances in-one-million would correspond to exposure to EtO levels of 0.264 ppb consistently over a 30-year period. South Coast AQMD monitored levels of EtO near the residential community on Fruitland Avenue. The monitoring data collected so far shows levels of EtO in the community to generally be below the significant risk threshold, as seen in **Figure HI-4** below. Further, the monitoring data collected near the residential community closest to Sterigenics have generally shown EtO levels to be consistent with regional background levels measured at the Central Los Angeles monitor.

Figure HI-4: South Coast AQMD's EtO Monitoring Results for Residents



2.3 Substances Emitted and Evaluated

The list of potentially emitted substances considered in preparation of the Modified 2021 HRA is from Appendix A-I of the California Air Resources Board (CARB) AB2588 requirements and the OEHHA Guidance. The AB2588 TACs potentially emitted from the Vernon facility are shown in **Table 1**, which also includes an identification of which compounds are evaluated for cancer risk, non-cancer chronic, or non-cancer acute impacts, as well as which compounds have non-inhalation routes of exposure.[5] **Table 2 - Table 5** summarize the estimated 2021 annual and hourly EtO emissions by emitted source and substance.

For carcinogens, cancer potency factors (CPF) were used for computing cancer risk. For non-cancer health effects, reference exposure levels (REL) were used. The non-carcinogenic hazard indices were computed for chronic and acute exposures with their respective toxicological endpoints shown. For multipathway pollutants, oral doses, oral CPFs, and/or non-inhalation RELs were used as appropriate. Details of the risk assessment procedures used are included in Section 4.

2.4 TAC Emission Sources

Sterigenics has the following TAC emission sources from different processes. These sources were divided into two groups based on the source configuration (e.g., point, volume, or area

[5] All potential non-inhalation pathways are listed in Table 1.

source) used in the air dispersion model. More details on the source characterization are discussed in Section 3.2.

1. Point sources includes as the follows:
   - 49th St. Scrubber
   - 50th St. Scrubber
   - 49th St. Abator (i.e., catalytic oxidizer)
   - 50th St. Abator (i.e., catalytic oxidizer)
   - 49th St. two boilers
   - 50th St. two boilers
2. Volume sources includes as the follows:
   - Fugitive EtO emissions from 49th St. building
   - Fugitive EtO emissions from 50th St. building

Annual and maximum hourly emissions for TACs were reported from the above eight source groups as shown in **Table 2** and **Table 4**. The emission calculation methodology and emission updates were discussed in the sections below.

2.5 Quantification of TAC Emissions

2.5.1 Sterilization Process Emissions

Medical devices are shipped to the Vernon facility via truck. These products are unloaded, sterilized with EtO, aerated, sometimes stored in the warehouse, then shipped out to medical facilities and customers. At each operation, EtO process emissions are treated through scrubbers and abators. Emissions calculations are based on U.S. EPA's methodology and assume that 93.36% of all EtO used at each facility enters the scrubber, 4% enters the abator as process emissions via the aeration room, 1% enters the abator as process emissions via sterilizer backvents, with 0.64% potentially released as fugitive emissions from the facility. For purposes of this HRA, the EPA methodology was refined based on site-specific configurations. An estimated 0.24% of the total EtO usage at the 50th Street operation was released as fugitives, while 0.4% amount of the total EtO usage was controlled by the 50th Street abator. Additionally, an estimated 0.54% of the total EtO usage at the 49th Street operation was released as fugitives, while 0.1% of total EtO usage was controlled by the 49th Street abator. Emissions were assumed to occur 24 hours per day, 7 days per week.

2.5.2 50th Street Operation Process Emissions

The 50th Street Facility operates six sterilization chambers (P/O G2980, G2981, G2982, G2983, G2984, and G2986). Calculations assume 2021 usage of EtO was distributed evenly amongst the sterilization chambers. Exhaust from these sterilizers is treated by a scrubber (P/O G2974). A source test conducted on this scrubber on 6/3/2022 showed that the scrubber controls 99.985% of the emissions from these sterilizers.

Emissions from the sterilization chamber back vents and aeration rooms (P/O G34007) are controlled via an abator (P/O G44886). A source test conducted on this abator on 4/30/2021 showed that the abator has a control efficiency of 99.8687% for the aeration room and a control efficiency of 99.885% for the backvents.

It is also assumed that these processes result in fugitive emissions, as further discussed in Section 2.6.

2.5.3 49th Street Operation Process Emissions

The 49th Street Facility operates eight sterilization chambers (P/O F37750, F37757, F37758, and F37760). Calculations assume 2021 usage of EtO was distributed evenly amongst the sterilization chambers. Exhaust from these sterilizers is treated by a scrubber (P/O G43812). A source test conducted on this scrubber on 6/3/2022 showed that the scrubber controls 99.969% of the emissions from these sterilizers.

Emissions from the sterilization chamber back vents and aeration equipment (P/O G43810) are controlled via an abator (P/O G44884). A source test conducted on this abator on 4/30/2021 showed that the abator has a control efficiency of 99.5749% for the aeration room and a control efficiency of 99.7616% for the backvents.

It is also assumed that these processes result in fugitive emissions, as further discussed in Section 2.6.

2.6 Fugitive Emissions

While modifying the 2021 HRA, South Coast AQMD used the methodology proposed by the U.S. EPA for estimating fugitive emissions from sterilizing facilities[6] to estimate the emissions from Sterigenics, with refinements for site-specific configurations as described in Section 2.5.1. **Table HI-1**, below, summarizes the industry-wide average percentages of EtO emitted by each process group. This information was published by the U.S. EPA for estimating fugitive emissions of EtO from sterilizers.

Table HI-1: Emissions of EtO By Process Group Per U.S. EPA

Emission Process Group (EPG)	Industry Average Percentage of EtO Use (2019 and 2021 data)
Aeration Room Vent (ARV)	4%
Chamber Exhaust Vent (CEV)	1%
Indoor EtO Storage	Confidential Business Information
EtO Dispensing (HC)	0.1%
Vacuum Pump Operation (VP)	0.1%
Pre-Aeration Handling Sterilized Material (PR)	0.2%
Post- Aeration Handling Sterilized Material (PO)	0.2%
Non-Oxidizer APCD Area (NO)	0.04%
Sterilization Chamber Vent (SC)	93.36%

[6] https://www.federalregister.gov/d/2023-06676/p-243

Fugitive emissions were modeled as volume sources to be as consistent as possible with known conditions of the operations in 2021. In AERMOD, volume sources must be entered as squares, so multiple square sources were used to approximate the locations of identified building draft openings and outdoor areas around the scrubbers. At each building, fugitive emissions from "Non-Oxidizer APCD Areas" were assigned to the volume sources around the scrubbers and all other fugitive emission groups were assumed to be split evenly among the remaining volume sources.

2.7 Combustion Source Emissions

The Sterigenics facility operate various pieces of natural gas-fired equipment as follows:

- 50th Street Operation:
  - Two permit-exempt boilers, both rated at 1.995 MMBtu/hr.
  - One 7.5 MMBtu/hr abator (Permit to Operate (P/O) G44886).
- 49th Street Operation:
  - Two permit-exempt boilers rated at 1.26 MMBtu/hr and 1.225 MMBtu/hr.
  - One 7.5 MMBtu/hr abator (P/O G44884).

Consistent with the emissions for the approved ATIR, TAC emissions were estimated from combustion equipment using natural gas usage obtained from the facility 2021 annual emissions reports (AER) and South Coast AQMD AB2588 reporting procedures default emission factors for natural gas-fired external combustion equipment with equipment ratings less than 10 MMBtu/hr without selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR).[7]

[7] Reporting Procedures for AB2588 Facilities Reporting their Quadrennial Air Toxic Emission Inventory in the Annual Emission Reporting Program. Available: http://www.aqmd.gov/docs/default-source/planning/risk-assessment/quadrennial_atir_procedure.pdf.

3. EXPOSURE ASSESSMENT

3.1 Air Dispersion Modeling

AERMOD (version 22112) and the South Coast AQMD selected meteorological station data was used to estimate ambient concentrations resulting from the TAC emissions from Sterigenics Vernon operations. The air dispersion analysis was performed in accordance with OEHHA Guidance, the SCAQMD Supplemental Guidelines, and South Coast AQMD Modeling Guidance for AERMOD. The results of the air dispersion analysis were used in conjunction with the chemical-specific emissions rates discussed above to estimate potential ambient air concentrations of each compound using Air Dispersion Modeling and Risk Tool (ADMRT) module in HARP developed by ARB.[8]

The air dispersion analysis requires the following: identification of source parameters and operating schedules, evaluation of building downwash effects, preparation of meteorological data, evaluation of potential terrain considerations, selection of appropriate dispersion coefficients based on land use, selection of receptor locations, and selection of appropriate averaging time periods. The following sections describe each of these steps.

Appendix A provide electronic files related to the air dispersion modeling analysis.

3.2 Source Characterization

AERMOD requires source-specific parameters such as stack height, stack inside diameter, exit velocity, and stack gas temperature. **Table 6** presents the AERMOD model options and inputs for the Modified 2021 HRA.

Three different representations of emission sources are used in the air dispersion model:

- Point sources; and
- Volume sources.

Point sources are used to represent those emissions that have single identifiable points of release. A typical point source will have a stack with a defined location. Other sources, however, do not have a single, discrete point of release. Sources that can be reasonably represented as emitting at a uniform rate over a two-dimensional surface are modeled as area sources. Sources that can be reasonably represented as emitting at a uniform rate from a three-dimensional space are modeled as volume sources. **Table 7** and **Table 8** summarize the source parameters in the AERMOD model for modeled point and volume TAC emission sources, respectively.

Figure 2 shows the modeled TAC emission sources for the Modified 2021 HRA.

3.3 Source Parameters and Operating Schedules

Combustion TAC emissions and process EtO emissions are modeled as point sources with the stack parameters from the source tests. To account for the emissions escaping from the building, per South Coast AQMD comment, fugitive EtO emissions are modeled as volume sources near the locations of wall vents, as presented in **Table 8**. The locations of potential onsite sources and nearby buildings are included as **Figure 2**. Routine sources were modeled according to Sterigenics' operating schedule (24 hours per day, and 7 days per week).

[8] HARP is available for download at: https://ww2.arb.ca.gov/our-work/programs/hot-spots-analysis-reporting-program. Accessed: November 2022

3.4 Building Downwash

All the point sources at the facility are located on or near the buildings (refer to **Figure 2**). Consistent with South Coast AQMD Modeling Guidance for AERMOD, the USEPA-approved Building Profile Input Program PRIME (BPIPPRIME) was used to simulate the building downwash, which is the effect of nearby structures on the flow of the plumes from their respective emission sources. **Figure 2** shows the buildings included and **Table 9** includes the building heights modeled in AERMOD.

3.5 Dispersion Parameters

Per the South Coast AQMD Modeling Guidance for AERMOD, the urban dispersion option was used, with a population of 9,818,605, based on the population of Los Angeles County. AERMOD was run using the regulatory default option, also per South Coast AQMD Modeling Guidance for AERMOD.

3.6 Receptor Locations

Health effect indices such as cancer risk, chronic hazard index, and acute hazard index were calculated for a variety of receptor locations. Receptors of primary interest are those at residential locations, at sensitive population locations, and at offsite worker locations. However, in order to get a more complete picture of the patterns of exposure, concentrations and risk are also calculated at regularly spaced grid points throughout the modeling domain.

Receptor networks were constructed for the dispersion analysis based on South Coast AQMD modeling guidance,[9] including along the property boundary line and out to 500 meters from the facility boundary with a spacing of 20 meters,[10] a fine grid containing receptors spaced 50 meters apart out to a 1,000-meter radius from the Facility, a medium coarse grid containing receptors spaced 100 meters apart out to a 2-km radius from the Facility, and a coarse grid containing receptors spaced 500 meters apart out to 10 kilometers from the facility boundary, as shown in **Figures 3a – 3d.** The grid receptor locations inside of the facility boundary are disregarded in the health risk analysis. Consistent with South Coast AQMD Modeling Guidance for AERMOD, all receptors were run with a height of 0.0 meters, so that ground-level concentrations are modeled. Sensitive receptor locations (schools, day care facilities, and hospitals) as included in **Table 10** were obtained via an internet search and the Google Maps database. A total of 4,962 fenceline and grid receptors were included in the analysis, plus an additional 19 sensitive receptors, for a total of 4,981 receptors.

Further, to calculate population exposure and cancer burden, separate dispersion modeling runs were performed at receptors located at the centroid of census blocks whose centroid was located within the modeling domain. The census blocks and population values from the 2010 United States Census Bureau's Cartographic Boundary Files were used to create the census tract centroid receptor grid.[11] A total of 1,065 census block centroid receptors were modeled as shown in **Figure 3e**.

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[9] South Coast Air Quality Management District, Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act, October 2020, Table 7 and Table 8.

[10] Per South Coast AQMD Supplemental Guidelines, a receptor spacing of 20 meters was used to place boundary receptors since the total Facility area is less than 4 acres.

[11] Available at: https://www.census.gov/geographies/mapping-files/time-series/geo/cartographic-boundary.2020.html#list-tab-NP83ZD75IOWNF0AYRQ

3.7 Coordinate System

The Universal Transverse Mercator (UTM) system of coordinates and the World Geodetic System (WGS84) were used for identifying the UTM coordinates of the various modeling objects (sources, buildings, receptors etc.).

3.8 Meteorological Data

South Coast AQMD's Central Los Angeles (CELA) meteorological station was selected by the South Coast AQMD staff as the most representative surface station for the facility. Five years of the AERMOD-ready meteorological data for CELA were downloaded from the South Coast AQMD website and used for the air dispersion modeling in the Modified 2021 HRA.[12] A wind rose for the CELA data in 2010, 2011, 2014, 2015, and 2016 is provided in **Figure 4**.

3.9 Terrain

Terrain data were obtained from the United States Geological Survey (USGS), with 1/3 arc-second (~10 meter) National Elevation Dataset (NED) data downloaded. Elevations and hill heights were calculated for all sources, buildings, and receptors, using AERMOD terrain preprocessor, AERMAP.

3.10 Averaging Times

Calculation of chemical concentrations for use in exposure analysis requires the selection of appropriate concentration averaging times. 1-hour and five-year (i.e., period) dispersion averaging times are used in this analysis and are discussed below. The AERMOD model input and output files used to estimate long- and short-term dispersion factors are presented as an electronic attachment in **Appendix A**.

3.10.1 Long Term

Average concentrations over the five-year span of the Central Los Angeles meteorological data were calculated for each compound for use in estimating potential residential cancer risks and chronic non-cancer health effects.

3.10.2 Short Term

Maximum short-term concentrations (one-hour averages) of the five-year period modeled were calculated using maximum hourly emission rates to estimate acute non-health effects. One-hour maximum source-specific concentrations were summed regardless of time of occurrence (*i.e.*, hour of year), which can differ by source, thereby conservatively overestimating the true one-hour maximum at any one time.

3.11 Dispersion Factors

Both point and volume source emissions were modeled using the X/Q ("chi over q") method, such that emission source groups are input to the model with unit average annual emission rates (*i.e.*, 1 gram per second [g/s]), and the model estimates 1-hour maximum or annual average dispersion factors (with units of [µg/m^3]/[g/s]). To calculate annual average ambient air concentrations, the five-year (i.e., period) average dispersion factors were multiplied by the annual emission rates. To calculate 1-hr maximum ambient air concentrations, the 1-hr maximum dispersion factors were multiplied by the maximum hourly emission rates.

[12] AERMOD-ready Meteorological Stations and Data. Available at: https://www.aqmd.gov/home/air-quality/meteorological-data/aermod-table-1.

3.12 Ground-Level Concentrations

Ground-level concentrations (GLCs) in the ambient air at each of the modeled Point of Maximum Impact (PMI), Maximally Exposed Individual Resident (MEIR), Maximally Exposed Individual Worker (MEIW), and maximally exposed individual sensitive receptor (MEISR) for both the long- and short-term scenarios are shown in **Table 11**.

4. RISK ASSESSMENT PROCEDURES

Modeled health risks were estimated for the Vernon Facility based on methods and tools outlined in the OEHHA Guidance. Potential Facility emissions and air dispersion results, using the HARP ADMRT tool, were input into HARP2, the OEHHA-recommended program for completing an HRA. The HARP emissions file used is provided in **Appendix B**.

4.1 Identification of Potentially Exposed Populations

The potentially exposed populations considered include current residents, off-site workers, and sensitive receptors located within the grid of receptors and described in Section 3.8. Locations of each potentially exposed population were identified based on review the parcel data for the County of the Los Angeles.[13] The nearest residential property identified is located approximately 500 feet south of the Facility.

Since the Facility is located in the industrial/commercial zone, when evaluating the MEIR, receptors within the industrial zone were excluded.

Sensitive population locations, such as hospitals, K-12 schools, preschools, and child care centers were obtained based on the review of Google Maps and California Department of Social Services Databases.[14]

Consistent with the methods specified by the OEHHA Guidance, risks were estimated at the location of the MEIR and the location of the MEIW. The MEIR and MEIW are defined as the off-site receptor locations where individuals may reside or work, respectively, with the potential highest cancer risk, acute Hazard Index (HI) or chronic non-cancer HI.

In addition, the point of PMI was identified for both cancer and non-cancer hazards.

4.1.1 Estimation of Exposure Point Concentrations

Exposure point concentrations are the concentrations of each chemical to which an individual may be exposed at a given receptor location. Chemical concentrations in air at each receptor location were estimated based on the air dispersion modeling described in Section 3. The exposure point concentrations used to estimate carcinogenic risks and chronic non-cancer HIs are the annual average concentrations of each chemical. The exposure point concentrations used to estimate acute non-cancer HIs are the one-hour maximum concentrations of each chemical. These concentrations at the 2021 operations modeled PMI, MEIR, MEIW, and the MEISR are presented in **Table 11**, respectively, as discussed in Section 3.12 above.

4.1.2 Exposure Pathways

The exposure pathways evaluated in the Modified 2021 HRA were selected in accordance with the OEHHA Guidance and the South Coast AQMD Supplemental Guidelines. The inhalation pathway must be evaluated for all chemicals. In addition, the OEHHA Guidance also requires the evaluation of non-inhalation exposure pathways, referred to as a multi-pathway analysis, for specific chemicals.

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[13] Los Angeles County Department of Regional Planning. Available at: https://planning.lacounty.gov/gis. Accessed: October 2022.

[14] California Department of Social Services. Available at: https://www.cdss.ca.gov/inforesources/community-care-licensing/facility-search-welcome. Accessed: October 2022.

Selection of the additional pathways for a multi-pathway analysis is specific to the chemical and land use in the area surrounding the Facility and was based on the recommendations in the OEHHA Guidance. The chemicals that must be evaluated in a multi-pathway analysis are shown in Table 5.1 of the OEHHA Guidance and are programmed into HARP. As discussed in Section 2, HARP, which complements the OEHHA Guidance with respect to exposure pathway selection, was used in the Modified 2021 HRA to estimate potential cancer risks and potential non-cancer hazards. The sections below discuss the exposure pathways considered for each potentially exposed population identified in the vicinity of the facility.

4.1.2.1 Residents

Consistent with the OEHHA Guidance for conducting a multi-pathway analysis, it was assumed that residents considered in the Modified 2021 HRA may be exposed to Sterigenics emissions via inhalation, dermal absorption, incidental ingestion of soil, ingestion of homegrown produce, and mother's milk. **Table 12** incudes exposure pathways associated with the potential TACs emitted from Sterigenics Vernon. A deposition rate of 0.02 meters per second (m/s) was used, per South Coast AQMD Supplemental Guidelines.

Since the Facility is located in an urban area with no agricultural areas (e.g., cattle grazing areas or dairy farms) in the vicinity, the Modified 2021 HRA does not include an evaluation of potential exposures via ingestion of meat, dairy, or eggs. However, potential exposures to chemicals in homegrown produce were evaluated for a resident in the 2021 HRA because it is possible that residents in the area may have small vegetable gardens exclusively for personal use. The default home-grown produce parameters for urban settings were used in HARP, consistent with South Coast AQMD Supplemental Guidelines. Nearby drinking water reservoirs were not identified within the modeled zone of impact; therefore, the drinking water pathway was not included.

4.1.2.2 Off-Site Workers

Consistent with the OEHHA Guidance, off-site workers are assumed to be potentially exposed to facility emissions via inhalation, dermal absorption, and incidental ingestion of soil. Similar to residents, a deposition rate of 0.02 meters per second (m/s) was used, per South Coast AQMD Supplemental Guidelines.

4.1.2.3 Sensitive Receptors

The sensitive populations considered in the Modified 2021 HRA include schools, hospitals, nursing homes, and daycare centers as identified in **Table 10**. However, HARP does not include methods for evaluating these specific populations differently than residential populations. Thus, as a conservative screening approach, sensitive receptor locations were evaluated assuming the exposure pathways utilized for evaluating the residential population noted above.

4.1.3 Exposure Assumptions

For all pathways, default exposure assumptions built into HARP were used in the risk calculations. The exposure assumptions in HARP are consistent with OEHHA Guidance. However, the specific exposure assumptions applied to calculate risks are dependent on the exposure analysis method selected to calculate risks, as described below in Section 4.1.4.

4.1.4 HARP Exposure Analysis Methods

HARP allows a user to select from a series of exposure analysis methods. Each method in HARP utilizes exposure assumptions differently, depending on the requirements of a specific

regulation (e.g., compliance with CARB's Air Toxics Hot Spots Program) or project need (e.g., provide point estimates for risk management decisions). That is, HARP will select the dominant pathway(s) and assign exposure assumptions depending on the exposure analysis method identified by the user. For the Modified 2021 HRA, each exposure analysis method selected was based on the type of receptor as presented in **Table 13** and is described below.

4.1.4.1 Resident

Consistent with HARP and OEHHA Guidance, potential cancer risks for residential populations were calculated based on RMP using Derived Analysis Method. This method applies conservative exposure assumptions to the two dominant exposure pathways for each chemical. The remaining pathways are evaluated using average exposure assumptions. If inhalation is one of the two dominant exposure pathways, then it is evaluated using the 80th percentile breathing rate.

As required in the OEHHA Guidance for preparing a Tier 1 risk assessment under AB2588, it was assumed that a resident may be exposed to Facility emissions for 30 years. Cancer risks estimated assuming a residential exposure duration of 30 years are used by State and local agencies for risk management and public notification purposes, even though could be conservative and not representative of actual exposure scenarios.

As discussed previously, it was assumed that individuals residing in the vicinity of the Facility may ingest produce obtained from vegetable gardens grown at their homes. Ingestion of homegrown produce is estimated by applying a default parameter of 13.7 percent of produce ingested by individuals in an urban setting that is homegrown and is comprised of four categories including exposed, leafy, protected, and root vegetables (OEHHA 2015). This is the default setting in HARP and is recommended in the South Coast AQMD Supplemental Guidelines.

The Derived (OEHHA) Analysis method was used to calculate chronic non-cancer HIs for the resident. This method utilizes high-end exposure assumptions to evaluate the two dominant pathways for each chemical. The remaining pathways are evaluated using average exposure assumptions.

4.1.4.2 Off-Site Worker

Consistent with the OEHHA Guidance, the Point Estimate Analysis method was used to calculate carcinogenic risks and chronic non-cancer HIs associated with off-site worker exposure to Facility emissions. This method utilizes the standard exposure assumptions for worker populations as defined in OEHHA Guidance.

Since potential cancer risks are driven by route emission sources (i.e., spray booths) operates 24 hours/day and 7 days/week, adjustment factor for worker ground-level concentrations is not required, following the 2020 South Coast AQMD Supplemental Guidelines for continuous operation. This is consistent with OEHHA Guidance which recommends using the average concentration that the worker breathes over their workday, which, for continuous operation, is equivalent to the annual average air concentration calculated in AERMOD.

4.1.4.3 Sensitive Receptor

The RMP using Derived Analysis method described previously was used to calculate risks for the MEISR. Potential exposures of the MEISR were evaluated using a continuous 30-year exposure duration, consistent with the residential exposure duration. This is a very

conservative approach, as the sensitive receptors include locations such as hospitals, K-12 schools, preschools, childcare facilities, and age-care facilities, where the exposure duration is not continuous and is much lower than 30 years.

4.2 Dose-Response Assessment

The dose-response assessment (also referred to as the toxicity assessment) examines the potential for a chemical to cause adverse health effects in exposed individuals (as modeled). Toxicity values that are used to estimate the likelihood of adverse effects occurring in humans are identified in this component of the risk assessment process. Toxicity factors in the latest HARP Health Database,[15] integrated into the HARP program were used in the Modified 2021 HRA. The HARP program contains the most up-to-date listing of available inhalation and oral CPFs, chronic inhalation and oral RELs, and acute RELs approved by California Environmental Protection Agency (Cal/EPA) for use in AB2588 Air Toxics Hot Spots Program risk assessments. OEHHA decided to withdraw the proposed rulemaking intended to update the CPF for EtO and plans to resume the rulemaking process at a later time. Once finalized, any future HRAs will utilize the updated value. The methods used to evaluate potential non-cancer effects of lead are described in Section 4.3.2.

4.3 Risk Characterization Methodology

This section describes the methods used to estimate potential adverse effects associated with off-site exposures to chemicals emitted from the Facility. The results of the Modified 2021 HRA are presented in Section 5. HARP was used to estimate carcinogenic risks and non-cancer HIs associated with potential exposures to potential emissions from the Facility.

4.3.1 Carcinogenic Risks

Carcinogenic risks were estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to carcinogens potentially present in Facility emissions (USEPA 1989). The estimated risk is expressed as a unitless probability. For carcinogenic chemicals, both inhalation and non-inhalation pathways must be considered, using the CPFs in HARP. Total risk is the sum of risks attributable to each chemical considered by each pathway.

The equation used to calculate the potential excess cancer risk from inhalation for each carcinogenic chemical is:

$$Risk_{inh} = DOSE_{air} \times CPF \times ASF \times ED/AT$$

Where:

$Risk_{inh}$	=	Excess cancer risk from inhalation of $chemical_i$
$Dose_{air}$	=	Daily inhalation dose of $chemical_i$ (mg/kg-day)
CPF_i	=	Inhalation CPF for $chemical_i$ $(mg/kg\text{-}day)^{-1}$
ASF	=	Age sensitivity factor for a specified age group (unitless)
ED	=	Exposure duration (in years) for a specified age group

[15] The latest HARP Health Database is available from ARB here: https://ww2.arb.ca.gov/sites/default/files/classic/toxics/healthval/contable.pdf

AT = Averaging time for lifetime cancer risk (70 years)

For residential cancer risk calculations, a factor for the fraction of time spent at home can also be applied to the equation above. A similar equation, using oral dose and the oral CPF, is used to calculate risks from oral exposure. In the Modified 2021 HRA, oral cancer risks include dermal absorption, incidental ingestion of soil, ingestion of homegrown produce, and mother's milk. HARP default exposure parameters were used, as described in Section 4.1.4. Doses by pathway of exposure for each substance at the PMI, MEIR, MEIW, and MEISR calculated by HARP are in **Tables 16 – 19**.

4.3.2 Chronic Non-Cancer Hazards

When evaluating chronic non-cancer effects due to chemical exposures, a hazard quotient HQ or hazard index HI is established for each constituent. The equation used to calculate an inhalation HQ is:

$$HQ_i = \frac{C_i}{REL_i}$$

Where:

HQ_i = Chronic hazard quotient for chemical$_i$

C_i = Annual average air concentration of chemical$_i$ (µg/m^3)

REL_i = Chronic REL for chemical$_i$ (µg/m^3)

To evaluate the potential for adverse non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals that affect the same target organ are summed yielding a HI. The HI is thus estimated as follows:

$$HI_{(eyes)} = \sum HQ_{substance\,1\,(eyes)} + HQ_{substance2\ \ (eyes)}$$

Estimation of non-inhalation chronic health effects uses a similar method, but the annual average air concentration is replaced by the dose calculated by HARP using the exposure parameters mentioned above, and the appropriate non-inhalation REL is used.

Estimation of an HI for each target organ (also referred to as a segregation of HI by target organ analysis) is recommended by OEHHA because the non-cancer effects of chemicals with different target organs are generally not additive. **Table 14** includes target organs for the TACs modeled in this analysis. For the Modified 2021 HRA, a segregation of hazard indices analysis was performed for the modeled PMI, MEIR, MEIW, and the MEISR.

4.3.3 Acute Non-Cancer Hazards

The potential for acute effects was evaluated by comparing the one-hour maximum concentrations with the acute RELs within the HARP program. Acute HQs were estimated for those chemicals for which an REL was available. The equation used to calculate acute HQs is as follows:

$$HQ_i = \frac{C_i}{REL_i}$$

Where:

HQ_i = Acute hazard quotient for chemical$_i$

C_i = One-hour maximum air concentration for chemical$_i$ (µg/m^3)

REL = Acute non-cancer reference exposure level for chemical$_i$ ($\mu g/m^3$)

The HQs were summed to obtain a target organ-specific HI as follows:

$$HI_{(eyes)} = \sum HQ_{substance\ 1\ (eyes)} + HQ_{substance2\ \ (eyes)}$$

Table 14 includes target organs for the TACs modeled in this analysis. The acute HIs presented in the Modified 2021 HRA conservatively overestimate the true one hour maximum at any one time because one hour maximum air concentrations were summed regardless of time of occurrence (i.e., hour of year) which can differ by source.

5. RISK CHARACTERIZATION FOR AB2588[16]

Table 15 shows the results of the Modified 2021 HRA at the modeled PMI, the modeled MEIR, the modeled MEISR, and the modeled MEIW. There are no sensitive receptors with a cancer risk at or above 10 chances in-one-million. Non-cancer health hazard indices for all the modeled receptors are below 0.5 with the exception of the chronic HI at the PMI.

Figures 5 through 8 show the locations of these receptors. **Figure 9** shows the location of sensitive receptors with risk greater or equal to 1 chance in-one-million. **Figure 10** shows the modeled 30-year lifetime cancer risk zone of impact, which represents receptor locations where the multi-pathway lifetime cancer risk is greater than 1 chance in-one-million. It is important to note that the zone of impact (i.e., 1 chance in-one-million cancer risk contour) presented in **Figure 10** conservatively assumes all receptors are residential (which is not the case), along with the modeled 10, 25, and 100 chances in-one-million cancer risk contours. **Figure 11** shows the modeled 25-year lifetime cancer risk based on the worker exposure scenario. The results of the HARP risk characterization runs are provided electronically in **Appendix B**.

5.1 Carcinogens

HARP calculates cancer risk based on five-year average concentrations estimated using the annual average emission rates and dispersion factors.

5.1.1 Point of Maximum Impact (PMI)

The cancer risk at the point of maximum impact[17] is 4760.2 chances in-one-million, at a fenceline receptor (#2) along the railroad tracks. Cancer risk at the PMI is broken down by substance and pathway in **Table 20**. Over 99.99% of the risk is due to ethylene oxide. Fugitive emissions are responsible for 99.84% of the risk, and scrubber emissions are responsible for 0.15% of the risk, due to their emissions of ethylene oxide and proximity to the receptor. The remainder of the cancer risk is due primarily to ethylene oxide emissions from the abators. Complete breakdowns of cancer risk by source at the PMI are provided in **Table 21**. **Figure 5** shows the location of the PMI for cancer risk.

5.1.2 Resident (MEIR)

The highest cancer risk at a residential receptor (#801) is a cancer risk value of 40.8 chances in-one-million. The receptor is located about 155 meters south of Sterigenics. Cancer risk at the MEIR is broken down by substance and pathway in **Table 22**. Similar to the PMI, nearly all of the risk is due to ethylene oxide. Scrubber emissions and fugitive emissions are responsible for 6.3% and 93.4% of the risk, respectively. Complete breakdowns of cancer risk by source at the MEIR are provided in **Table 23**. **Figure 5** shows the location of the MEIR for cancer risk. A contour map showing the 30-yr residential cancer risk is included as **Figure 10**.

5.1.3 Off-Site Worker (MEIW)

The MEIW cancer risk is 77.1 chances in-one-million located directly east of the Sterigenics 49th St operation, at a fenceline receptor (#27). Cancer risk at the MEIW is broken down by

[16] When evaluating risk results, total multi-pathway potential cancer risks and maximum potential non-cancer hazard indices as reported in HARP were used. Additionally, rounding procedures specified in Section 4.2 of the South Coast AQMD Supplemental Guidelines were followed.

[17] Based on 30-yr residential exposure.

substance and pathway in **Table 24**. Ethylene oxide contributes to more than 99% of the risk. The primary sources of the worker cancer are fugitive emissions and scrubber emissions, accounting for 98.7% and 1.2% of the risk, respectively. Complete breakdowns of cancer risk by source at the MEIW are provided in **Table 25**. A contour map showing the 25-yr worker cancer risk is included as **Figure 11**.

5.1.4 Maximally Exposed Individual Sensitive Receptor (MEISR)

The highest calculated cancer risk at a sensitive receptor is 4.9 chances in-one-million, at Maywood Elementary School (sensitive receptor #1) located about 1700 feet southeast of Sterigenics. Cancer risk at the maximum exposed sensitive receptor is broken down by substance and pathway in **Table 26**. Cancer risk at this receptor is primarily due to exposure to ethylene oxide, making up 99.9% of the cancer risk. Scrubber emissions, fugitive emissions, and abator emissions are responsible for 5.1%, 93.9%, and 0.9% of the risk, respectively. Complete breakdowns of cancer risk by source at the maximum exposed sensitive receptor are provided in **Table 27**.

Figure 5 shows the location of the maximum exposed sensitive receptor. **Table 10** provides a list of all sensitive receptors. **Figure 9** shows the locations of sensitive receptors with cancer risk greater than or equal to one chance in-one-million.

5.1.5 Population Exposure & Cancer Burden

Along with potential cancer risk, potential population exposure was analyzed, and potential cancer burden was calculated within the modeled zone of impact. Census block receptors were extracted from HARP within the one chance in-one-million 30-year exposure cancer risk isopleth and were modeled in AERMOD. To determine population exposure, modeling was performed at receptors located at the centroid of all census blocks whose centroid was located within the modeling domain. Both AERMOD and HARP were run in the manner as was done previously, except with the census block centroid receptors instead of fenceline, grid, and sensitive receptors. 70-yr residential cancer risk was calculated at each of these receptors. For any receptor with a cancer risk greater than one chance in-one-million, the population of the census block represented by that receptor was summed to determine the total exposure to various levels of cancer risk. The results of these calculations are provided in Table 28. Additionally, cancer burden was calculated based on the total population exposed to 70-yr cancer risk above one chance in-one-million. The population of each census tract was multiplied by the 70-yr cancer risk calculated at the representative receptor. These products were summed, and the cancer burden was determined to be 0.11.

5.2 Non-Carcinogens

As described in Section 4.3.2 and 4.3.3, the non-cancer health impacts are characterized through a hazard index (HI). When more than one chemical is considered, it is assumed that the effects are additive provided the associated chemicals are expected to have an adverse impact on the same target organ system (respiratory system, liver, etc.). Thus, chemical-specific hazard indices are summed to arrive at a hazard index for each target organ. For any organ system, a total hazard index exceeding 1.0 indicates a potential health effect. Although the assumption of additivity of exposure to multiple chemicals ignores possible antagonistic or synergistic interactions, this approach has been accepted by regulatory agencies as generally conservative.

5.2.1 Chronic HI

The chronic HI calculations are based on annual average concentrations and the chronic REL.

The chronic hazard index at the PMI is 0.76, at receptor #2 located along the railroad tracks. The chronic hazard index at the PMI is broken down by substance and pathway in **Table 29**. The primary chemical contributing to the chronic hazard index is ethylene oxide (over 99.99%). The associated target organ is the central nervous system. Over 99% of the chronic risk is a result of emissions from fugitive emissions (66.3%) and scrubber emissions (33.5%). Complete breakdowns of chronic risk by source at the PMI are provided in **Table 30**.

The maximum chronic hazard index at a residential receptor is 0.01, at receptor #801 located about 155 meters south of Sterigenics. The chronic hazard index at the MEIR is broken down by substance and pathway in **Table 31**. The primary chemical contributing to the chronic hazard index is ethylene oxide (99.998%). The associated target organ is the central nervous system. Over 99% of the chronic risk is a result of scrubber emissions (6.3%) and fugitive emissions (93.5%). Complete breakdowns of chronic risk by source at the MEIR are provided in **Table 32**.

The maximum chronic hazard index at a worker receptor is 0.15, at receptor #27 located at a fenceline receptor directly east of the 49th Street operation. The chronic hazard index at the MEIW is broken down by substance and pathway in **Table 33.** The primary chemical contributing to the chronic hazard index is ethylene oxide (99.999%). The associated target organ is the central nervous system. Over 98% of the chronic risk is a result of fugitive emissions (98.8%). Complete breakdowns of chronic risk by source at the MEIW are provided in **Table 34**.

The maximum chronic hazard index is 0.001 at sensitive receptor #1 located about 1700 feet southeast of Sterigenics (Maywood Elementary School). The chronic hazard index at the MEISR is broken down by substance and pathway in **Table 35**. The primary chemical contributing to the chronic hazard index is ethylene oxide (99.998%). The associated target organ is the central nervous system. About 99.999% of the chronic risk is a result of scrubber emissions (5.1%), fugitive emissions (94.0%), and abator emissions (0.9%). Complete breakdowns of chronic risk by source at the MEISR are provided in **Table 36**.

Figure 6 shows the location of these receptors. A contour map showing the chronic risk is included as **Figure 12**.

5.2.2 8-Hour Chronic HI

The 8-hr chronic hazard index at the point of maximum impact is well below 0.01, at a fenceline receptor (#36) located on the railroad tracks. The 8-hr chronic hazard index at the PMI is broken down by substance and pathway in **Table 37**. The primary chemicals contributing to the 8-hr chronic hazard index are acrolein (67.0%) and formaldehyde (32.8%). The associated target organ is the respiratory system. The sources responsible for the 8-hr chronic risk are boilers (96.1%) and abators (3.9%). Complete breakdowns of 8-hr chronic risk by source at the PMI are provided in **Table 38**.

The 8-hr chronic hazard index at a worker receptor is well below 0.01, at receptor #1351 located in the parking lot approximately 14 meters north of the 50th Street operation and east of the 49th Street operation. The 8-hr chronic hazard index at the MEIW is broken down by substance and pathway in **Table 41**. The primary chemicals contributing to the 8-hr

chronic hazard index are acrolein (66.1%) and formaldehyde (33.7%). The associated target organ is the respiratory system. The sources responsible for the 8-hr chronic risk are boilers (97.4%) and abators (2.6%). Complete breakdowns of 8-hr chronic risk by source at the MEIW are provided in **Table 42**.

The maximum 8-hr chronic hazard index at a residential receptor is well below 0.01 at receptor #799 located about 161 meters south of Sterigenics. The chronic hazard index at the MEIR is broken down by substance and pathway in **Table 39**. The primary chemicals contributing to the 8-hr chronic hazard index are acrolein (67.0%) and formaldehyde (32.8%). The associated target organ is the respiratory system. The sources responsible for the 8-hr chronic risk are boilers (92.6%) and abators (7.4%). Complete breakdowns of 8-hr chronic risk by source at the MEIR are provided in **Table 40**.

The maximum 8-hr chronic hazard index at a sensitive receptor is well below 0.01 at sensitive receptor #7 located about 644 meters southwest of Sterigenics (Rodas Family Childcare). The chronic hazard index at the MEISR is broken down by substance and pathway in **Table 43**. The primary chemicals contributing to the 8-hr chronic hazard index are acrolein (67.0%) and formaldehyde (32.8%). The associated target organ is the respiratory system. The sources responsible for the 8-hr chronic risk are boilers (56.9%) and abators (43.1%). Complete breakdowns of 8-hr chronic risk by source at the MEISR are provided in **Table 44**.

Figure 7 shows the location of these receptors. 8-hr chronic HI contours are not presented as the estimated 8-hr chronic HI at all the modeled receptors is below 0.5.

5.2.3 Acute HI

The acute hazard index at the point of maximum impact is well below 0.01, at receptor #1351 located in the parking lot approximately 14 meters north of the 50th Street operation and east of the 49th Street operation. The acute hazard index at the PMI is broken down by substance and pathway in **Table 45**. The primary chemicals contributing to the acute hazard index are acrolein (44.9%), ammonia (41.6%), and formaldehyde (12.8%). The associated target organ is the eyes. The sources responsible for the acute risk are boilers (89.2%) and abators (10.8%). Complete breakdowns of acute risk by source at the PMI are provided in **Table 46**.

The maximum acute hazard index at a residential receptor is well below 0.01, at receptor #801 located about 161 meters south of Sterigenics. The acute hazard index at the MEIR is broken down by substance and pathway in **Table 47**. The primary chemicals contributing to the acute hazard index are acrolein (44.9%), ammonia (41.6%), and formaldehyde (12.8%). The associated target organ is the eyes. The sources responsible for the acute risk are boilers (80.5%) and abators (19.5%). Complete breakdowns of acute risk by source at the MEIR are provided in **Table 48**.

The acute hazard index at the MEIW is well below 0.01, at receptor #1351, same location as the PMI. The acute hazard index at the MEIW is broken down by substance and pathway in **Table 49**. The primary chemicals contributing to the acute hazard index are acrolein (44.9%), ammonia (41.6%), and formaldehyde (12.8%). The associated target organ is the eyes. The sources responsible for the acute risk are boilers (89.2%) and abators (10.8%). Complete breakdowns of acute risk by source at the MEIW are provided in **Table 50**.

The maximum acute hazard index at a sensitive receptor is well below 0.01 at receptor #1 located about 534 meters southeast of Sterigenics (Maywood Elementary School). The acute hazard index at the MEISR is broken down by substance and pathway in **Table 51**. The primary chemicals contributing to the acute hazard index are acrolein (44.9%), ammonia (41.6%), and formaldehyde (12.8%). The associated target organ is the eyes. The sources responsible for the acute risk are boilers (55.3%) and abators (44.7%). Complete breakdowns of acute risk by source at the MEISR are provided in **Table 52**.

The MEI locations for acute HI are shown in **Figure 8**. Acute HI contours are not presented as the estimated acute HI at all the modeled receptors is below 0.5.

6. UNCERTAINTIES

In any risk evaluation, a number of assumptions must be made in order to estimate human exposure and to calculate potential risks. These assumptions may, however, introduce uncertainty in risk calculations. Regulatory guidance requires that conservative assumptions be used to provide an upper-bound estimate of the risk and to avoid underestimating the potential exposures and associated health risks, even though these assumptions may not be indicative or representative of actual conditions at and in the vicinity of the Facility. The key sources of uncertainty in the Modified 2021 HRA include:

- Estimation of emissions,
- Estimation of exposure concentrations,
- Exposure assumptions, and
- Chemical toxicity criteria.

In all of these cases, conservative, health-protective assumptions were used in the Modified 2021 HRA. By compounding conservative assumptions, the estimated excess cancer risks are upper-bound estimates, and the actual incidence of cancer or non-cancer health impacts is likely to be significantly lower (USEPA 1989). The following sections summarize the critical uncertainties associated with the emissions estimation, air dispersion modeling, and risk estimation components of the risk assessment.

6.1 Estimation of Emissions

There are some uncertainties associated with the estimation of emissions in this Modified 2021 HRA. These uncertainties would affect the subsequent estimation of exposure concentrations and risk characterization. In particular, there could be some uncertainties associated with the estimation of potential fugitive emissions from the Facility as presented in the Modified 2021 HRA.

The EPA methodology used to prepare this HRA was formulated using industry-wide information, however minor adjustments were made for site-specific data where possible.

6.2 Estimation of Exposure Concentrations

There are a number of uncertainties associated with the estimation of exposure concentrations from air dispersion modeling of potential emissions from the Sterigenics Vernon operations, particularly when focusing on near-source receptors. This section briefly describes some of the uncertainties that may influence the exposure concentrations used in the risk characterization.

In this instance, air monitoring data is available from near-source locations at Sterigenics. The air monitoring data supports certain uncertainties associated with near-source air dispersion modeling and can qualitatively be referenced to provide a more comprehensive understanding of EtO exposures near the facility.

6.2.1 Estimates from Air Dispersion Models

As discussed in Section 3, the dispersion modeling algorithm in AERMOD was used to estimate average off-site TAC exposure concentrations at the various offsite receptor locations. The AERMOD model uses a steady-state Gaussian plume equation to calculate ambient air concentrations from emission sources. AERMOD does not predict concentrations during calm winds. AERMOD may not be appropriate for some near-field modeling in cases

where the wind field is complex due to complicated building configurations or terrain wake effects.

When air flows over buildings and similar structures, it creates a turbulent area on the downwind side of the building called a wake. A plume in the path of this airflow is drawn into the wake, temporarily trapping it in a recirculating cavity. This downwash effect leads to higher ground-level pollutant concentrations near the building than if the building was not present. The AERMOD model includes algorithms to model the effects of building downwash on emissions from nearby or adjacent point sources. As discussed in Section 2, fugitive emissions were modeled as volume sources. AERMOD currently does not account for potential downwash affects for volume sources, which is likely leading to underestimated ground level concentrations near the buildings.

The limitations of the air dispersion model provide a source of uncertainty in the estimation of exposure concentrations. According to USEPA, errors due to the limitation of the algorithms implemented in the AERMOD model in the highest estimated concentrations of +/- 10 percent to 40 percent are typical (USEPA 2005).

6.2.2 Meteorological Data Selection

Uncertainty also exists in the meteorological data used in the AERMOD air dispersion model. These uncertainties are related to the use of meteorological data that is not collected at the site. Therefore, the meteorological data used in this analysis was based on meteorological data from a South Coast AQMD's monitor station in Central Los Angeles, which is much closer to mountains than the Sterigenics sites. While this meteorological station is close to the Facility, the uncertainties due to the use of meteorological data not collected at the site resulted in approximate exposure concentrations.

6.3 Risk Characterization

There are a number of uncertainties associated with the risk characterization process. This section briefly describes some of the uncertainties that may influence the risk estimates produced in this analysis.

6.3.1 Exposure Assumption Uncertainties

Consistent with OEHHA Guidance, risks were estimated assuming that hypothetical residents at the receptor points spend a continuous 30 years at one location. However, the USEPA has estimated that 50% of the population lives in the same residence for only eight years, while only 10% remain in the same house for 32 years (USEPA 2011). Adults, moreover, spend only 66 to 82% of their total daily time at home (USEPA 2011), rather than the 73% assumed here. Accordingly, the actual risks to hypothetical residents at the modeled receptor locations are likely lower than those calculated in this assessment. Moreover, as discussed previously, use of residential exposure parameters represents a conservative assessment of actual risk to other types of receptors, such as sensitive receptors.

6.3.2 Dose-Response Assessment

The primary uncertainties associated with the toxicity assessment are related to derivation of toxicity values. Standard RELs and CPFs established by Cal/EPA and listed in the HARP model were used to estimate potential carcinogenic and non-cancer health effects from exposures to compounds emitted from the Facility. These values are derived by applying conservative assumptions and are intended to protect the most sensitive individuals in the potentially exposed populations.

To derive the toxicity values, Cal/EPA makes several assumptions that tend to overestimate the actual hazard or risk to human health. Because data from human studies are generally unavailable, RELs are typically derived from animal studies. Uncertainty factors and modifying factors are then applied to these data to ensure that the RELs are adequately protective of human health. For many compounds, it is anticipated that this approach overestimates the potential for non-cancer effects.

CPFs used to estimate carcinogenic risk are also typically derived based on data from animal studies. These data are based on studies in which high doses of a test chemical were administered to laboratory animals, and the reported response is extrapolated to the much lower doses typical of human exposure. Very little experimental data are available on the nature of the dose-response relationship at low doses, such as whether a threshold exists or if the dose-response curve passes through the origin. Because of this uncertainty, a conservative model is used to estimate the low-dose relationship and uses an upper bound estimate (the 95 upper confidence limit of the slope predicted by the extrapolation model) as the CPF. With this factor, an upper-bound estimate of potential cancer risks is obtained.

OEHHA is currently evaluating changes to its inhalation unit risk for ethylene oxide, so it is possible that the OEHHA value will change. For this HRA, since the process has not yet been finalized, the HRA was prepared using OEHHA's current IUR for EtO. If OEHHA ultimately finalizes a higher cancer potency value, then the resulting estimated health risks from Sterigenics would be higher.

6.3.3 Risk Calculation

The USEPA (1989) notes that the conservative assumptions used in a risk assessment are intended to assure that the estimated risks do not underestimate the actual risks posed by a site and that the estimated risks do not necessarily represent actual risks experienced by populations at or near a site. The estimated risks in this risk assessment are based primarily on a series of conservative assumptions related to predicted environmental concentrations, exposure, and chemical toxicity. The use of conservative assumptions tends to produce upper-bound estimates of risk. Although it is difficult to quantify the uncertainties associated with all the assumptions made in this risk assessment, the use of conservative assumptions is likely to result in substantial overestimates of exposure, and hence, risk.

7. CONCLUSIONS

The results of the HRA indicate that the Notification Risk Level and the Action Risk Level for cancer risk are exceeded based on the 2021 emissions from Sterigenics. Modified 2021 HRA results are summarized in **Table 15**. Based on these results and the Potentially High Risk Level Facility designation, Sterigenics is subject to the following Rule 1402 provisions on an accelerated timeline:

7.1 Public Notice

As results of this HRA, cancer risk exceeds the Notification Risk Level, Sterigenics will be required to provide public notice, in accordance with the procedures in the most current version of "South Coast AQMD Public Notification Procedures for Facilities Under the Air Toxics 'Hot Spots' Information and Assessment Act (AB 2588) and Rule 1402.

7.2 Risk Reduction Plan (RRP)

As results of this Modified 2021 HRA for cancer risk exceed the Action Risk Level, Sterigenics is required to prepare a Risk Reduction Plan (RRP) based on these results and the Potentially High Risk Level Facility designation. The purpose of the RRP is to perform risk reduction measures at both the Vernon operations which will bring modeled risk below the Action Risk Level. Sterigenics has already evaluated various risk reduction measures to be implemented and included in a Risk Reduction Plan (RRP), per the Rule 1402 Significant Risk Level requirements. An Early Risk Reduction Plan to expeditiously reduce risk was submitted on September 2, 2022, as required by the Potentially High Risk Level Facility designation. A RRP will be submitted that will reflect the results of the post-RRP control measures.

7.3 Current Mitigation Measures

As described in Section 6, the results of this HRA relied on various conservative assumptions which could overestimate the emissions and therefore subsequent exposure concentration and risk at the offsite receptors. Based on the Modified 2021 HRA results, the theoretical risk and associated impact area could vary significant depending on the percent of fugitive emissions of the total ethylene oxide usage that are assumed.

Notably, the results of this HRA **do not** represent current risk levels as Sterigenics has already implemented numerous risk reduction measures and continues to assess others. As early as April 2022, after South Coast AQMD raised concerns based on the nearby air monitoring results, Sterigenics began identifying actions they could quickly take to reduce emissions, and thus risk, through procedural changes, process changes, physical modifications, and curtailments. The following risk reduction measures have already been implemented at the Vernon facility:

- Installed temporary enclosures using physical barriers, where feasible, using physical barriers such as plastic sheeting (10 mil thickness or greater), plastic strip curtains, accordion doors, etc.
- Direct fugitive emissions to control equipment where feasible.
- Vented (or otherwise direct air from) areas with fugitive EtO to portable capture and control equipment, including additional fans routed to existing emission controls and portable Timilon filter systems.
- Sealed off all building draft openings that were not under negative pressure as verified by conducting smoke testing or differential pressure measurements.

- Kept all access doors in process, storage, and shipping areas closed, except while they are in active use.
- Installed signage on both sides of personnel and vehicle access doors for areas with known fugitive EtO emissions.
- Began, where possible, keeping truck bay doors closed during loading and unloading, or ensuring that truck bay doors remain closed except when personnel are actively involved in truck movement and/or truck loading and unloading.
- Began inspecting all roll-up door(s) on a daily basis for any damage that may allow for potential fugitive EtO emissions to pass through such door. Sterigenics maintains a log that documents all daily inspections.
- Developed and submitted for District review and approval a differential pressure monitoring plan. This plan requires installation, operation, and maintenance of a differential pressure monitoring system for each total enclosure.
- Performs daily inspections of temporary enclosure measures for integrity against breaches.
- Increased aeration time by 24 hours or more where practical in the aeration room.
- Performs daily inspection of the acid scrubber systems for potential ethylene glycol leaks.
- Began a Leak Detection and Repair (LDAR) program to inspect scrubber and oxidizer piping under positive pressure.
- Constructed and installed additional air pollution control equipment (dry beds) at the 49th and 50th Street facility to further control process EtO emissions. With installation of these dry beds, the facility is maintaining a continuous negative pressure and treatment system within the shipping areas.
- Connected the existing scrubber exhaust to the existing Donaldson abator stack at each facility to increase dispersion.

Additionally, Sterigenics intends to implement the following measures:

- Construct and operate Permanent Total Enclosure (PTE) to eliminate fugitive emissions.
- Reroute the scrubber, dry beds, and Donaldson abator exhausts to one single exhaust stack at each facility. The new stacks will be taller than the previous scrubber exhaust stacks and will exhaust at a higher temperature and flow rate than the previous scrubber stacks, this increasing dispersion.

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TABLES

Table 1
List of TAC Compounds, Associated Endpoints Evaluated, and Identification of Non-Inhalation Pathways
Sterigenics
Vernon, CA

Compound	CAS Number / Emittant ID	Endpoints Evaluated[1]			Pathways Evaluated[1]			
		Cancer Risk	Chronic HI	Acute HI	Inhalation	Soil Ingestion	Dermal	Mother's Milk Ingestion
Acetaldehyde	75-07-0	X	X	X	X			
Acrolein	107-02-8		X	X	X			
Ammonia	7664-41-7		X	X	X			
Benzene	71-43-2	X	X	X	X			
Ethylbenzene	100-41-4	X	X		X			
Ethylene oxide	75-21-8	X	X		X			
Formaldehyde	50-00-0	X	X	X	X			
Hexane	110-54-3		X		X			
Naphthalene	91-20-3	X	X		X			
Toluene	108-88-3		X	X	X			
Total PAHs [excluding naphthalene]	1151	X			X	X	X	X
Xylene	1330-20-7		X	X	X			

Notes:

[1] Endpoints and exposure pathyways were identified based on classifications within ARB's HARP. Available at: https://ww2.arb.ca.gov/our-work/programs/hot-spots-analysis-reporting-program. Accessed: October 2022.

Abbreviations:

ARB = (California) Air Resources Board
CAS = Chemical Abstract Service
HARP = Hotspots Analysis and Reporting Program
HI = Hazard Index
OEHHA = Office of Environmental Health Hazard Assessment
TAC = Toxic Air Contaminant

Table 2
2021 Modeled Annual Emissions by Source and Substance, in Pounds per Year and Grams per Second
Sterigenics
Vernon, CA

Source ID	Source Description	Compound		Annual Emissions	
		CAS Number / Emittant ID	Name	lb/year	g/s
49B1	49th St. Boiler #1	71-43-2	Benzene	1.99E-02	2.87E-07
49B1		50-00-0	Formaldehyde	4.23E-02	6.09E-07
49B1		1151	Total PAHs [excluding naphthalene]	2.49E-04	3.58E-09
49B1		91-20-3	Naphthalene	7.47E-04	1.07E-08
49B1		75-07-0	Acetaldehyde	1.07E-02	1.54E-07
49B1		107-02-8	Acrolein	6.72E-03	9.67E-08
49B1		7664-41-7	Ammonia	7.97E+00	1.15E-04
49B1		100-41-4	Ethylbenzene	2.37E-02	3.40E-07
49B1		110-54-3	Hexane	1.57E-02	2.26E-07
49B1		108-88-3	Toluene	9.11E-02	1.31E-06
49B1		1330-20-7	Xylene	6.77E-02	9.74E-07
49B2	49th St. Boiler #2	71-43-2	Benzene	1.99E-02	2.87E-07
49B2		50-00-0	Formaldehyde	4.23E-02	6.09E-07
49B2		1151	Total PAHs [excluding naphthalene]	2.49E-04	3.58E-09
49B2		91-20-3	Naphthalene	7.47E-04	1.07E-08
49B2		75-07-0	Acetaldehyde	1.07E-02	1.54E-07
49B2		107-02-8	Acrolein	6.72E-03	9.67E-08
49B2		7664-41-7	Ammonia	7.97E+00	1.15E-04
49B2		100-41-4	Ethylbenzene	2.37E-02	3.40E-07
49B2		110-54-3	Hexane	1.57E-02	2.26E-07
49B2		108-88-3	Toluene	9.11E-02	1.31E-06
49B2		1330-20-7	Xylene	6.77E-02	9.74E-07
49A	49th St. Abator	71-43-2	Benzene	5.98E-02	8.60E-07
49A		50-00-0	Formaldehyde	1.27E-01	1.83E-06
49A		1151	Total PAHs [excluding naphthalene]	7.47E-04	1.07E-08
49A		91-20-3	Naphthalene	2.24E-03	3.22E-08
49A		75-07-0	Acetaldehyde	3.21E-02	4.62E-07
49A		107-02-8	Acrolein	2.02E-02	2.90E-07
49A		7664-41-7	Ammonia	2.39E+01	3.44E-04
49A		100-41-4	Ethylbenzene	7.10E-02	1.02E-06
49A		110-54-3	Hexane	4.71E-02	6.77E-07
49A		108-88-3	Toluene	2.73E-01	3.93E-06
49A		1330-20-7	Xylene	2.03E-01	2.92E-06
49A		75-21-8	Ethylene oxide	1.59E+01	2.28E-04
49S	49th St. Scrubber	75-21-8	Ethylene oxide	2.32E+01	3.34E-04
49FUG	49th St. Fugitive Emissions	75-21-8	Ethylene oxide	4.33E+02	6.23E-03
50B1	50th St. Boiler #1	71-43-2	Benzene	2.43E-02	3.50E-07
50B1		50-00-0	Formaldehyde	5.17E-02	7.44E-07
50B1		1151	Total PAHs [excluding naphthalene]	3.04E-04	4.38E-09
50B1		91-20-3	Naphthalene	9.13E-04	1.31E-08
50B1		75-07-0	Acetaldehyde	1.31E-02	1.88E-07
50B1		107-02-8	Acrolein	8.22E-03	1.18E-07
50B1		7664-41-7	Ammonia	9.74E+00	1.40E-04
50B1		100-41-4	Ethylbenzene	2.89E-02	4.16E-07
50B1		110-54-3	Hexane	1.92E-02	2.76E-07
50B1		108-88-3	Toluene	1.11E-01	1.60E-06
50B1		1330-20-7	Xylene	8.28E-02	1.19E-06

Table 2
2021 Modeled Annual Emissions by Source and Substance, in Pounds per Year and Grams per Second
Sterigenics
Vernon, CA

Source ID	Source Description	Compound		Annual Emissions	
		CAS Number / Emittant ID	Name	lb/year	g/s
50B2	50th St. Boiler #2	71-43-2	Benzene	2.43E-02	3.50E-07
50B2		50-00-0	Formaldehyde	5.17E-02	7.44E-07
50B2		1151	Total PAHs [excluding naphthalene]	3.04E-04	4.38E-09
50B2		91-20-3	Naphthalene	9.13E-04	1.31E-08
50B2		75-07-0	Acetaldehyde	1.31E-02	1.88E-07
50B2		107-02-8	Acrolein	8.22E-03	1.18E-07
50B2		7664-41-7	Ammonia	9.74E+00	1.40E-04
50B2		100-41-4	Ethylbenzene	2.89E-02	4.16E-07
50B2		110-54-3	Hexane	1.92E-02	2.76E-07
50B2		108-88-3	Toluene	1.11E-01	1.60E-06
50B2		1330-20-7	Xylene	8.28E-02	1.19E-06
50A	50th St. Abator	71-43-2	Benzene	7.30E-02	1.05E-06
50A		50-00-0	Formaldehyde	1.55E-01	2.23E-06
50A		1151	Total PAHs [excluding naphthalene]	9.13E-04	1.31E-08
50A		91-20-3	Naphthalene	2.74E-03	3.94E-08
50A		75-07-0	Acetaldehyde	3.93E-02	5.65E-07
50A		107-02-8	Acrolein	2.47E-02	3.55E-07
50A		7664-41-7	Ammonia	2.92E+01	4.20E-04
50A		100-41-4	Ethylbenzene	8.67E-02	1.25E-06
50A		110-54-3	Hexane	5.75E-02	8.27E-07
50A		108-88-3	Toluene	3.34E-01	4.81E-06
50A		1330-20-7	Xylene	2.48E-01	3.57E-06
50A		75-21-8	Ethylene oxide	1.14E+01	1.64E-04
50S	50th St. Scrubber	75-21-8	Ethylene oxide	2.30E+01	3.31E-04
50FUG	50th St. Fugitive Emissions	75-21-8	Ethylene oxide	3.94E+02	5.67E-03

Abbreviations:

CAS = Chemical Abstract Service
lb = pound
PAHs = Polycyclic aromatic hydrocarbons
g/s = grams per second

Table 3
2021 Modeled Annual Emissions by Substance, in Pounds per Year and Grams per Second
Sterigenics
Vernon, CA

Compound		Annual Emissions	
CAS Number / Emittant ID	**Name**	**lb/year**	**g/s**
71-43-2	Benzene	2.21E-01	3.18E-06
50-00-0	Formaldehyde	4.70E-01	6.77E-06
1151	Total PAHs [excluding naphthalene]	2.77E-03	3.98E-08
91-20-3	Naphthalene	8.30E-03	1.19E-07
75-07-0	Acetaldehyde	1.19E-01	1.71E-06
107-02-8	Acrolein	7.47E-02	1.07E-06
7664-41-7	Ammonia	8.85E+01	1.27E-03
100-41-4	Ethylbenzene	2.63E-01	3.78E-06
110-54-3	Hexane	1.74E-01	2.51E-06
108-88-3	Toluene	1.01E+00	1.46E-05
1330-20-7	Xylene	7.53E-01	1.08E-05
75-21-8	Ethylene oxide	9.01E+02	1.30E-02

Abbreviations:

CAS = Chemical Abstract Service

lb = pound

PAHs = Polycyclic aromatic hydrocarbons

g/s = grams per second

Table 4
2021 Modeled Maximum Hourly Emissions by Source and Substance, in Pounds per Hour and Grams per Second
Sterigenics
Vernon, CA

Source ID	Source Description	Compound		Hourly Emissions	
		CAS Number / Emittant ID	Name	lb/hr	g/s
49B1	49th St. Boiler #1	71-43-2	Benzene	2.27E-06	2.87E-07
49B1		50-00-0	Formaldehyde	4.83E-06	6.09E-07
49B1		1151	Total PAHs [excluding naphthalene]	2.84E-08	3.58E-09
49B1		91-20-3	Naphthalene	8.53E-08	1.07E-08
49B1		75-07-0	Acetaldehyde	1.22E-06	1.54E-07
49B1		107-02-8	Acrolein	7.67E-07	9.67E-08
49B1		7664-41-7	Ammonia	9.10E-04	1.15E-04
49B1		100-41-4	Ethylbenzene	2.70E-06	3.40E-07
49B1		110-54-3	Hexane	1.79E-06	2.26E-07
49B1		108-88-3	Toluene	1.04E-05	1.31E-06
49B1		1330-20-7	Xylene	7.73E-06	9.74E-07
49B2	49th St. Boiler #2	71-43-2	Benzene	2.27E-06	2.87E-07
49B2		50-00-0	Formaldehyde	4.83E-06	6.09E-07
49B2		1151	Total PAHs [excluding naphthalene]	2.84E-08	3.58E-09
49B2		91-20-3	Naphthalene	8.53E-08	1.07E-08
49B2		75-07-0	Acetaldehyde	1.22E-06	1.54E-07
49B2		107-02-8	Acrolein	7.67E-07	9.67E-08
49B2		7664-41-7	Ammonia	9.10E-04	1.15E-04
49B2		100-41-4	Ethylbenzene	2.70E-06	3.40E-07
49B2		110-54-3	Hexane	1.79E-06	2.26E-07
49B2		108-88-3	Toluene	1.04E-05	1.31E-06
49B2		1330-20-7	Xylene	7.73E-06	9.74E-07
49A	49th St. Abator	71-43-2	Benzene	6.82E-06	8.60E-07
49A		50-00-0	Formaldehyde	1.45E-05	1.83E-06
49A		1151	Total PAHs [excluding naphthalene]	8.53E-08	1.07E-08
49A		91-20-3	Naphthalene	2.56E-07	3.22E-08
49A		75-07-0	Acetaldehyde	3.67E-06	4.62E-07
49A		107-02-8	Acrolein	2.30E-06	2.90E-07
49A		7664-41-7	Ammonia	2.73E-03	3.44E-04
49A		100-41-4	Ethylbenzene	8.10E-06	1.02E-06
49A		110-54-3	Hexane	5.37E-06	6.77E-07
49A		108-88-3	Toluene	3.12E-05	3.93E-06
49A		1330-20-7	Xylene	2.32E-05	2.92E-06
49A		75-21-8	Ethylene oxide	4.58E-03	5.77E-04
49S	49th St. Scrubber	75-21-8	Ethylene oxide	8.69E-03	1.10E-03
49FUG	49th St. Fugitive Emissions	75-21-8	Ethylene oxide	4.58E-03	5.77E-04
50B1	50th St. Boiler #1	71-43-2	Benzene	2.78E-06	3.50E-07
50B1		50-00-0	Formaldehyde	5.91E-06	7.44E-07
50B1		1151	Total PAHs [excluding naphthalene]	3.47E-08	4.38E-09
50B1		91-20-3	Naphthalene	1.04E-07	1.31E-08
50B1		75-07-0	Acetaldehyde	1.49E-06	1.88E-07
50B1		107-02-8	Acrolein	9.38E-07	1.18E-07
50B1		7664-41-7	Ammonia	1.11E-03	1.40E-04
50B1		100-41-4	Ethylbenzene	3.30E-06	4.16E-07
50B1		110-54-3	Hexane	2.19E-06	2.76E-07
50B1		108-88-3	Toluene	1.27E-05	1.60E-06
50B1		1330-20-7	Xylene	9.45E-06	1.19E-06

Table 4
2021 Modeled Maximum Hourly Emissions by Source and Substance, in Pounds per Hour and Grams per Second
Sterigenics
Vernon, CA

Source ID	Source Description	Compound		Hourly Emissions	
		CAS Number / Emittant ID	Name	lb/hr	g/s
50B2	50th St. Boiler #2	71-43-2	Benzene	2.78E-06	3.50E-07
50B2		50-00-0	Formaldehyde	5.91E-06	7.44E-07
50B2		1151	Total PAHs [excluding naphthalene]	3.47E-08	4.38E-09
50B2		91-20-3	Naphthalene	1.04E-07	1.31E-08
50B2		75-07-0	Acetaldehyde	1.49E-06	1.88E-07
50B2		107-02-8	Acrolein	9.38E-07	1.18E-07
50B2		7664-41-7	Ammonia	1.11E-03	1.40E-04
50B2		100-41-4	Ethylbenzene	3.30E-06	4.16E-07
50B2		110-54-3	Hexane	2.19E-06	2.76E-07
50B2		108-88-3	Toluene	1.27E-05	1.60E-06
50B2		1330-20-7	Xylene	9.45E-06	1.19E-06
50A	50th St. Abator	71-43-2	Benzene	8.34E-06	1.05E-06
50A		50-00-0	Formaldehyde	1.77E-05	2.23E-06
50A		1151	Total PAHs [excluding naphthalene]	1.04E-07	1.31E-08
50A		91-20-3	Naphthalene	3.13E-07	3.94E-08
50A		75-07-0	Acetaldehyde	4.48E-06	5.65E-07
50A		107-02-8	Acrolein	2.81E-06	3.55E-07
50A		7664-41-7	Ammonia	3.34E-03	4.20E-04
50A		100-41-4	Ethylbenzene	9.90E-06	1.25E-06
50A		110-54-3	Hexane	6.57E-06	8.27E-07
50A		108-88-3	Toluene	3.81E-05	4.81E-06
50A		1330-20-7	Xylene	2.83E-05	3.57E-06
50A		75-21-8	Ethylene oxide	9.36E-03	1.18E-03
50S	50th St. Scrubber	75-21-8	Ethylene oxide	1.78E-02	2.24E-03
50FUG	50th St. Fugitive Emissions	75-21-8	Ethylene oxide	9.36E-03	1.18E-03

Abbreviations:

CAS = Chemical Abstract Service
hr = hour
lb = pound
PAHs = Polycyclic aromatic hydrocarbons
g/s = grams per second

Table 5

Modeled Maximum Hourly Emissions by Substance, in Pounds per Hour and Grams per Second

Sterigenics

Vernon, CA

Compound		Hourly Emissions	
CAS Number / Emittant ID	**Name**	**lb/hr**	**g/s**
71-43-2	Benzene	2.53E-05	3.18E-06
50-00-0	Formaldehyde	5.37E-05	6.77E-06
1151	Total PAHs [excluding naphthalene]	3.16E-07	3.98E-08
91-20-3	Naphthalene	9.48E-07	1.19E-07
75-07-0	Acetaldehyde	1.36E-05	1.71E-06
107-02-8	Acrolein	8.53E-06	1.07E-06
7664-41-7	Ammonia	1.01E-02	1.27E-03
100-41-4	Ethylbenzene	3.00E-05	3.78E-06
110-54-3	Hexane	1.99E-05	2.51E-06
108-88-3	Toluene	1.16E-04	1.46E-05
1330-20-7	Xylene	8.59E-05	1.08E-05
75-21-8	Ethylene oxide	5.43E-02	6.85E-03

Abbreviations:

CAS = Chemical Abstract Service

hr = hour

lb = pound

PAHs = Polycyclic aromatic hydrocarbons

g/s = grams per second

Table 6
Summary of Model Options and Parameters
Sterigenics
Vernon, CA

Parameter	Assumptions
Model Control Options	
Use Regulatory Default	Yes
Urban or Rural Option	Urban
Flagpole Receptor Height	0.0 meters
Source Options	
Include Building Downwash	Yes
Receptor Information	
Census Receptors	292 Receptors within 1-in-a-million residential cancer risk isopleth
Fenceline Receptors	32 receptors at 20 meter spacing along property boundary line
Sensitive Receptors	19 Receptors within 1-in-a-million residential cancer risk isopleth
Grid Receptors	4,930 receptors; fine grid at 20 meter spacing to 500 meter radius, medium grid at 100 meter spacing to 1,000 meter radius, and coarse grid at 250 meter spacing to 5 km radius
Meteorology Information	
Meteorological Station[1]	Central Los Angeles met station
Station Base Elevation	87 meters
Output	
Averaging Times	Highest 1-hour and Period (Five-Year) Average

Notes:
[1]Meteorological station was selected by SCAQMD.

References:
South Coast Air Quality Management District (SCAQMD). Processed hourly meteorological data are available for AERMOD applicaations. Available at: https://www.aqmd.gov/home/air-quality/meteorological-data/data-for-aermod

Table 7
Point Source Modeling Parameters
Sterigenics
Vernon, CA

AERMOD Source Group	Source[1]	UTM East (m)	UTM North (m)	Base Elevation (m)	Modeled Emission Rate (g/s)	Stack Height (m)	Stack Temperature (K)	Exhaust Velocity (m/s)	Stack Diameter (m)
50S	50th St. Wet Acid Scrubber	390112	3762410	48.98	1	13.7	301.3	22.0	0.30
50A	50th St. Donaldson Abator	390131	3762407	48.77	1	24.1	370.5	9.6	0.91
50B1	50th St. 1.995 MMBtu/hr Boiler	390097	3762388	49.07	1	9.7	494.3	7.1	0.30
50B2	50th St. 1.995 MMBtu/hr Boiler	390099	3762389	49.07	1	10.0	494.3	7.1	0.30
49S	49th St. Wet Acid Scrubber	390052	3762430	49.31	1	13.7	298.9	27.4	0.30
49A	49th St. Donaldson Abator	390080	3762426	49.07	1	24.1	361.3	9.4	0.91
49B1	49th St. 1.26 MMBtu/hr Boiler	390032	3762448	49.38	1	9.2	494.3	4.4	0.30
49B2	49th St. 1.225 MMBtu/hr Boiler	390034	3762447	49.38	1	9.2	494.3	4.4	0.30

Notes
1 Stack parameters are based on the 2021 source test results and 2022 source test results for the scrubbers and the abators, respectively.

Abbreviations:
AERMOD = AMS/EPA Regulatory Model
g/s = grams per second
K = Kelvin
m = meter
m/s = meters per second
UTM = Universal Transverse Mercator

Table 8
Volume Source Modeling Parameters
Sterigenics
Vernon, CA

AERMOD Source Group	Source	UTM East (m)	UTM North (m)	Base Elevation (m)	Modeled Emission Rate (g/s)	Release Height[2] (m)	Initial Lateral Dimension (m)	Initial Vertical Dimension[1] (m)
50FUG	50F1 (50th St. Fugitive Emissions)	390,044	3,762,417	49	1	3	0.11	3.97
50FUG	50F2 (50th St. Fugitive Emissions)	390,054	3,762,416	49	1	3	0.11	3.97
50FUG	50F3 (50th St. Fugitive Emissions)	390,061	3,762,415	49	1	3	0.11	3.97
50FUG	50F4 (50th St. Fugitive Emissions)	390,068	3,762,414	49	1	3	0.11	3.97
50FUG	50F5 (50th St. Fugitive Emissions)	390,085	3,762,411	49	1	3	0.11	3.97
50FUG	50F6 (50th St. Fugitive Emissions)	390,112	3,762,410	49	1	2	0.92	3.97
49FUG	49F1 (49th St. Fugitive Emissions)	390,029	3,762,447	49	1	3	0.11	3.97
49FUG	49F2 (49th St. Fugitive Emissions)	390,029	3,762,441	49	1	3	0.11	3.97
49FUG	49F3 (49th St. Fugitive Emissions)	390,028	3,762,435	49	1	3	0.11	3.97
49FUG	49F4 (49th St. Fugitive Emissions)	390,041	3,762,433	49	1	3	0.11	3.97
49FUG	49F5 (49th St. Fugitive Emissions)	390,047	3,762,433	49	1	3	0.11	3.97
49FUG	49F6 (49th St. Fugitive Emissions)	390,052	3,762,432	49	1	3	0.11	3.97
49FUG	49F7 (49th St. Fugitive Emissions)	390,057	3,762,431	49	1	3	0.11	3.97
49FUG	49F8 (49th St. Fugitive Emissions)	390,063	3,762,431	49	1	3	0.11	3.97
49FUG	49F9 (49th St. Fugitive Emissions)	390,069	3,762,430	49	1	3	0.11	3.97
49FUG	49F10 (49th St. Fugitive Emissions)	390,052	3,762,430	49	1	2	1.21	3.97

Notes:

[1] The initial vertical dimension represents the building height divided by 2.15, per AERMOD user's guide. Available at: https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_userguide.pdf. Accessed: October 2022.

Abbreviations:

AERMOD = AMS/EPA Regulatory Model
SCAQMD = South Coast Air Quality Management District
g/s = grams per second
g/s-m^2 = grams per second per meter squared
m = meter
USEPA = US Environmental Protection Agency
UTM = Universal Transverse Mercator

Table 9
Building Downwash Parameters
Sterigenics
Vernon, CA

Building ID	Building	Building UTM East[1] (m)	Building UTM North[1] (m)	Building Height[1] (m)
1	343 E 50th St, Vernon, CA 90058	390,024	3,762,420	8.53
2	343 E 50th St, Vernon, CA 90058	390,170	3,762,400	7.32
3	4900 Gifford Ave, Vernon, CA 90058	390,033	3,762,465	8.53
4	4950 E 49th St, Vernon, CA 90058	390,146	3,762,450	7.92
5	4900 District Blvd	390,208	3,762,441	7.92
6	4801/4809/4819 E 49th St. and 4825/4827 District Blv	390,037	3,762,515	9.14
7	4900 E 49th St and 4764 E 49th St, Vernon, CA 90058	389,784	3,762,499	7.32
8	4940 District Blvd	389,926	3,762,433	9.14
9	4940 District Blvd	389,990	3,762,424	9.75
10	4753 E 49th St, Vernon, CA 90058	389,975	3,762,525	8.23
11	4767 E 49th St, Vernon, CA 90058	389,944	3,762,529	8.23
12	4820 E 50th St, Vernon, CA 90058	390,148	3,762,354	7.62

Notes:
[1] Building heights were estimated using elevation data from the Google Earth Pro.

Abbreviations:
m = meter
UTM = Universal Transverse Mercator

Table 10
Modeled Sensitive Receptors
Sterigenics
Vernon, CA

Sensitive Receptor ID	Description	Type	Address	UTM East[1] (m)	UTM North[1] (m)
1	Maywood Elementary School	Elementary School	5200 Cudahy Ave, Maywood, CA 90270	390,614	3,762,081
2	Loma Vista Ave Elementary School	Elementary School	3629 E 58th St, Maywood, CA 90270	389,296	3,761,725
3	Fishburn Ave Elementary School	Elementary School	5701 Fishburn Ave #2819, Maywood, CA 90270	390,012	3,761,631
4	Maywood Christian School	K-12	3759 E 57th St, Maywood, CA 90270	389,512	3,761,812
5	Nimitz Middle School	Middle School	6021 Carmelita Ave, Huntington Park, CA 90255	389,426	3,761,291
6	Maywood Villas Senior Apartments	Senior Center	5601 Atlantic Blvd, Maywood, CA 90270	390,503	3,761,676
7	Rodas Family Child Care	Child Care Center	4034 E 56th St, Maywood, CA 90270	389,835	3,761,772
8	Calderon Sergio	Preschool	4529 E 56th St, Maywood, CA 90270	390,637	3,761,699
9	Coalicion De Latinos Americanos	Preschool	3801 Slauson Ave, Maywood, CA 90270	389,523	3,761,562
10	Maywood Academy High School	High School	6125 Pine Ave, Maywood, CA 90270	390,064	3,761,006
11	Huntington Park Elementary School	Elementary School	6055 Corona Ave, Huntington Park, CA 90255	389,633	3,761,195
12	Saint Rose of Lima School	K-8	4422 E 60th St, Maywood, CA 90270	390,269	3,761,181
13	Aspire Antonio Maria Lugo Academy	K-12	6100 Carmelita Ave, Huntington Park, CA 90255	389,483	3,761,086
14	Bright Beginnings Preschool	Daycare	4207 E 61st St, Huntington Park, CA 90255	389,959	3,761,074
15	Nueva Vista Elementary School	Elementary School	4412 Randolph St, Bell, CA 90201	390,135	3,760,749
16	Heliotrope Ave Elementary School	Elementary School	5911 Woodlawn Ave #3525, Maywood, CA 90270	391,112	3,761,268
17	Maywood Center for Enriched Studies	High School	5800 King Ave, Maywood, CA 90270	390,731	3,761,544
18	Sunnyside Daycare	Daycare	3639 Randolph St, Huntington Park, CA 90255	389,149	3,760,987
19	Maywood Healthcare & Wellness	Nursing Home	6025 Pine Ave, Maywood, CA 90270	390,158	3,761,122

Abbreviations:

m = meter
UTM = Universal Transverse Mercator

Table 11
2021 Ground-level Concentrations (GLCs) at the PMI, MEIR, MEIW and MEISR
Sterigenics
Vernon, CA

Compound	CAS Number / Emittant ID	Average Annual Concentration (µg/m^3) at Cancer Risk MEI				Average Annual Concentration (µg/m^3) at Chronic HI MEI				One-Hour Maximum Concentration (µg/m^3) at Acute HI PMI/MEI			
		PMI[5]	MEISR[6]	MEIR[1]	MEIW[2]	PMI[5]	MEISR[6]	MEIR[1]	MEIW[2]	PMI[3]	MEISR[6]	MEIR[4]	MEIW[3]
Benzene	71-43-2	9.31E-05	3.26E-06	2.57E-05	1.59E-04	9.31E-05	3.26E-06	2.57E-05	1.59E-04	1.95E-03	2.90E-05	2.50E-04	1.95E-03
Formaldehyde	50-00-0	1.98E-04	6.93E-06	5.46E-05	3.38E-04	1.98E-04	6.93E-06	5.46E-05	3.38E-04	4.14E-03	6.25E-05	5.31E-04	4.14E-03
Total PAHs [excluding naphthalene]	1151	1.16E-06	4.07E-08	3.21E-07	1.99E-06	1.16E-06	4.07E-08	3.21E-07	1.99E-06	2.43E-05	3.67E-07	3.12E-06	2.43E-05
Naphthalene	91-20-3	3.49E-06	1.22E-07	9.64E-07	5.96E-06	3.49E-06	1.22E-07	9.64E-07	5.96E-06	7.30E-05	1.10E-06	9.36E-06	7.30E-05
Acetaldehyde	75-07-0	5.00E-05	1.75E-06	1.38E-05	8.54E-05	5.00E-05	1.75E-06	1.38E-05	8.54E-05	1.05E-03	1.57E-05	1.34E-04	1.05E-03
Acrolein	107-02-8	3.14E-05	1.10E-06	8.68E-06	5.36E-05	3.14E-05	1.10E-06	8.68E-06	5.36E-05	6.58E-04	9.92E-06	8.43E-05	6.58E-04
Ammonia	7664-41-7	3.72E-02	1.30E-03	1.03E-02	6.36E-02	3.72E-02	1.30E-03	1.03E-02	6.36E-02	7.80E-01	1.18E-02	9.99E-02	7.80E-01
Ethylbenzene	100-41-4	1.11E-04	3.87E-06	3.05E-05	1.89E-04	1.11E-04	3.87E-06	3.05E-05	1.89E-04	2.31E-03	3.49E-05	2.97E-04	2.31E-03
Hexane	110-54-3	7.33E-05	2.57E-06	2.02E-05	1.25E-04	7.33E-05	2.57E-06	2.02E-05	1.25E-04	1.53E-03	2.32E-05	1.97E-04	1.53E-03
Toluene	108-88-3	4.26E-04	1.49E-05	1.18E-04	7.27E-04	4.26E-04	1.49E-05	1.18E-04	7.27E-04	8.91E-03	1.35E-04	1.14E-03	8.91E-03
Xylene	1330-20-7	3.17E-04	1.11E-05	8.74E-05	5.40E-04	3.17E-04	1.11E-05	8.74E-05	5.40E-04	6.63E-03	1.00E-04	8.49E-04	6.63E-03
Ethylene oxide	75-21-8	2.27E+01	2.31E-02	1.94E-01	4.42E+00	2.27E+01	2.31E-02	1.94E-01	4.42E+00	1.03E+01	9.57E-02	7.52E-01	1.03E+01

Notes:

[1]Maximally Exposed Individual Resident for cancer and chronic is #801 at UTM 11N 390045.7 m E 3762227.37 m N.

[2] Maximally Exposed Individual Worker for cancer and chronic is #27 at UTM 11N 390088.22 m E 3762439.24 m N.

[3] Point of Maximum Impact and Maximally Exposed Individual Worker for acute is #1351 at UTM 11N 390105.7 m E 3762427.37 m N.

[4] Maximally Exposed Individual Resident for acute is #801 at UTM 11N 390045.7 m E 3762227.37 m N.

[5] Point of maximum impact for cancer and chronic is #2 at UTM 11N 390064.37 m E 3762419.3 m N.

[6] Maximally Exposed Individual Sensitive Receptor for cancer, chronic and acute is Sensitive Receptor #1 at UTM 11N 390,614 m E 3,762,081 m N.

Abbreviations:

µg = microgram
CAS = Chemical Abstract Service
GLC = Ground-Level Concentration
m = meter
m^3 = cubic meter
MEI = Maximally Exposed Individual
MEIR = Maximally Exposed Individual Resident
MEIW = Maximally Exposed Individual Worker
MEISR = Maximally Exposed Individual Sensitive Receptor
PAHs = Polycyclic aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 12
Multipathway Substances and Pathways
Sterigenics
Vernon, CA

Compound	CAS Number / Emittant ID	Pathways				
		Inhalation	Soil Ingestion	Dermal	Homegrown Produce	Mother's Milk Ingestion
Acetaldehyde	75-07-0	X				
Acrolein	107-02-8	X				
Ammonia	7664-41-7	X				
Benzene	71-43-2	X				
Ethylbenzene	100-41-4	X				
Ethylene oxide	75-21-8	X				
Formaldehyde	50-00-0	X				
Hexane	110-54-3	X				
Naphthalene	91-20-3	X				
Toluene	108-88-3	X				
Total PAHs [excluding naphthalene]	1151	X	X	X	X	X
Xylene	1330-20-7	X				

Abbreviations:

CAS = Chemical Abstract Services

PAHs = Polycyclic aromatic hydrocarbons

Table 13
HARP 2 Risk Analysis Options
Sterigenics
Vernon, CA

HARP2 Risk Analysis		Residential Cancer Risk	Population-wide Cancer Risk	Worker Cancer Risk	Residential Chronic HI	Worker Chronic HI	8-Hour Chronic HI	Acute HI
Risk Scenario	Analysis Type	Cancer Risk			Chronic HI		8-Hour Chronic HI	Acute HI
	Receptor Type	Resident	Population-wide	Worker	Resident	Worker	Worker	N/A
	Exposure Duration	30 Year	70 Year	25 year	N/A	N/A	N/A	N/A
	Intake Rate Percentile	RMP using the Derived Method	RMP using the Derived Method	OEHHA Derived Method	OEHHA Derived Method	OEHHA Derived Method	OEHHA Derived Method	N/A
Pathways to Evaluate	Tab "Pathways to Evaluate"	Inhalation, Soil ingestion, Dermal, Mother's milk, and Homegrown produce Deposition rate of 0.02 m/s		Worker Pathways Deposition rate of 0.02 m/s	Inhalation, Soil ingestion, Dermal, Mother's milk, and Homegrown produce Deposition rate of 0.02 m/s	Worker Pathways Deposition rate of 0.02 m/s	HARP Default	HARP Default
	Tab "Inh"	Apply fraction of time at residence to age bins greater than or equal to 16 years	HARP Defaults	Sources operating 24/7, no worker adjustment factor (WAF) needed	HARP Default	HARP Default	HARP Default	HARP Default
	Tab "Soil"	HARP Default	HARP Default	HARP Default	HARP Default	N/A	N/A	N/A
	Tab "Derm"	Using Warm Climate					N/A	N/A
	Tab "MMlk"	HARP Default	HARP Default	N/A	HARP Default	N/A	N/A	N/A
	Tab "HG Produce"	HARP Default	HARP Default	N/A	HARP Default	N/A	N/A	N/A

References:

South Coast Air Quality Management District (South Coast AQMD). 2020. AB2588 and Rule 1402 Supplemental Guidelines. October. Available online at: http://www.aqmd.gov/docs/default-source/planning/risk-assessment/ab-2588-supplemental-guidelines.pdf

Table 14
Target Organ Systems for Non-cancer Health Effects
Sterigenics
Vernon, CA

Compound	CAS Number / Emittant ID	Chronic Hazard Target Organs		Acute Hazard Target Organs
		Inhalation	Oral	
Acetaldehyde	75-07-0	Respiratory System	-	Eyes; Respiratory System
Acrolein	107-02-8	Respiratory System	-	Eyes; Respiratory System
Ammonia	7664-41-7	Respiratory System	-	Eyes; Respiratory System
Benzene	71-43-2	Hematologic System	-	Reproductive / Development; Immune System; Hematologic System
Ethylbenzene	100-41-4	Alimentary System; Endocrine System; Kidney; Development	-	-
Ethylene oxide	75-21-8	Nervous System	-	-
Formaldehyde	50-00-0	Respiratory System	-	Eyes
Hexane	110-54-3	Nervous System	-	-
Naphthalene	91-20-3	Respiratory System	-	-
Toluene	108-88-3	Nervous System; Development; Respiratory System	-	Nervous System; Respiratory System; Eyes; Reproductive / Developmental
Total PAHs [excluding naphthalene]	1151	-	-	-
Xylene	1330-20-7	Nervous System; Respiratory System; Eyes	-	Eyes; Respiratory System; Nervous System

Notes:

CAS = Chemical Abstract Service

HARP = Hotspots Analysis Reporting Program

OEHHA = Office of Environmental Health Hazard Assessment

PAHs = Polycyclic aromatic hydrocarbons

References:

Office of Environmental Health Hazard Assessment (OEHHA). 2015. Guidance Manual for Preparation of Health Risk Assessments: Appendix L. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015gmappendiceslm.pdf

Table 15
2021 Health Effects Results for PMI, MEIR, MEISR, and MEIW
Sterigenics
Vernon, CA

Health Effect	Receptor Type	Receptor ID	UTM East (m)	UTM North (m)	Cancer Risk (in a million) or HI	SCAQMD Thresholds[4]	
						Public Notice	Action Level
Cancer[1]	PMI-R[3]	2	390,064.37	3,762,419.30	4760.2	10	25
	MEIR	801	390,045.70	3,762,227.37	40.8		
	PMI-W[3]	2	390,064.37	3,762,419.30	395.8		
	MEIW	27	390,088.22	3,762,439.24	77.1		
	MEISR	1	390,614.46	3,762,080.69	4.9		
Chronic HI[2]	PMI[3]	2	390,064.37	3,762,419.30	0.76	1	3
	MEIR	801	390,045.70	3,762,227.37	0.01		
	MEIW	27	390,088.22	3,762,439.24	0.15		
	MEISR	1	390,614.46	3,762,080.69	0.001		
8-Hr Chronic HI[2]	PMI[3]	36	390,104.07	3,762,417.09	0.00016		
	MEIR	799	390,005.70	3,762,227.37	0.00002		
	MEIW	36	390,104.07	3,762,417.09	0.00016		
	MEISR	7	389,834.55	3,761,771.88	0.000003		
Acute HI[2]	PMI[3]	1351	390,105.70	3,762,427.37	0.00059		
	MEIR	801	390,045.70	3,762,227.37	0.00008		
	MEIW	1351	390,105.70	3,762,427.37	0.00059		
	MEISR	1	390,614.46	3,762,080.69	0.000009		

Notes:

[1] Excess cancer risks for MEIR assume a 30-year exposure period; excess cancer risk for MEIW assumes a 25-year exposure period.

[2] The chronic HI and acute HI reflect the maximum risk to a given target organ.

[3] The location of the PMI includes the facility boundary.

[4] SCAQMD thresholds are defined per Rule 1402.

Abbreviations:

ARB = (California) Air Resources Board
SCAQMD = South Coast Air Quality Management District
HARP = Hotspots Analysis Reporting Program
HI = Hazard Index
m = meters
MEIR = Maximally Exposed Individual Resident
MEIW = Maximally Exposed Individual Worker
MEISR= Maximally Exposure Individual Sensitive Receptor
OEHHA = Office of Environmental Health Hazard Assessment
PMI = Point of Maximum Impact
PMI-R = Point of Maximum Impact Residential Scenario
PMI-W = Point of Maximum Impact Worker Scenario
UTM = Universal Transverse Mercator

Table 16
Inhalation Concentration and Dose by Substance and Exposure Pathway at the 2021 Modeled Cancer Risk PMI
Sterigenics
Vernon, CA

Cancer Risk PMI: Receptor #2						
UTM East (m): 390064.37, UTM North (m): 3762419.3						
Chemical Name	**CAS Number / Emittant ID**	**Inhalation Concentration ($\mu g/m^3$)**	**Estimated Dose by Pathway (mg/kg/d)**			
			Soil Ingestion	**Dermal**	**Homegrown Produce**	**Mother's Milk**
Benzene	71-43-2	9.3E-05	-	-	-	-
Formaldehyde	50-00-0	2.0E-04	-	-	-	-
Total PAHs [excluding naphthalene]	1151	1.2E-06	1.5E-10	7.8E-11	2.3E-09	1.4E-08
Naphthalene	91-20-3	3.5E-06	-	-	-	-
Acetaldehyde	75-07-0	5.0E-05	-	-	-	-
Acrolein	107-02-8	3.1E-05	-	-	-	-
Ammonia	7664-41-7	3.7E-02	-	-	-	-
Ethylbenzene	100-41-4	1.1E-04	-	-	-	-
Hexane	110-54-3	7.3E-05	-	-	-	-
Toluene	108-88-3	4.3E-04	-	-	-	-
Xylene	1330-20-7	3.2E-04	-	-	-	-
Ethylene oxide	75-21-8	2.3E+01	-	-	-	-

Abbreviations:

μg = microgram
CAS = Chemical Abstract Service
d = day
kg = kilogram
m = meter
m^3 = cubic meter
mg = milligram
PAHs = Polycyclic aromatic hydrocarbons
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 17
Inhalation Concentration and Dose by Substance and Exposure Pathway at the 2021 Modeled Cancer Risk MEIR
Sterigenics
Vernon, CA

Cancer Risk MEIR: Receptor #801						
UTM East (m): 390045.70, UTM North (m): 3762227.37						
Chemical Name	**CAS Number / Emittant ID**	**Inhalation Concentration ($\mu g/m^3$)**	**Estimated Dose by Pathway (mg/kg/d)**			
			Soil Ingestion	**Dermal**	**Homegrown Produce**	**Mother's Milk**
Benzene	71-43-2	2.6E-05	-	-	-	-
Formaldehyde	50-00-0	5.5E-05	-	-	-	-
Total PAHs [excluding naphthalene]	1151	3.2E-07	4.1E-11	2.2E-11	6.3E-10	3.8E-09
Naphthalene	91-20-3	9.6E-07	-	-	-	-
Acetaldehyde	75-07-0	1.4E-05	-	-	-	-
Acrolein	107-02-8	8.7E-06	-	-	-	-
Ammonia	7664-41-7	1.0E-02	-	-	-	-
Ethylbenzene	100-41-4	3.1E-05	-	-	-	-
Hexane	110-54-3	2.0E-05	-	-	-	-
Toluene	108-88-3	1.2E-04	-	-	-	-
Xylene	1330-20-7	8.7E-05	-	-	-	-
Ethylene oxide	75-21-8	1.9E-01	-	-	-	-

Abbreviations:

µg = microgram
CAS = Chemical Abstract Service
d = day
kg = kilogram
m = meter
m^3 = cubic meter
MEIR = Maximally Exposed Individual Resident
mg = milligram
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 18
Inhalation Concentration and Dose by Substance and Exposure Pathway at the 2021 Modeled Cancer Risk MEIW
Sterigenics
Vernon, CA

Cancer Risk MEIW: Receptor #27				
UTM East (m): 390088.22, UTM North (m): 3762439.24				
Chemical Name	**CAS Number / Emittant ID**	**Inhalation Concentration ($\mu g/m^3$)**	**Estimated Dose by Pathway (mg/kg/d)**	
			Soil Ingestion	**Dermal**
Benzene	71-43-2	1.6E-04	-	-
Formaldehyde	50-00-0	3.4E-04	-	-
Total PAHs [excluding naphthalene]	1151	2.0E-06	2.5E-10	1.3E-10
Naphthalene	91-20-3	6.0E-06	-	-
Acetaldehyde	75-07-0	8.5E-05	-	-
Acrolein	107-02-8	5.4E-05	-	-
Ammonia	7664-41-7	6.4E-02	-	-
Ethylbenzene	100-41-4	1.9E-04	-	-
Hexane	110-54-3	1.3E-04	-	-
Toluene	108-88-3	7.3E-04	-	-
Xylene	1330207	5.4E-04	-	-
Ethylene oxide	75-21-8	4.4E+00	-	-

Abbreviations:

µg = microgram
CAS = Chemical Abstract Service
d = day
kg = kilogram
m = meter
m^3 = cubic meter
MEIW = Maximally Exposed Individual Worker
mg = milligram
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 19
Inhalation Concentration and Dose by Substance and Exposure Pathway at the 2021 Modeled Cancer Risk MEISR
Sterigenics
Vernon, CA

Cancer Risk MEISR: Sensitive Receptor #1						
UTM East (m): 390614.46, UTM North (m): 3762419.30						
Chemical Name	**CAS Number / Emittant ID**	**Inhalation Concentration ($\mu g/m^3$)**	**Estimated Dose by Pathway (mg/kg/d)**			
			Soil Ingestion	**Dermal**	**Homegrown Produce**	**Mother's Milk**
Benzene	71-43-2	3.3E-06	-	-	-	-
Formaldehyde	50-00-0	6.9E-06	-	-	-	-
Total PAHs [excluding naphthalene]	1151	4.1E-08	5.2E-12	2.7E-12	8.0E-11	4.8E-10
Naphthalene	91-20-3	1.2E-07	-	-	-	-
Acetaldehyde	75-07-0	1.8E-06	-	-	-	-
Acrolein	107-02-8	1.1E-06	-	-	-	-
Ammonia	7664-41-7	1.3E-03	-	-	-	-
Ethylbenzene	100-41-4	3.9E-06	-	-	-	-
Hexane	110-54-3	2.6E-06	-	-	-	-
Toluene	108-88-3	1.5E-05	-	-	-	-
Xylene	1330-20-7	1.1E-05	-	-	-	-
Ethylene oxide	75-21-8	2.3E-02	-	-	-	-

Abbreviations:

μg = microgram
CAS = Chemical Abstract Service
d = day
kg = kilogram
m = meter
m^3 = cubic meter
MEISR = Maximally Exposed Individual Sensitive Receptor
mg = milligram
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 20
Excess Cancer Risk Contribution by Substance at the 2021 Modeled Cancer Risk PMI
Sterigenics
Vernon, CA

Residential Cancer Risk PMI: Receptor #2									
UTM East (m): 390064.37, UTM North (m): 3762419.3									
Chemical Name	**CAS Number / Emittant ID**	**Excess Cancer Risk by Exposure Pathway**					**Total Cancer Risk**	**Total Excess Cancer Risk (number in one million)**	**Cancer Risk Contribution (%)**
		Inhalation	**Soil Ingestion**	**Dermal**	**Homegrown Produce**	**Mother's Milk**			
Benzene	71-43-2	6.3E-09	-	-	-	-	6.3E-09	6.3E-03	0.000%
Formaldehyde	50-00-0	2.8E-09	-	-	-	-	2.8E-09	2.8E-03	0.000%
Total PAHs [excluding naphthalene]	1151	2.2E-09	8.07E-09	2.01E-09	5.46E-08	1.92E-08	8.6E-08	8.6E-02	0.002%
Naphthalene	91-20-3	2.8E-10	-	-	-	-	2.8E-10	2.8E-04	0.000%
Acetaldehyde	75-07-0	3.4E-10	-	-	-	-	3.4E-10	3.4E-04	0.000%
Acrolein	107-02-8	-	-	-	-	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	-	-	-	-
Ethylbenzene	100-41-4	6.5E-10	-	-	-	-	6.5E-10	6.5E-04	0.000%
Hexane	110-54-3	-	-	-	-	-	-	-	-
Toluene	108-88-3	-	-	-	-	-	-	-	-
Xylene	1330-20-7	-	-	-	-	-	-	-	-
Ethylene oxide	75-21-8	4.8E-03	-	-	-	-	4.8E-03	4760	99.998%
	Total	**4.8E-03**	**8.1E-09**	**2.0E-09**	**5.5E-08**	**1.9E-08**	**4.8E-03**	**4760.2**	**100%**

Worker Cancer Risk PMI: Receptor #2									
UTM East (m): 390064.37, UTM North (m): 3762419.3									
Chemical Name	**CAS Number / Emittant ID**	**Excess Cancer Risk by Exposure Pathway**					**Total Cancer Risk**	**Total Excess Cancer Risk (number in one million)**	**Cancer Risk Contribution (%)**
		Inhalation	**Soil Ingestion**	**Dermal**	**Homegrown Produce**	**Mother's Milk**			
Benzene	71-43-2	5.2E-10	-	-	-	-	5.2E-10	5.2E-04	0.000%
Formaldehyde	50-00-0	2.3E-10	-	-	-	-	2.3E-10	2.3E-04	0.000%
Total PAHs [excluding naphthalene]	1151	1.9E-10	8.04E-10	6.97E-10	-	-	1.7E-09	1.7E-03	0.000%
Naphthalene	91-20-3	2.4E-11	-	-	-	-	2.4E-11	2.4E-05	0.000%
Acetaldehyde	75-07-0	2.8E-11	-	-	-	-	2.8E-11	2.8E-05	0.000%
Acrolein	107-02-8	-	-	-	-	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	-	-	-	-
Ethylbenzene	100-41-4	5.4E-11	-	-	-	-	5.4E-11	5.4E-05	0.000%
Hexane	110-54-3	-	-	-	-	-	-	-	-
Toluene	108-88-3	-	-	-	-	-	-	-	-
Xylene	1330-20-7	-	-	-	-	-	-	-	-
Ethylene oxide	75-21-8	4.0E-04	-	-	-	-	4.0E-04	400	99.999%
	Total	**4.0E-04**	**8.0E-10**	**7.0E-10**	**-**	**-**	**4.0E-04**	**400.0**	**100%**

Abbreviations:
CAS = Chemical Abstract Service
m = meter
MEIR = Maximally Exposed Individual Resident
PAHs = Polycyclic aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 21
Cancer Risk Contribution by Source at the 2021 Modeled Cancer Risk PMI
Sterigenics
Vernon, CA

Residential Cancer Risk PMI: Receptor #2									
UTM East (m): 390064.37, UTM North (m): 3762419.3									
DEV_ID	Source	Cancer Risk by Exposure Pathway					Total Cancer Risk	Total Cancer Risk (number in one million)	Cancer Risk Contribution (%)
		Inhalation	Soil Ingestion	Dermal	Homegrown Produce	Mother's Milk			
49A	49th St. Abator	2.8E-08	4.3E-11	1.1E-11	2.9E-10	1.0E-10	2.8E-08	2.8E-02	0.001%
49B1	49th St. Boiler #1	2.8E-09	1.8E-09	4.6E-10	1.2E-08	4.4E-09	2.2E-08	2.2E-02	0.00%
49B2	49th St. Boiler #2	2.8E-09	1.8E-09	4.5E-10	1.2E-08	4.3E-09	2.2E-08	2.2E-02	0.00%
49FUG	49th St. Fugitive Emissions	1.4E-03	-	-	-	-	1.4E-03	1.4E+03	30.36%
49S	49th St. Scrubber	2.7E-06	-	-	-	-	2.7E-06	2.7E+00	0.06%
50A	50th St. Abator	1.3E-07	3.5E-10	8.8E-11	2.4E-09	8.4E-10	1.4E-07	1.4E-01	0.003%
50B1	50th St. Boiler #1	3.2E-09	2.1E-09	5.2E-10	1.4E-08	4.9E-09	2.5E-08	2.5E-02	0.00%
50B2	50th St. Boiler #2	3.0E-09	1.9E-09	4.8E-10	1.3E-08	4.6E-09	2.3E-08	2.3E-02	0.00%
50FUG	50th St. Fugitive Emissions	3.3E-03	-	-	-	-	3.3E-03	3.3E+03	69.48%
50S	50th St. Scrubber	4.5E-06	-	-	-	-	4.5E-06	4.5E+00	0.09%
	Total	**4.8E-03**	**8.1E-09**	**2.0E-09**	**5.5E-08**	**1.9E-08**	**4.8E-03**	**4760.30**	**100%**

Worker Cancer Risk PMI: Receptor #2									
UTM East (m): 390064.37, UTM North (m): 3762419.3									
DEV_ID	Source	Cancer Risk by Exposure Pathway					Total Cancer Risk	Total Cancer Risk (number in one million)	Cancer Risk Contribution (%)
		Inhalation	Soil Ingestion	Dermal	Homegrown Produce	Mother's Milk			
49A	49th St. Abator	2.3E-09	4.3E-12	3.7E-12	-	-	2.3E-09	2.3E-03	0.001%
49B1	49th St. Boiler #1	2.4E-10	1.8E-10	1.6E-10	-	-	5.8E-10	5.8E-04	0.00%
49B2	49th St. Boiler #2	2.4E-10	1.8E-10	1.6E-10	-	-	5.8E-10	5.8E-04	0.00%
49FUG	49th St. Fugitive Emissions	1.3E-04	-	-	-	-	1.3E-04	1.3E+02	33.50%
49S	49th St. Scrubber	2.3E-07	-	-	-	-	2.3E-07	2.3E-01	0.06%
50A	50th St. Abator	1.1E-08	3.5E-11	3.1E-11	-	-	1.1E-08	1.1E-02	0.003%
50B1	50th St. Boiler #1	2.7E-10	2.1E-10	1.8E-10	-	-	6.6E-10	6.6E-04	0.00%
50B2	50th St. Boiler #2	2.5E-10	1.9E-10	1.7E-10	-	-	6.1E-10	6.1E-04	0.00%
50FUG	50th St. Fugitive Emissions	2.6E-04	-	-	-	-	2.6E-04	2.6E+02	66.35%
50S	50th St. Scrubber	3.7E-07	-	-	-	-	3.7E-07	3.7E-01	0.09%
	Total	**4.0E-04**	**8.0E-10**	**7.0E-10**	**0.0E+00**	**0.0E+00**	**4.0E-04**	**395.81**	**100%**

Abbreviations:
m = meter
MEIR = Maximally Exposed Individual Resident
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 22
Excess Cancer Risk Contribution by Substance at the 2021 Modeled Cancer Risk MEIR
Sterigenics
Vernon, CA

Cancer Risk MEIR: Receptor #801									
UTM East (m): 390045.70, UTM North (m): 3762227.37									
Chemical Name	**CAS Number / Emittant ID**	**Excess Cancer Risk by Exposure Pathway**					**Total Cancer Risk**	**Total Excess Cancer Risk (number in one million)**	**Cancer Risk Contribution (%)**
		Inhalation	**Soil Ingestion**	**Dermal**	**Homegrown Produce**	**Mother's Milk**			
Benzene	71-43-2	1.7E-09	-	-	-	-	1.7E-09	1.7E-03	0.004%
Formaldehyde	50-00-0	7.76E-10	-	-	-	-	7.8E-10	7.76E-04	0.002%
Total PAHs [excluding naphthalene]	1151	5.98E-10	2.23E-09	5.55E-10	1.51E-08	5.30E-09	2.4E-08	2.38E-02	0.058%
Naphthalene	91-20-3	7.83E-11	-	-	-	-	7.8E-11	7.83E-05	0.000%
Acetaldehyde	75-07-0	9.35E-11	-	-	-	-	9.4E-11	9.35E-05	0.000%
Acrolein	107-02-8	-	-	-	-	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	-	-	-	-
Ethylbenzene	100-41-4	1.80E-10	-	-	-	-	1.8E-10	1.80E-04	0.000%
Hexane	110-54-3	-	-	-	-	-	-	-	-
Toluene	108-88-3	-	-	-	-	-	-	-	-
Xylene	1330-20-7	-	-	-	-	-	-	-	-
Ethylene oxide	75-21-8	4.1E-05	-	-	-	-	4.1E-05	41	99.935%
	Total	**4.1E-05**	**2.2E-09**	**5.6E-10**	**1.5E-08**	**5.3E-09**	**4.1E-05**	**40.8**	**100%**

Abbreviations:

CAS = Chemical Abstract Service

m = meter

MEIR = Maximally Exposed Individual Resident

PAHs = Polycyclic aromatic hydrocarbons

UTM = Universal Transverse Mercator

Table 23
Cancer Risk Contribution by Source at the 2021 Modeled Cancer Risk MEIR
Sterigenics
Vernon, CA

Cancer Risk MEIR: Receptor #801									
UTM East (m): 390045.70, UTM North (m): 3762227.37									
DEV_ID	Source	Cancer Risk by Exposure Pathway					Total Cancer Risk	Total Cancer Risk (number in one million)	Cancer Risk Contribution (%)
		Inhalation	Soil Ingestion	Dermal	Homegrown Produce	Mother's Milk			
49A	49th St. Abator	4.6E-08	7.2E-11	1.8E-11	4.8E-10	1.7E-10	4.7E-08	4.7E-02	0.1%
49B1	49th St. Boiler #1	4.5E-10	2.9E-10	7.3E-11	2.0E-09	6.9E-10	3.5E-09	3.5E-03	0.0%
49B2	49th St. Boiler #2	4.6E-10	2.9E-10	7.3E-11	2.0E-09	7.0E-10	3.5E-09	3.5E-03	0.0%
49FUG	49th St. Fugitive Emissions	1.7E-05	-	-	-	-	1.7E-05	1.7E+01	41.5%
49S	49th St. Scrubber	7.6E-07	-	-	-	-	7.6E-07	7.6E-01	1.9%
50A	50th St. Abator	4.2E-08	1.1E-10	2.8E-11	7.5E-10	2.6E-10	4.3E-08	4.3E-02	0.1%
50B1	50th St. Boiler #1	1.1E-09	7.2E-10	1.8E-10	4.9E-09	1.7E-09	8.6E-09	8.6E-03	0.0%
50B2	50th St. Boiler #2	1.2E-09	7.4E-10	1.8E-10	5.0E-09	1.8E-09	8.9E-09	8.9E-03	0.0%
50FUG	50th St. Fugitive Emissions	2.1E-05	-	-	-	-	2.1E-05	2.1E+01	51.9%
50S	50th St. Scrubber	1.8E-06	-	-	-	-	1.8E-06	1.8E+00	4.4%
	Total	**4.1E-05**	**2.2E-09**	**5.6E-10**	**1.5E-08**	**5.3E-09**	**4.1E-05**	**40.8**	**100%**

Abbreviations:

m = meter
MEIR = Maximally Exposed Individual Resident
UTM = Universal Transverse Mercator

Table 24
Excess Cancer Risk Contribution by Substance at the 2021 Modeled Cancer Risk MEIW
Sterigenics
Vernon, CA

Cancer Risk MEIW: Receptor #27							
UTM East (m): 390088.22, UTM North (m): 3762439.24							
Chemical Name	**CAS Number / Emittant ID**	**Excess Cancer Risk by Exposure Pathway**			**Total Cancer Risk**	**Total Excess Cancer Risk (number in one million)**	**Cancer Risk Contribution (%)**
		Inhalation	**Soil Ingestion**	**Dermal**			
Benzene	71-43-2	8.9E-10	-	-	8.9E-10	8.9E-04	0.001%
Formaldehyde	50-00-0	4.0E-10	-	-	4.0E-10	3.99E-04	0.001%
Total PAHs [excluding naphthalene]	1151	3.2E-10	1.4E-09	1.2E-09	2.9E-09	2.88E-03	0.004%
Naphthalene	91-20-3	4.0E-11	-	-	4.0E-11	4.02E-05	0.000%
Acetaldehyde	75-07-0	4.8E-11	-	-	4.8E-11	4.81E-05	0.000%
Acrolein	107-02-8	-	-	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	-	-
Ethylbenzene	100-41-4	9.2E-11	-	-	9.2E-11	9.24E-05	0.000%
Hexane	110-54-3	-	-	-	-	-	-
Toluene	108-88-3	-	-	-	-	-	-
Xylene	1330-20-7	-	-	-	-	-	-
Ethylene oxide	75-21-8	7.7E-05	-	-	7.7E-05	77	99.994%
	Total	**7.7E-05**	**1.4E-09**	**1.2E-09**	**7.7E-05**	**77.0**	**100%**

Abbreviations:

CAS = Chemical Abstract Service

m = meter

MEIW = Maximally Exposed Individual Worker

PAHs = Polycyclic aromatic hydrocarbons

UTM = Universal Transverse Mercator

Table 25
Cancer Risk Contribution by Source at the 2021 Modeled Cancer Risk MEIW
Sterigenics
Vernon, CA

Cancer Risk MEIW: Receptor #27							
UTM East (m): 390088.22, UTM North (m): 3762439.24							
DEV_ID	Source	Cancer Risk by Exposure Pathway			Total Cancer Risk	Total Cancer Risk (number in one million)	Cancer Risk Contribution (%)
		Inhalation	Soil Ingestion	Dermal			
49A	49th St. Abator	6.6E-09	1.2E-11	1.1E-11	6.6E-09	6.6E-03	0.01%
49B1	49th St. Boiler #1	4.4E-10	3.4E-10	2.9E-10	1.1E-09	1.1E-03	0.00%
49B2	49th St. Boiler #2	4.4E-10	3.4E-10	2.9E-10	1.1E-09	1.1E-03	0.00%
49FUG	49th St. Fugitive Emissions	4.0E-05	-	-	4.0E-05	4.0E+01	51.36%
49S	49th St. Scrubber	6.7E-07	-	-	6.7E-07	6.7E-01	0.87%
50A	50th St. Abator	7.3E-09	2.3E-11	2.0E-11	7.4E-09	7.4E-03	0.01%
50B1	50th St. Boiler #1	4.6E-10	3.5E-10	3.0E-10	1.1E-09	1.1E-03	0.00%
50B2	50th St. Boiler #2	4.1E-10	3.1E-10	2.7E-10	9.9E-10	9.9E-04	0.00%
50FUG	50th St. Fugitive Emissions	3.7E-05	-	-	3.7E-05	3.7E+01	47.39%
50S	50th St. Scrubber	2.8E-07	-	-	2.8E-07	2.8E-01	0.36%
	Total	**7.7E-05**	**1.4E-09**	**1.2E-09**	**7.7E-05**	**77.05**	**100%**

Abbreviations:

m = meter
MEIW = Maximally Exposed Individual Worker
UTM = Universal Transverse Mercator

Table 26
Excess Cancer Risk Contribution by Substance at the 2021 Modeled Cancer Risk MEISR
Sterigenics
Vernon, CA

Cancer Risk MEISR: Sensitive Receptor #1									
UTM East (m): 390614.46, UTM North (m): 3762080.69									
Chemical Name	**CAS Number / Emittant ID**	**Excess Cancer Risk by Exposure Pathway**					**Total Cancer Risk**	**Total Excess Cancer Risk (number in one million)**	**Cancer Risk Contribution (%)**
		Inhalation	**Soil Ingestion**	**Dermal**	**Homegrown Produce**	**Mother's Milk**			
Benzene	71-43-2	2.2E-10	-	-	-	-	2.2E-10	2.2E-04	0.005%
Formaldehyde	50-00-0	9.8E-11	-	-	-	-	9.8E-11	9.84E-05	0.002%
Total PAHs [excluding naphthalene]	1151	7.6E-11	2.8E-10	7.0E-11	1.9E-09	6.7E-10	3.0E-09	3.01E-03	0.062%
Naphthalene	91-20-3	9.9E-12	-	-	-	-	9.9E-12	9.92E-06	0.000%
Acetaldehyde	75-07-0	1.2E-11	-	-	-	-	1.2E-11	1.19E-05	0.000%
Acrolein	107-02-8	-	-	-	-	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	-	-	-	-
Ethylbenzene	100-41-4	2.3E-11	-	-	-	-	2.3E-11	2.28E-05	0.000%
Hexane	110-54-3	-	-	-	-	-	-	-	-
Toluene	108-88-3	-	-	-	-	-	-	-	-
Xylene	1330-20-7	-	-	-	-	-	-	-	-
Ethylene oxide	75-21-8	4.9E-06	-	-	-	-	4.9E-06	5	99.930%
	Total	**4.9E-06**	**2.8E-10**	**7.0E-11**	**1.9E-09**	**6.7E-10**	**4.9E-06**	**4.9**	**100%**

Abbreviations:

CAS = Chemical Abstract Service

m = meter

MEISR = Maximally Exposed Individual Sensitive Receptor

PAHs = Polycyclic aromatic hydrocarbons

UTM = Universal Transverse Mercator

Table 27
Cancer Risk Contribution by Source at the 2021 Modeled Cancer Risk MEISR
Sterigenics
Vernon, CA

Cancer Risk MEISR: Sensitive Receptor #1									
UTM East (m): 390614.46, UTM North (m): 3762080.69									
DEV_ID	Source	Cancer Risk by Exposure Pathway					Total Cancer Risk	Total Cancer Risk (number in one million)	Cancer Risk Contribution (%)
		Inhalation	Soil Ingestion	Dermal	Homegrown Produce	Mother's Milk			
49A	49th St. Abator	2.6E-08	4.0E-11	1.0E-11	2.7E-10	9.6E-11	2.6E-08	2.6E-02	0.5%
49B1	49th St. Boiler #1	6.3E-11	4.1E-11	1.0E-11	2.7E-10	9.6E-11	4.8E-10	4.8E-04	0.0%
49B2	49th St. Boiler #2	6.3E-11	4.1E-11	1.0E-11	2.8E-10	9.7E-11	4.9E-10	4.9E-04	0.0%
49FUG	49th St. Fugitive Emissions	2.3E-06	-	-	-	-	2.3E-06	2.3E+00	47.2%
49S	49th St. Scrubber	1.2E-07	-	-	-	-	1.2E-07	1.2E-01	2.4%
50A	50th St. Abator	1.7E-08	4.5E-11	1.1E-11	3.1E-10	1.1E-10	1.8E-08	1.8E-02	0.4%
50B1	50th St. Boiler #1	9.2E-11	5.9E-11	1.5E-11	4.0E-10	1.4E-10	7.1E-10	7.1E-04	0.0%
50B2	50th St. Boiler #2	8.8E-11	5.7E-11	1.4E-11	3.8E-10	1.3E-10	6.8E-10	6.8E-04	0.0%
50FUG	50th St. Fugitive Emissions	2.3E-06	-	-	-	-	2.3E-06	2.3E+00	46.8%
50S	50th St. Scrubber	1.3E-07	-	-	-	-	1.3E-07	1.3E-01	2.7%
	Total	**4.9E-06**	**2.8E-10**	**7.0E-11**	**1.9E-09**	**6.7E-10**	**4.9E-06**	**4.9**	**100%**

Abbreviations:

m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
UTM = Universal Transverse Mercator

Table 28
Population Exposure within 2021 Modeled Zone of Impact[1,2]
Sterigenics
Vernon, CA

Cancer Risk (number in one million)	Population
≥1 to <10	26,508
≥10 to <25	1,620
≥25 to <100	22
≥100 to <1000	0
≥1000	0
Total	**28,150**

Notes:

[1] Maximum Chronic and Acute HIs do not exceed 0.5, therefore corresponding population exposures are not applicable.

[2] The Zone of Impact is defined as the area subject to an added lifetime cancer risk (all pathways) of one in one million or greater ($\geq 1.0 \times 10^{-6}$) or a hazard index of greater than or equal to one half (≥ 0.5).

Abbreviations:

HI = Hazard Index
OEHHA = Office of Environmental Health Hazard Assessment

References:

Office of Environmental Health Hazard Assessment (OEHHA). 2015. Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. February. Available online at: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf.

Table 29
Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled Chronic HI PMI
Sterigenics
Vernon, CA

Chronic HI PMI: Receptor #2										
UTM East (m): 390064.37, UTM North (m): 3762419.3										
Chemical Name	CAS Number / Emittant ID	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
Benzene	71-43-2	-	-	-	-	-	-	-	1.8E-05	-
Formaldehyde	50-00-0	-	-	-	-	1.2E-05	-	-	-	-
Total PAHs [excluding naphthalene]	1151	-	-	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	2.2E-07	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	-	2.0E-07	-	-	-	-
Acrolein	107-02-8	-	-	-	-	5.1E-05	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	1.1E-04	-	-	-	-
Ethylbenzene	100-41-4	-	3.1E-08	3.1E-08	3.1E-08	-	-	3.1E-08	-	-
Hexane	110-54-3	5.9E-09	-	-	-	-	-	-	-	5.9E-09
Toluene	108-88-3	-	-	-	-	-	5.8E-07	-	-	-
Xylene	1330-20-7	2.6E-07	-	-	-	2.6E-07	2.6E-07	-	-	2.6E-07
Ethylene oxide	75-21-8	7.3E-01	-	-	-	-	-	-	-	7.3E-01
Total		**7.3E-01**	**3.1E-08**	**3.1E-08**	**3.1E-08**	**1.7E-04**	**8.3E-07**	**3.1E-08**	**1.8E-05**	**7.3E-01**

Notes:
[1]Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:
HI = Hazard Index
m = meter
PAHs = Polycyclic aromatic hydrocarbons
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 30
Chronic Health Quotients by Source at the 2021 Modeled Chronic HI PMI
Sterigenics
Vernon, CA

Chronic HI PMI: Receptor #2										
UTM East (m): 390064.37, UTM North (m): 3762419.3										
DEV_ID	Source	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
49A	49th St. Abator	4.4E-06	2.9E-10	2.9E-10	2.9E-10	1.6E-06	7.8E-09	2.9E-10	1.7E-07	4.4E-06
49B1	49th St. Boiler #1	1.1E-07	1.3E-08	1.3E-08	1.3E-08	6.8E-05	3.3E-07	1.3E-08	7.0E-06	1.1E-07
49B2	49th St. Boiler #2	1.0E-07	1.2E-08	1.2E-08	1.2E-08	6.7E-05	3.3E-07	1.2E-08	7.0E-06	1.0E-07
49FUG	49th St. Fugitive Emissions	2.5E-01	-	-	-	-	-	-	-	2.5E-01
49S	49th St. Scrubber	4.3E-04	-	-	-	-	-	-	-	4.3E-04
50A	50th St. Abator	2.1E-05	2.4E-09	2.4E-09	2.4E-09	1.3E-05	6.4E-08	2.4E-09	1.4E-06	2.1E-05
50B1	50th St. Boiler #1	1.2E-07	1.4E-08	1.4E-08	1.4E-08	7.7E-05	3.8E-07	1.4E-08	8.0E-06	1.2E-07
50B2	50th St. Boiler #2	1.1E-07	1.3E-08	1.3E-08	1.3E-08	7.2E-05	3.5E-07	1.3E-08	7.5E-06	1.1E-07
50FUG	50th St. Fugitive Emissions	5.0E-01	-	-	-	-	-	-	-	5.0E-01
50S	50th St. Scrubber	7.1E-04	-	-	-	-	-	-	-	7.1E-04
	Total	**7.6E-01**	**5.5E-08**	**5.5E-08**	**5.5E-08**	**3.0E-04**	**1.5E-06**	**5.5E-08**	**3.1E-05**	**7.6E-01**

Notes:

[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:

HI = Hazard Index
m = meter
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 31
Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled Chronic HI MEIR
Sterigenics
Vernon, CA

Chronic Risk MEIR: Receptor #801										
UTM East (m): 390045.70, UTM North (m): 3762227.37										
Chemical Name	CAS Number / Emittant ID	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
Benzene	71-43-2	-	-	-	-	-	-	-	8.6E-06	-
Formaldehyde	50-00-0	-	-	-	-	6.1E-06	-	-	-	-
Total PAHs [excluding naphthalene]	1151	-	-	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	1.1E-07	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	-	9.9E-08	-	-	-	-
Acrolein	107-02-8	-	-	-	-	2.5E-05	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	5.1E-05	-	-	-	-
Ethylbenzene	100-41-4	-	1.5E-08	1.5E-08	1.5E-08	-	-	1.5E-08	-	-
Hexane	110-54-3	2.9E-09	-	-	-	-	-	-	-	2.9E-09
Toluene	108-88-3	-	-	-	-	-	2.8E-07	-	-	-
Xylene	1330-20-7	1.2E-07	-	-	-	1.2E-07	1.2E-07	-	-	1.2E-07
Ethylene oxide	75-21-8	6.5E-03	-	-	-	-	-	-	-	6.5E-03
	Total	**6.5E-03**	**1.5E-08**	**1.5E-08**	**1.5E-08**	**8.3E-05**	**4.0E-07**	**1.5E-08**	**8.6E-06**	**6.5E-03**

Notes:
[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:
HI = Hazard Index
m = meter
MEIR = Maximally Exposed Individual Resident
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 32
Chronic Health Quotients by Source at the 2021 Modeled Chronic HI MEIR
Sterigenics
Vernon, CA

Chronic Risk MEIR: Receptor #801										
UTM East (m): 390045.70, UTM North (m): 3762227.37										
DEV_ID	Source	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
49A	49th St. Abator	7.3E-06	4.9E-10	4.9E-10	4.9E-10	2.7E-06	1.3E-08	4.9E-10	2.8E-07	7.3E-06
49B1	49th St. Boiler #1	1.7E-08	2.0E-09	2.0E-09	2.0E-09	1.1E-05	5.3E-08	2.0E-09	1.1E-06	1.7E-08
49B2	49th St. Boiler #2	1.7E-08	2.0E-09	2.0E-09	2.0E-09	1.1E-05	5.3E-08	2.0E-09	1.1E-06	1.7E-08
49FUG	49th St. Fugitive Emissions	2.9E-03	-	-	-	-	-	-	-	2.9E-03
49S	49th St. Scrubber	1.2E-04	-	-	-	-	-	-	-	1.2E-04
50A	50th St. Abator	6.7E-06	7.6E-10	7.6E-10	7.6E-10	4.1E-06	2.0E-08	7.6E-10	4.3E-07	6.7E-06
50B1	50th St. Boiler #1	4.1E-08	4.9E-09	4.9E-09	4.9E-09	2.7E-05	1.3E-07	4.9E-09	2.8E-06	4.1E-08
50B2	50th St. Boiler #2	4.3E-08	5.1E-09	5.1E-09	5.1E-09	2.8E-05	1.3E-07	5.1E-09	2.9E-06	4.3E-08
50FUG	50th St. Fugitive Emissions	3.1E-03	-	-	-	-	-	-	-	3.1E-03
50S	50th St. Scrubber	2.9E-04	-	-	-	-	-	-	-	2.9E-04
	Total	**6.5E-03**	**1.5E-08**	**1.5E-08**	**1.5E-08**	**8.3E-05**	**4.0E-07**	**1.5E-08**	**8.6E-06**	**6.5E-03**

Notes:

[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:

HI = Hazard Index
m = meter
MEIR = Maximally Exposed Individual Resident
UTM = Universal Transverse Mercator

Table 33
Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled Chronic HI MEIW
Sterigenics
Vernon, CA

Chronic HI MEIW: Receptor #27										
UTM East (m): 390088.22, UTM North (m): 3762439.24										
Chemical Name	CAS Number / Emittant ID	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
Benzene	71-43-2	-	-	-	-	-	-	-	5.3E-05	-
Formaldehyde	50-00-0	-	-	-	-	3.8E-05	-	-	-	-
Total PAHs [excluding naphthalene	1151	-	-	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	6.6E-07	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	-	6.1E-07	-	-	-	-
Acrolein	107-02-8	-	-	-	-	1.5E-04	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	3.2E-04	-	-	-	-
Ethylbenzene	100-41-4	-	9.4E-08	9.4E-08	9.4E-08	-	-	9.4E-08	-	-
Hexane	110-54-3	1.8E-08	-	-	-	-	-	-	-	1.8E-08
Toluene	108-88-3	-	-	-	-	-	1.7E-06	-	-	-
Xylene	1330-20-7	7.7E-07	-	-	-	7.7E-07	7.7E-07	-	-	7.7E-07
Ethylene oxide	75-21-8	1.5E-01	-	-	-	-	-	-	-	1.5E-01
Total		**1.5E-01**	**9.4E-08**	**9.4E-08**	**9.4E-08**	**5.1E-04**	**2.5E-06**	**9.4E-08**	**5.3E-05**	**1.5E-01**

Notes:

[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:

HI = Hazard Index
m = meter
MEIW = Maximally Exposed Individual Worker
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 34
Chronic Health Quotients by Source at the 2021 Modeled Chronic HI MEIW
Sterigenics
Vernon, CA

Chronic HI MEIW: Receptor #27										
UTM East (m): 390088.22, UTM North (m): 3762439.24										
DEV_ID	Source	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
49A	49th St. Abator	1.3E-05	8.4E-10	8.4E-10	8.4E-10	4.6E-06	2.2E-08	8.4E-10	4.7E-07	1.3E-05
49B1	49th St. Boiler #1	1.9E-07	2.3E-08	2.3E-08	2.3E-08	1.3E-04	6.1E-07	2.3E-08	1.3E-05	1.9E-07
49B2	49th St. Boiler #2	2.0E-07	2.3E-08	2.3E-08	2.3E-08	1.3E-04	6.2E-07	2.3E-08	1.3E-05	2.0E-07
49FUG	49th St. Fugitive Emissions	7.6E-02	-	-	-	-	-	-	-	7.6E-02
49S	49th St. Scrubber	1.3E-03	-	-	-	-	-	-	-	1.3E-03
50A	50th St. Abator	1.4E-05	1.6E-09	1.6E-09	1.6E-09	8.6E-06	4.2E-08	1.6E-09	9.0E-07	1.4E-05
50B1	50th St. Boiler #1	2.0E-07	2.4E-08	2.4E-08	2.4E-08	1.3E-04	6.4E-07	2.4E-08	1.3E-05	2.0E-07
50B2	50th St. Boiler #2	1.8E-07	2.1E-08	2.1E-08	2.1E-08	1.2E-04	5.7E-07	2.1E-08	1.2E-05	1.8E-07
50FUG	50th St. Fugitive Emissions	7.0E-02	-	-	-	-	-	-	-	7.0E-02
50S	50th St. Scrubber	5.4E-04	-	-	-	-	-	-	-	5.4E-04
	Total	**1.5E-01**	**9.4E-08**	**9.4E-08**	**9.4E-08**	**5.1E-04**	**2.5E-06**	**9.4E-08**	**5.3E-05**	**1.5E-01**

Notes:
[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:
HI = Hazard Index
m = meter
MEIW = Maximally Exposed Individual Worker
UTM = Universal Transverse Mercator

Table 35
Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled Chronic HI MEISR
Sterigenics
Vernon, CA

Chronic HI MEISR: Sensitive Receptor #1										
UTM East (m): 390614.46, UTM North (m): 3762080.69										
Chemical Name	**CAS Number / Emittant ID**	**Chronic Hazard Quotients for Target Organs**								**Maximum Chronic HI[1]**
		Central Nervous System (CNS)	**Kidney**	**Gastro-Intestinal (GILV)**	**Repro-ductive System/ Develop-mental**	**Respiratory System**	**Eye**	**Endocrine System**	**Blood**	
Benzene	71-43-2	-	-	-	-	-	-	-	1.1E-06	-
Formaldehyde	50-00-0	-	-	-	-	7.7E-07	-	-	-	-
Total PAHs [excluding naphthalene	1-15-1	-	-	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	1.4E-08	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	-	1.3E-08	-	-	-	-
Acrolein	107-02-8	-	-	-	-	3.1E-06	-	-	-	-
Ammonia	7664-41-7	-	-	-	-	6.5E-06	-	-	-	-
Ethylbenzene	100-41-4	-	1.9E-09	1.9E-09	1.9E-09	-	-	1.9E-09	-	-
Hexane	110-54-3	3.7E-10	-	-	-	-	-	-	-	3.7E-10
Toluene	108-88-3	-	-	-	-	-	3.6E-08	-	-	-
Xylene	1330-20-7	1.6E-08	-	-	-	1.6E-08	1.6E-08	-	-	1.6E-08
Ethylene oxide	75-21-8	7.7E-04	-	-	-	-	-	-	-	7.7E-04
	Total	**7.7E-04**	**1.9E-09**	**1.9E-09**	**1.9E-09**	**1.0E-05**	**5.1E-08**	**1.9E-09**	**1.1E-06**	**7.7E-04**

Notes:

[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:

HI = Hazard Index
m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 36
Chronic Health Quotients by Source at the 2021 Modeled Chronic HI MEISR
Sterigenics
Vernon, CA

Chronic HI MEISR: Sensitive Receptor #1										
UTM East (m): 390614.46, UTM North (m): 3762080.69										
DEV_ID	Source	Chronic Hazard Quotients for Target Organs								Maximum Chronic HI[1]
		Central Nervous System (CNS)	Kidney	Gastro-Intestinal (GILV)	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Endocrine System	Blood	
49A	49th St. Abator	4.1E-06	2.8E-10	2.8E-10	2.8E-10	1.5E-06	7.3E-09	2.8E-10	1.5E-07	4.1E-06
49B1	49th St. Boiler #1	2.3E-09	2.8E-10	2.8E-10	2.8E-10	1.5E-06	7.4E-09	2.8E-10	1.6E-07	2.3E-09
49B2	49th St. Boiler #2	2.3E-09	2.8E-10	2.8E-10	2.8E-10	1.5E-06	7.4E-09	2.8E-10	1.6E-07	2.3E-09
49FUG	49th St. Fugitive Emissions	3.6E-04	-	-	-	-	-	-	-	3.6E-04
49S	49th St. Scrubber	1.8E-05	-	-	-	-	-	-	-	1.8E-05
50A	50th St. Abator	2.7E-06	3.1E-10	3.1E-10	3.1E-10	1.7E-06	8.2E-09	3.1E-10	1.7E-07	2.7E-06
50B1	50th St. Boiler #1	3.4E-09	4.1E-10	4.1E-10	4.1E-10	2.2E-06	1.1E-08	4.1E-10	2.3E-07	3.4E-09
50B2	50th St. Boiler #2	3.2E-09	3.9E-10	3.9E-10	3.9E-10	2.1E-06	1.0E-08	3.9E-10	2.2E-07	3.2E-09
50FUG	50th St. Fugitive Emissions	3.6E-04	-	-	-	-	-	-	-	3.6E-04
50S	50th St. Scrubber	2.1E-05	-	-	-	-	-	-	-	2.1E-05
	Total	**7.7E-04**	**1.9E-09**	**1.9E-09**	**1.9E-09**	**1.0E-05**	**5.1E-08**	**1.9E-09**	**1.1E-06**	**7.7E-04**

Notes:
[1] Chronic HI results presented are for the the highest impact target organ, Central Nervous System (CNS).

Abbreviations:
HI = Hazard Index
m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
UTM = Universal Transverse Mercator

Table 37
8-hr Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled 8-hr Chronic HI PMI
Sterigenics
Vernon, CA

8-hr Chronic HI PMI: Receptor #36					
UTM East (m): 390,104.07, UTM North (m): 3,762,417.09					
Chemical Name	**CAS Number / Emittant ID**	**8-hr Chronic Hazard Quotients for Target Organs**			**Maximum 8-hr Chronic HI[1]**
		Respiratory System	**Eye**	**Blood**	
Benzene	71-43-2	-	-	7.4E-05	-
Formaldehyde	50-00-0	5.2E-05	-	-	5.2E-05
Total PAHs [excluding naphthalene]	1151	-	-	-	-
Naphthalene	91-20-3	-	-	-	-
Acetaldehyde	75-07-0	4.0E-07	-	-	4.0E-07
Acrolein	107-02-8	1.1E-04	-	-	1.1E-04
Ammonia	7664-41-7	-	-	-	-
Ethylbenzene	100-41-4	-	-	-	-
Hexane	110-54-3	-	-	-	-
Toluene	108-88-3	-	1.2E-06	-	-
Xylene	1330-20-7	-	-	-	-
Ethylene oxide	75-21-8	-	-	-	-
Total		**1.6E-04**	**1.2E-06**	**7.4E-05**	**1.6E-04**

2.5E-03

Notes:

[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:

HI = Hazard Index
m = meter
PAHs = Polycyclic aromatic hydrocarbons
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 38
8-hr Chronic Health Quotients by Source at the 2021 Modeled 8-hr Chronic HI PMI
Sterigenics
Vernon, CA

8-hr Chronic HI PMI: Receptor #36					
UTM East (m): 390,104.07, UTM North (m): 3,762,417.09					
DEV_ID	Source	8-hr Chronic Hazard Quotients for Target Organs			Maximum 8-hr Chronic HI[1]
		Respiratory System	Eye	Blood	
49A	49th St. Abator	2.3E-07	1.8E-09	1.1E-07	2.3E-07
49B1	49th St. Boiler #1	2.1E-05	1.6E-07	9.7E-06	2.1E-05
49B2	49th St. Boiler #2	2.1E-05	1.6E-07	9.8E-06	2.1E-05
49FUG	49th St. Fugitive Emissions	-	-	-	-
49S	49th St. Scrubber	-	-	-	-
50A	50th St. Abator	6.0E-06	4.6E-08	2.8E-06	6.0E-06
50B1	50th St. Boiler #1	5.6E-05	4.3E-07	2.6E-05	5.6E-05
50B2	50th St. Boiler #2	5.5E-05	4.2E-07	2.6E-05	5.5E-05
50FUG	50th St. Fugitive Emissions	-	-	-	-
50S	50th St. Scrubber	-	-	-	-
	Total	**1.6E-04**	**1.2E-06**	**7.4E-05**	**1.6E-04**

Notes:
[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:
HI = Hazard Index
m = meter
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 39
8-hr Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled 8-hr Chronic HI MEIR
Sterigenics
Vernon, CA

8-hr Chronic HI MEIR: Receptor #799					
UTM East (m): 390,005.70, UTM North (m): 3,762,227.37					
		8-hr Chronic Hazard Quotients for Target Organs			
Chemical Name	**CAS Number / Emittant ID**	**Respiratory System**	**Eye**	**Blood**	**Maximum 8-hr Chronic HI[1]**
Benzene	71-43-2	-	-	9.9E-06	-
Formaldehyde	50-00-0	7.0E-06	-	-	7.0E-06
Total PAHs [excluding naphthalene	1151	-	-	-	-
Naphthalene	91-20-3	-	-	-	-
Acetaldehyde	75-07-0	5.3E-08	-	-	5.3E-08
Acrolein	107-02-8	1.4E-05	-	-	1.4E-05
Ammonia	7664-41-7	-	-	-	-
Ethylbenzene	100-41-4	-	-	-	-
Hexane	110-54-3	-	-	-	-
Toluene	108-88-3	-	1.6E-07	-	-
Xylene	1330-20-7	-	-	-	-
Ethylene oxide	75-21-8	-	-	-	-
Total		**2.1E-05**	**1.6E-07**	**9.9E-06**	**2.1E-05**

Notes:
[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:
HI = Hazard Index
m = meter
MEIR = Maximally Exposed Individual Resident
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 40
8-hr Chronic Health Quotients by Source at the 2021 Modeled 8-hr Chronic HI MEIR
Sterigenics
Vernon, CA

8-hr Chronic HI MEIR: Receptor #799					
UTM East (m): 390,005.70, UTM North (m): 3,762,227.37					
DEV_ID	Source	8-hr Chronic Hazard Quotients for Target Organs			Maximum 8-hr Chronic HI[1]
		Respiratory System	Eye	Blood	
49A	49th St. Abator	6.5E-07	5.0E-09	3.0E-07	6.5E-07
49B1	49th St. Boiler #1	2.2E-06	1.7E-08	1.0E-06	2.2E-06
49B2	49th St. Boiler #2	2.2E-06	1.7E-08	1.0E-06	2.2E-06
49FUG	49th St. Fugitive Emissions	-	-	-	-
49S	49th St. Scrubber	-	-	-	-
50A	50th St. Abator	9.2E-07	7.1E-09	4.3E-07	9.2E-07
50B1	50th St. Boiler #1	7.6E-06	5.8E-08	3.5E-06	7.6E-06
50B2	50th St. Boiler #2	7.7E-06	5.9E-08	3.6E-06	7.7E-06
50FUG	50th St. Fugitive Emissions	-	-	-	-
50S	50th St. Scrubber	-	-	-	-
	Total	**2.1E-05**	**1.6E-07**	**9.9E-06**	**2.1E-05**

Notes:

[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:

HI = Hazard Index
m = meter
MEIR = Maximally Exposed Individual Resident
UTM = Universal Transverse Mercator

Table 41
8-hr Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled 8-hr Chronic HI MEIW
Sterigenics
Vernon, CA

8-hr Chronic HI MEIW: Receptor #1351					
UTM East (m): 390105.70, UTM North (m): 3762427.37					
Chemical Name	**CAS**	**8-hr Chronic Hazard Quotients for Target Organs**			**Maximum 8-hr Chronic HI[1]**
		Respiratory System	**Eye**	**Blood**	
Benzene	71-43-2	-	-	7.2E-05	-
Formaldehyde	50-00-0	5.1E-05	-	-	5.1E-05
Total PAHs [excluding naphthalene	1-15-1	-	-	-	-
Naphthalene	91-20-3	-	-	-	-
Acetaldehyde	75-07-0	3.9E-07	-	-	3.9E-07
Acrolein	107-02-8	1.0E-04	-	-	1.0E-04
Ammonia	7664-41-7	-	-	-	-
Ethylbenzene	100-41-4	-	-	-	-
Hexane	110-54-3	-	-	-	-
Toluene	108-88-3	-	1.2E-06	-	-
Xylene	1330-20-7	-	-	-	-
Ethylene oxide	75-21-8	-	-	-	-
Total		**1.5E-04**	**1.2E-06**	**7.2E-05**	**1.5E-04**

Notes:
[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:
HI = Hazard Index
m = meter
MEIW = Maximally Exposed Individual Worker
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 42
8-hr Chronic Health Quotients by Source at the 2021 Modeled 8-hr Chronic HI MEIW
Sterigenics
Vernon, CA

8-hr Chronic HI MEIW: Receptor #1351					
UTM East (m): 390105.70, UTM North (m): 3762427.37					
		8-hr Chronic Hazard Quotients for Target Organs			
DEV_ID	Source	Respiratory System	Eye	Blood	Maximum 8-hr Chronic HI[1]
49A	49th St. Abator	3.7E-07	2.8E-09	1.7E-07	3.7E-07
49B1	49th St. Boiler #1	2.6E-05	2.0E-07	1.2E-05	2.6E-05
49B2	49th St. Boiler #2	2.6E-05	2.0E-07	1.2E-05	2.6E-05
49FUG	49th St. Fugitive Emissions	-	-	-	-
49S	49th St. Scrubber	-	-	-	-
50A	50th St. Abator	3.7E-06	2.8E-08	1.7E-06	3.7E-06
50B1	50th St. Boiler #1	5.0E-05	3.9E-07	2.3E-05	5.0E-05
50B2	50th St. Boiler #2	4.9E-05	3.8E-07	2.3E-05	4.9E-05
50FUG	50th St. Fugitive Emissions	-	-	-	-
50S	50th St. Scrubber	-	-	-	-
	Total	**1.6E-04**	**1.2E-06**	**7.2E-05**	**1.6E-04**

Notes:
[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:
HI = Hazard Index
m = meter
MEIW = Maximally Exposed Individual Worker
UTM = Universal Transverse Mercator

Table 43
8-hr Chronic Health Quotients by Substance and Target Organ at the 2021 Modeled 8-hr Chronic HI MEISR
Sterigenics
Vernon, CA

8-hr Chronic Risk MEISR: Sensitive Receptor #7					
UTM East (m): 389,834.55, UTM North (m): 376,1771.88					
Chemical Name	CAS	8-hr Chronic Hazard Quotients for Target Organs			Maximum 8-hr Chronic HI[1]
		Respiratory System	Eye	Blood	
Benzene	71-43-2	-	-	1.5E-06	-
Formaldehyde	50-00-0	1.1E-06	-	-	1.1E-06
Total PAHs [excluding naphthalene]	1-15-1	-	-	-	-
Naphthalene	91-20-3	-	-	-	-
Acetaldehyde	75-07-0	8.1E-09	-	-	8.1E-09
Acrolein	107-02-8	2.2E-06	-	-	2.2E-06
Ammonia	7664-41-7	-	-	-	-
Ethylbenzene	100-41-4	-	-	-	-
Hexane	110-54-3	-	-	-	-
Toluene	108-88-3	-	2.5E-08	-	-
Xylene	1330-20-7	-	-	-	-
Ethylene oxide	75-21-8	-	-	-	-
Total		**3.3E-06**	**2.5E-08**	**1.5E-06**	**3.27E-06**

Notes:

[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:

HI = Hazard Index
m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 44
8-hr Chronic Health Quotients by Source at the 2021 Modeled 8-hr Chronic HI MEISR
Sterigenics
Vernon, CA

8-hr Chronic HI MEISR: Sensitive Receptor #7					
UTM East (m): 389,834.55, UTM North (m): 376,1771.88					
DEV_ID	Source	8-hr Chronic Hazard Quotients for Target Organs			Maximum 8-hr Chronic HI[1]
		Respiratory System	Eye	Blood	
49A	49th St. Abator	6.3E-07	4.8E-09	2.9E-07	6.3E-07
49B1	49th St. Boiler #1	3.3E-07	2.5E-09	1.5E-07	3.3E-07
49B2	49th St. Boiler #2	3.3E-07	2.5E-09	1.5E-07	3.3E-07
49FUG	49th St. Fugitive Emissions	-	-	-	-
49S	49th St. Scrubber	-	-	-	-
50A	50th St. Abator	7.8E-07	6.0E-09	3.6E-07	7.8E-07
50B1	50th St. Boiler #1	6.0E-07	4.6E-09	2.8E-07	6.0E-07
50B2	50th St. Boiler #2	6.0E-07	4.6E-09	2.8E-07	6.0E-07
50FUG	50th St. Fugitive Emissions	-	-	-	-
50S	50th St. Scrubber	-	-	-	-
	Total	**3.3E-06**	**2.5E-08**	**1.5E-06**	**3.3E-06**

Notes:

[1] 8-hr Chronic HI results presented are for the the highest impact target organ, Respiratory System.

Abbreviations:

HI = Hazard Index
m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
UTM = Universal Transverse Mercator

Table 45
Acute Health Quotients by Substance and Target Organ at the 2021 Modeled Acute HI PMI
Sterigenics
Vernon, CA

Acute HI PMI: Receptor #1351								
UTM East (m): 390105.70, UTM North (m): 3762427.37								
Chemical Name	**CAS Number / Pollutant ID**	**Acute Hazard Quotients for Target Organs**						**Maximum Acute HI[1]**
		Central Nervous System (CNS)	**Immune System**	**Repro-ductive System/ Develop-mental**	**Respiratory System**	**Eye**	**Blood**	
Benzene	71-43-2	-	7.2E-05	7.2E-05	-	-	6.7E-05	-
Formaldehyde	50-00-0	-	-	-	-	7.5E-05	-	7.5E-05
Total PAHs [excluding naphthalene	1151	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	2.2E-06	2.2E-06	-	2.2E-06
Acrolein	107-02-8	-	-	-	2.6E-04	2.6E-04	-	2.6E-04
Ammonia	7664-41-7	-	-	-	2.3E-04	2.4E-04	-	2.4E-04
Ethylbenzene	100-41-4	-	-	-	-	-	-	-
Hexane	110-54-3	-	-	-	-	-	-	-
Toluene	108-88-3	1.8E-06	-	-	1.8E-06	1.8E-06	-	1.8E-06
Xylene	1330-20-7	3.0E-07	-	-	3.0E-07	3.0E-07	-	3.0E-07
Ethylene oxide	75-21-8	-	-	-	-	-	-	-
Total		**2.1E-06**	**7.2E-05**	**7.2E-05**	**4.9E-04**	**5.9E-04**	**6.7E-05**	**5.9E-04**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

CAS = Chemical Abstract Service
HI = Hazard Index
m = meter
PAHs = Polycyclic aromatic hydrocarbons
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 46
Acute Health Quotients by Source at the 2021 Modeled Acute HI PMI
Sterigenics
Vernon, CA

Acute HI PMI: Receptor #1351								
UTM East (m): 390105.70, UTM North (m): 3762427.37								
DEV_ID	Source	Acute Hazard Quotients for Target Organs						Maximum Acute HI[1]
		Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	
49A	49th St. Abator	6.8E-08	2.4E-06	2.4E-06	1.7E-05	1.9E-05	2.4E-06	2.3E-05
49B1	49th St. Boiler #1	4.5E-07	1.6E-05	1.6E-05	1.1E-04	1.3E-04	1.6E-05	1.1E-04
49B2	49th St. Boiler #2	4.5E-07	1.6E-05	1.6E-05	1.1E-04	1.3E-04	1.6E-05	1.1E-04
49FUG	49th St. Fugitive Emissions	-	-	-	-	-	-	-
49S	49th St. Scrubber	-	-	-	-	-	-	-
50A	50th St. Abator	1.6E-07	5.4E-06	5.4E-06	3.8E-05	4.4E-05	5.4E-06	4.1E-05
50B1	50th St. Boiler #1	4.9E-07	1.7E-05	1.7E-05	1.2E-04	1.4E-04	1.7E-05	1.3E-04
50B2	50th St. Boiler #2	4.7E-07	1.6E-05	1.6E-05	1.1E-04	1.3E-04	1.6E-05	1.3E-04
50FUG	50th St. Fugitive Emissions	-	-	-	-	-	-	-
50S	50th St. Scrubber	-	-	-	-	-	-	-
	Total	**2.1E-06**	**7.2E-05**	**7.2E-05**	**5.1E-04**	**5.9E-04**	**7.2E-05**	**5.9E-04**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

HI = Hazard Index
m = meter
PMI = Point of Maximum Impact
UTM = Universal Transverse Mercator

Table 47
Acute Health Quotients by Substance and Target Organ at the 2021 Modeled Acute HI MEIR
Sterigenics
Vernon, CA

Acute HI MEIR: Receptor #801								
UTM East (m): 390045.7, UTM North (m): 3762227.37								
		Acute Hazard Quotients for Target Organs						
Chemical Name	CAS Number / Pollutant ID	Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	Maximum Acute HI[1]
Benzene	71-43-2	-	9.2E-06	9.2E-06	-	-	9.2E-06	-
Formaldehyde	50-00-0	-	-	-	-	9.6E-06	-	9.6E-06
Total PAHs [excluding naphthalene	1151	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	2.9E-07	2.9E-07	-	2.9E-07
Acrolein	107-02-8	-	-	-	3.4E-05	3.4E-05	-	3.4E-05
Ammonia	7664-41-7	-	-	-	3.1E-05	3.1E-05	-	3.1E-05
Ethylbenzene	100-41-4	-	-	-	-	-	-	-
Hexane	110-54-3	-	-	-	-	-	-	-
Toluene	108-88-3	2.3E-07	-	-	2.3E-07	2.3E-07	-	2.3E-07
Xylene	1330207	3.9E-08	-	-	3.9E-08	3.9E-08	-	3.9E-08
Ethylene oxide	75-21-8	-	-	-	-	-	-	-
Total		**2.7E-07**	**9.2E-06**	**9.2E-06**	**6.5E-05**	**7.5E-05**	**9.2E-06**	**7.5E-05**

Notes:
[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:
CAS = Chemical Abstract Service
HI = Hazard Index
m = meter
MEIR = Maximally Exposed Individual Resident
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 48
Acute Health Quotients by Source at the 2021 Modeled Acute HI MEIR
Sterigenics
Vernon, CA

Acute HI MEIR: Receptor #801								
UTM East (m): 390045.7, UTM North (m): 3762227.37								
DEV_ID	Source	Acute Hazard Quotients for Target Organs						Maximum Acute HI[1]
		Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	
49A	49th St. Abator	2.3E-08	7.9E-07	7.9E-07	5.6E-06	6.4E-06	7.9E-07	6.4E-06
49B1	49th St. Boiler #1	5.6E-08	1.9E-06	1.9E-06	1.4E-05	1.6E-05	1.9E-06	1.6E-05
49B2	49th St. Boiler #2	5.4E-08	1.9E-06	1.9E-06	1.3E-05	1.5E-05	1.9E-06	1.5E-05
49FUG	49th St. Fugitive Emissions	-	-	-	-	-	-	-
49S	49th St. Scrubber	-	-	-	-	-	-	-
50A	50th St. Abator	2.9E-08	1.0E-06	1.0E-06	7.1E-06	8.2E-06	1.0E-06	8.2E-06
50B1	50th St. Boiler #1	5.1E-08	1.8E-06	1.8E-06	1.3E-05	1.4E-05	1.8E-06	1.4E-05
50B2	50th St. Boiler #2	5.4E-08	1.9E-06	1.9E-06	1.3E-05	1.5E-05	1.9E-06	1.5E-05
50FUG	50th St. Fugitive Emissions	-	-	-	-	-	-	-
50S	50th St. Scrubber	-	-	-	-	-	-	-
	Total	**2.7E-07**	**9.2E-06**	**9.2E-06**	**6.5E-05**	**7.5E-05**	**9.2E-06**	**7.5E-05**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

HI = Hazard Index
m = meter
MEIR = Maximally Exposed Individual Resident
UTM = Universal Transverse Mercator

Table 49
Acute Health Quotients by Substance and Target Organ at the 2021 Modeled Acute HI MEIW
Sterigenics
Vernon, CA

Acute HI MEIW: Receptor #1351								
UTM East (m): 390105.70, UTM North (m): 3762427.37								
Chemical Name	CAS Number / Pollutant ID	Acute Hazard Quotients for Target Organs						Maximum Acute HI[1]
		Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	
Benzene	71-43-2	-	7.2E-05	7.2E-05	-	-	6.7E-05	-
Formaldehyde	50-00-0	-	-	-	-	7.5E-05	-	7.5E-05
Total PAHs [excluding naphthalene	1151	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	-	-	-
Acetaldehyde	75-07-0	-	-	-	2.2E-06	2.2E-06	-	2.2E-06
Acrolein	107-02-8	-	-	-	2.6E-04	2.6E-04	-	2.6E-04
Ammonia	7664-41-7	-	-	-	2.3E-04	2.4E-04	-	2.4E-04
Ethylbenzene	100-41-4	-	-	-	-	-	-	-
Hexane	110-54-3	-	-	-	-	-	-	-
Toluene	108-88-3	1.8E-06	-	-	1.8E-06	1.8E-06	-	1.8E-06
Xylene	1330-20-7	3.0E-07	-	-	3.0E-07	3.0E-07	-	3.0E-07
Ethylene oxide	75-21-8	-	-	-	-	-	-	-
	Total	**2.1E-06**	**7.2E-05**	**7.2E-05**	**4.9E-04**	**5.9E-04**	**6.7E-05**	**5.9E-04**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

CAS = Chemical Abstract Service
HI = Hazard Index
m = meter
MEIW = Maximally Exposed Individual Worker
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 50
Acute Health Quotients by Source at the 2021 Modeled Acute HI MEIW
Sterigenics
Vernon, CA

Acute HI MEIW: Receptor #1351								
UTM East (m): 390105.70, UTM North (m): 3762427.37								
DEV_ID	Source	Acute Hazard Quotients for Target Organs						Maximum Acute HI[1]
		Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	
49A	49th St. Abator	6.8E-08	2.4E-06	2.4E-06	1.7E-05	1.9E-05	2.4E-06	2.3E-05
49B1	49th St. Boiler #1	4.5E-07	1.6E-05	1.6E-05	1.1E-04	1.3E-04	1.6E-05	1.1E-04
49B2	49th St. Boiler #2	4.5E-07	1.6E-05	1.6E-05	1.1E-04	1.3E-04	1.6E-05	1.1E-04
49FUG	49th St. Fugitive Emissions	-	-	-	-	-	-	-
49S	49th St. Scrubber	-	-	-	-	-	-	-
50A	50th St. Abator	1.6E-07	5.4E-06	5.4E-06	3.8E-05	4.4E-05	5.4E-06	4.1E-05
50B1	50th St. Boiler #1	4.9E-07	1.7E-05	1.7E-05	1.2E-04	1.4E-04	1.7E-05	1.3E-04
50B2	50th St. Boiler #2	4.7E-07	1.6E-05	1.6E-05	1.1E-04	1.3E-04	1.6E-05	1.3E-04
50FUG	50th St. Fugitive Emissions	-	-	-	-	-	-	-
50S	50th St. Scrubber	-	-	-	-	-	-	-
	Total	**2.1E-06**	**7.2E-05**	**7.2E-05**	**5.1E-04**	**5.9E-04**	**7.2E-05**	**5.9E-04**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

HI = Hazard Index
m = meter
MEIW = Maximally Exposed Individual Worker
UTM = Universal Transverse Mercator

Table 51
Acute Health Quotients by Substance and Target Organ at the 2021 Modeled Acute HI MEISR
Sterigenics
Vernon, CA

Acute HI MEISR: Sensitive Receptor #1								
UTM East (m): 390614.46, UTM North (m): 3762080.69								
		Acute Hazard Quotients for Target Organs						
Chemical Name	CAS	Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	Maximum Acute HI[1]
Acetaldehyde	75-07-0	-	-	-	3.4E-08	3.4E-08	-	3.4E-08
Acrolein	107-02-8	-	-	-	4.0E-06	4.0E-06	-	4.0E-06
Ammonia	7664-41-7	-	-	-	3.7E-06	3.7E-06	-	3.7E-06
Benzene	71-43-2	-	1.1E-06	1.1E-06	-	-	1.1E-06	-
Ethylbenzene	100-41-4	-	-	-	-	-	-	-
Ethylene oxide	75-21-8	-	-	-	-	-	-	-
Formaldehyde	50-00-0	-	-	-	-	1.1E-06	-	1.1E-06
Hexane	110-54-3	-	-	-	-	-	-	-
Naphthalene	91-20-3	-	-	-	-	-	-	-
Toluene	108-88-3	2.7E-08	-	-	2.7E-08	2.7E-08	-	2.7E-08
Total PAHs [excluding naphthalene	1151	-	-	-	-	-	-	-
Xylene	1330-20-7	4.5E-09	-	-	4.5E-09	4.5E-09	-	4.5E-09
	Total	**3.1E-08**	**1.1E-06**	**1.1E-06**	**7.7E-06**	**8.8E-06**	**1.1E-06**	**8.8E-06**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

CAS = Chemical Abstract Service
HI = Hazard Index
m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
PAHs = Polycyclic aromatic hydrocarbons
UTM = Universal Transverse Mercator

Table 52
Acute Health Quotients by Source at the 2021 Modeled Acute HI MEISR
Sterigenics
Vernon, CA

Acute HI MEISR: Sensitive Receptor #1								
UTM East (m): 390614.46, UTM North (m): 3762080.69								
DEV_ID	Source	Acute Hazard Quotients for Target Organs						Maximum Acute HI[1]
		Central Nervous System (CNS)	Immune System	Repro-ductive System/ Develop-mental	Respiratory System	Eye	Blood	
49A	49th St. Abator	5.7E-09	2.0E-07	2.0E-07	1.4E-06	1.6E-06	2.0E-07	1.6E-06
49B1	49th St. Boiler #1	3.6E-09	1.3E-07	1.3E-07	8.9E-07	1.0E-06	1.3E-07	1.0E-06
49B2	49th St. Boiler #2	3.6E-09	1.3E-07	1.3E-07	8.9E-07	1.0E-06	1.3E-07	1.0E-06
49FUG	49th St. Fugitive Emissions	-	-	-	-	-	-	-
49S	49th St. Scrubber	-	-	-	-	-	-	-
50A	50th St. Abator	8.3E-09	2.9E-07	2.9E-07	2.0E-06	2.3E-06	2.9E-07	2.3E-06
50B1	50th St. Boiler #1	5.7E-09	2.0E-07	2.0E-07	1.4E-06	1.6E-06	2.0E-07	1.6E-06
50B2	50th St. Boiler #2	4.4E-09	1.5E-07	1.5E-07	1.1E-06	1.3E-06	1.5E-07	1.3E-06
50FUG	50th St. Fugitive Emissions	-	-	-	-	-	-	-
50S	50th St. Scrubber	-	-	-	-	-	-	-
	Total	**3.1E-08**	**1.1E-06**	**1.1E-06**	**7.7E-06**	**8.9E-06**	**1.1E-06**	**8.9E-06**

Notes:

[1] Acute HI results presented are for the the highest impact target organ, Eye.

Abbreviations:

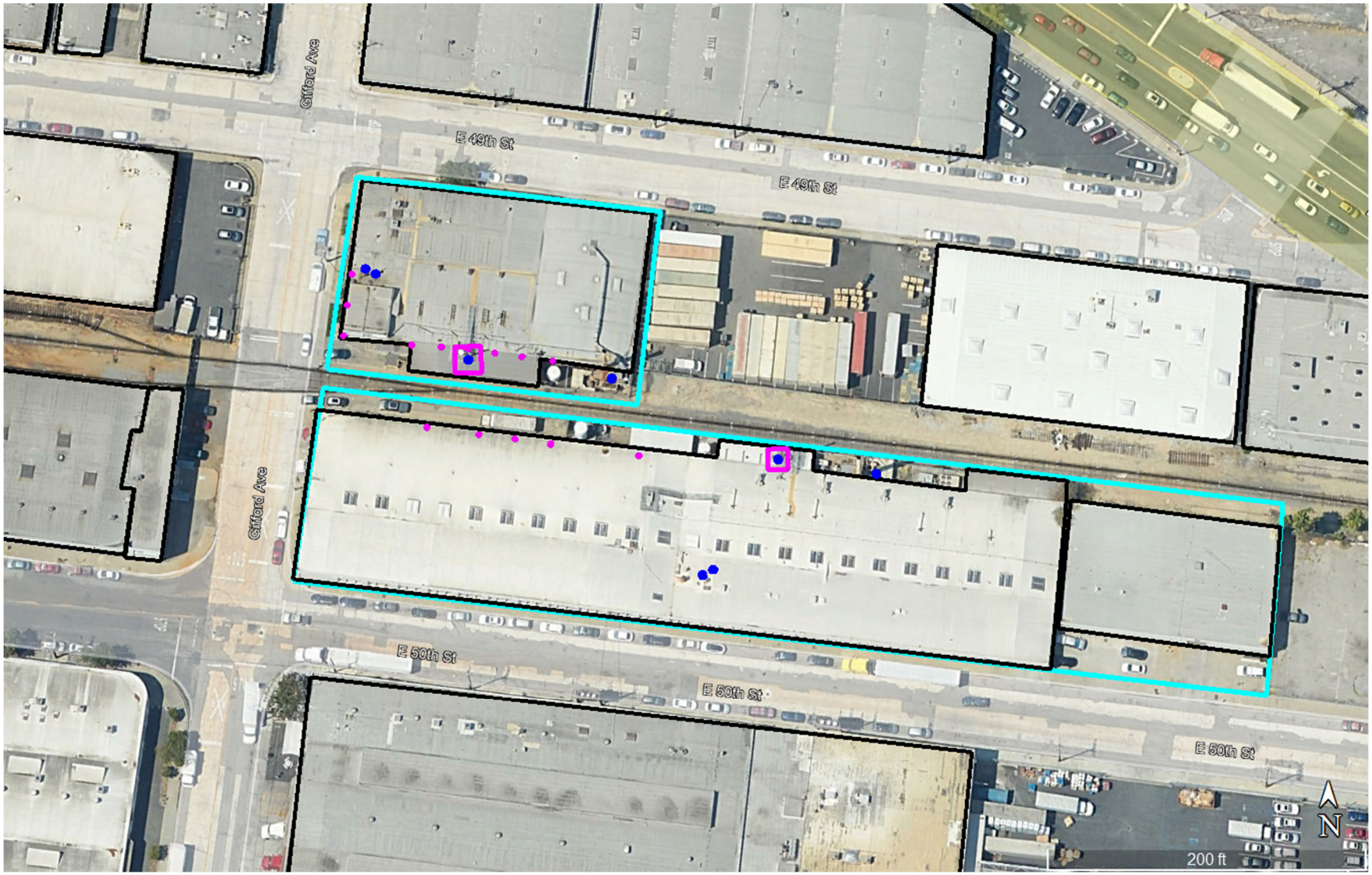
HI = Hazard Index
m = meter
MEISR = Maximally Exposed Individual Sensitive Receptor
UTM = Universal Transverse Mercator

FIGURES

Facility Boundary

Figure 01:

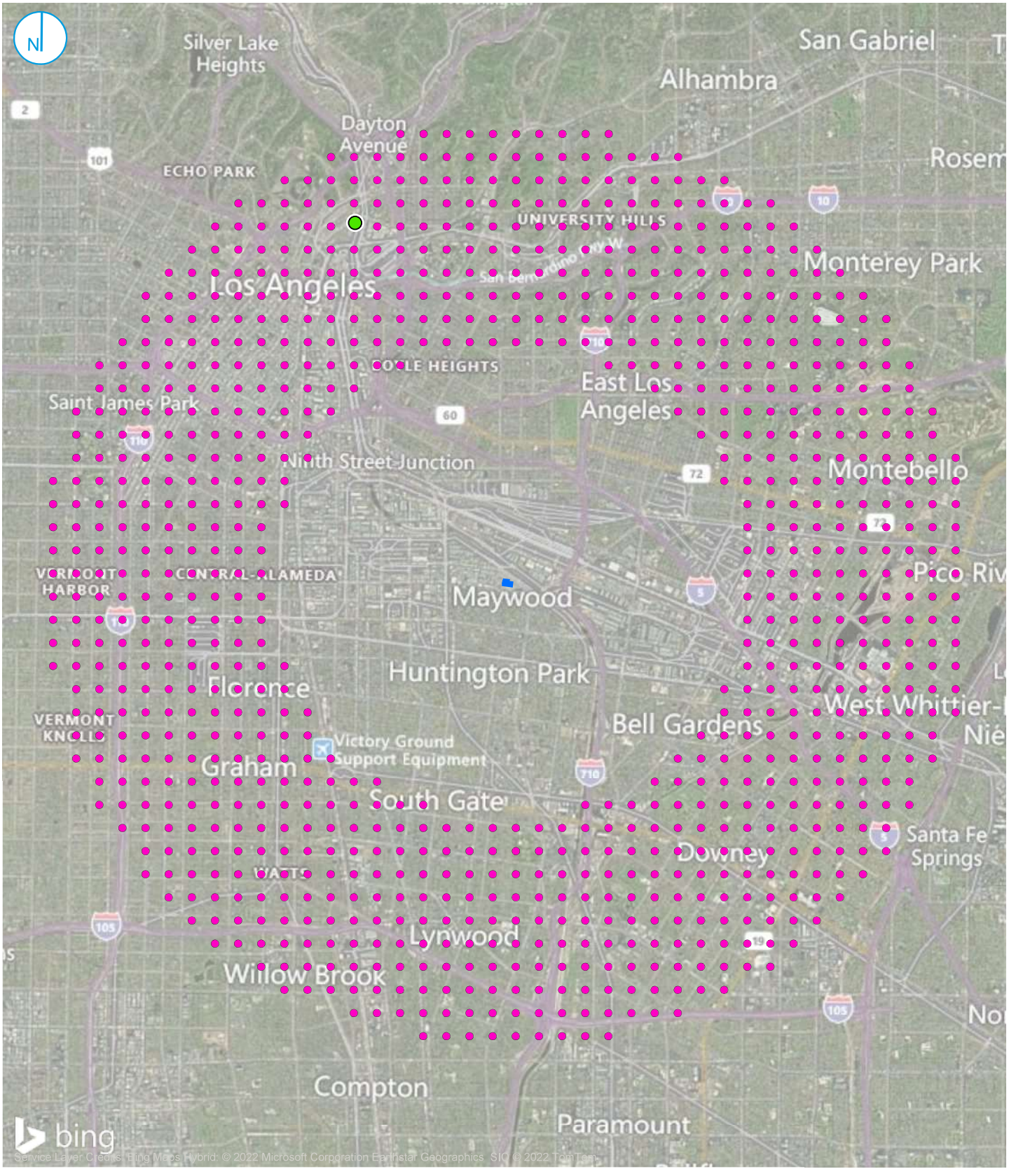
Site Location



Facility Boundary
Buildings
Fugitive Sources
Point Sources

Figure 02:

Site Plot Plan with Sources and Buildings



C:\Users\CWILLIAMSFREIER\Ramboll\Melody Kneale - Projects\Sterigenics\Vernon\20221110_HRA_Report\20221110_HRA_Report.aprx\Figure 03a - Receptors (500m)

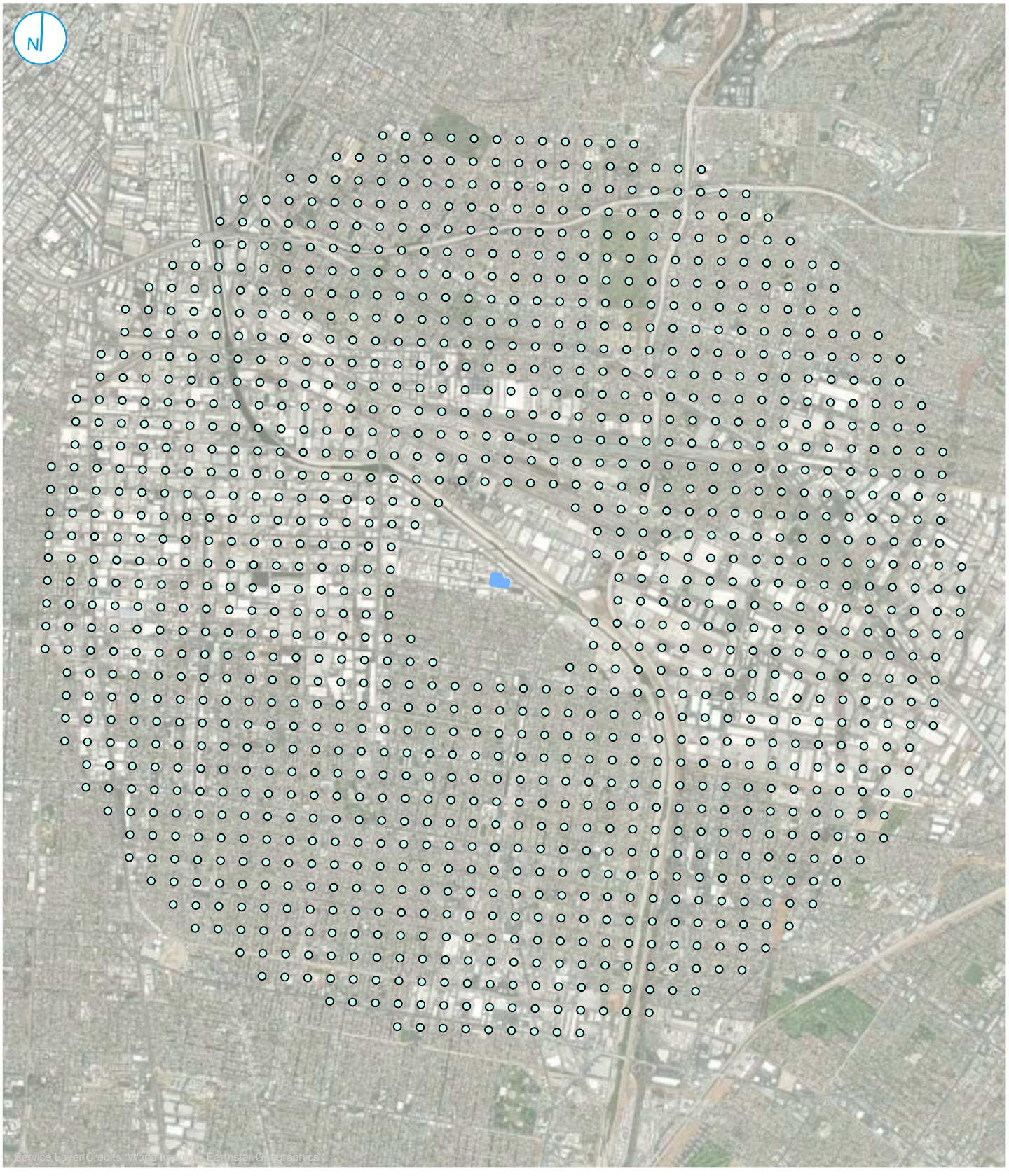
Site Boundary
500m-spacing Receptors
Meteorological Station

0 2,500 5,000
Feet

RECEPTORS (500 METER SPACING) AND METEOROLOGICAL STATION

FIGURE 03a

Sterigenics US, LLC
4801-63 E. 50th Street
& 4900 Gifford Avenue
Vernon, California



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PROJECT: 1690027195| DATED: 11/11/2022 | DESIGNER: RPEPEL

Site Boundary

250m-spacing Receptors

0 2,500 5,000 Feet

RECEPTORS (250 METER SPACING)

Sterigenics US, LLC
4801-63 E. 50th Street
& 4900 Gifford Avenue
Vernon, California

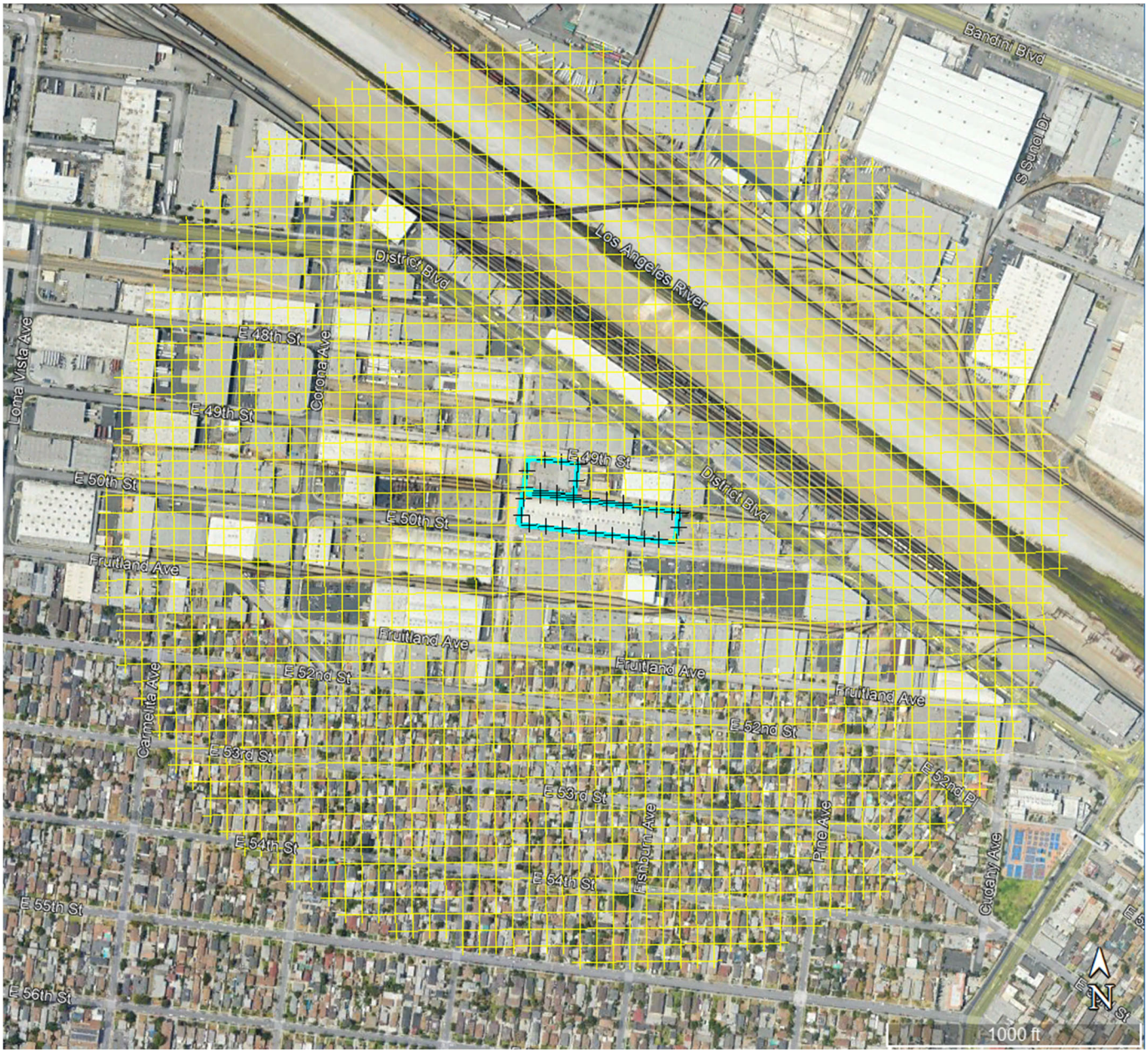
FIGURE 3b

Facility Boundary

100m-spacing Receptors

Figure 03c:

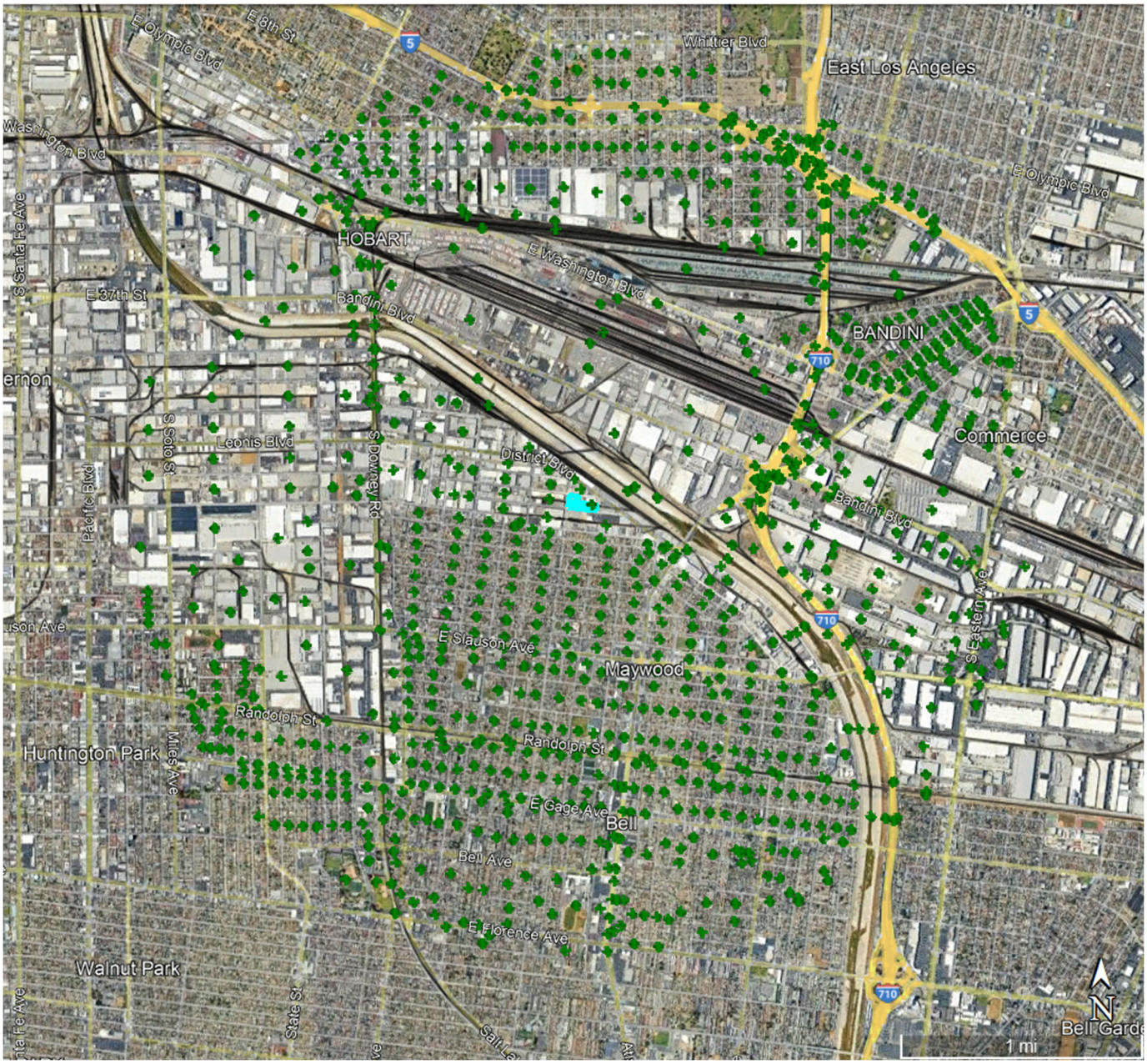
Receptors (100 meter spacing)



Facility Boundary
Fenceline Receptors
20m-spacing Receptor Grid

Figure 03d:

Receptors (20 meter spacing)



Facility Boundary

Census Block Centroid Receptors

Figure 03e:

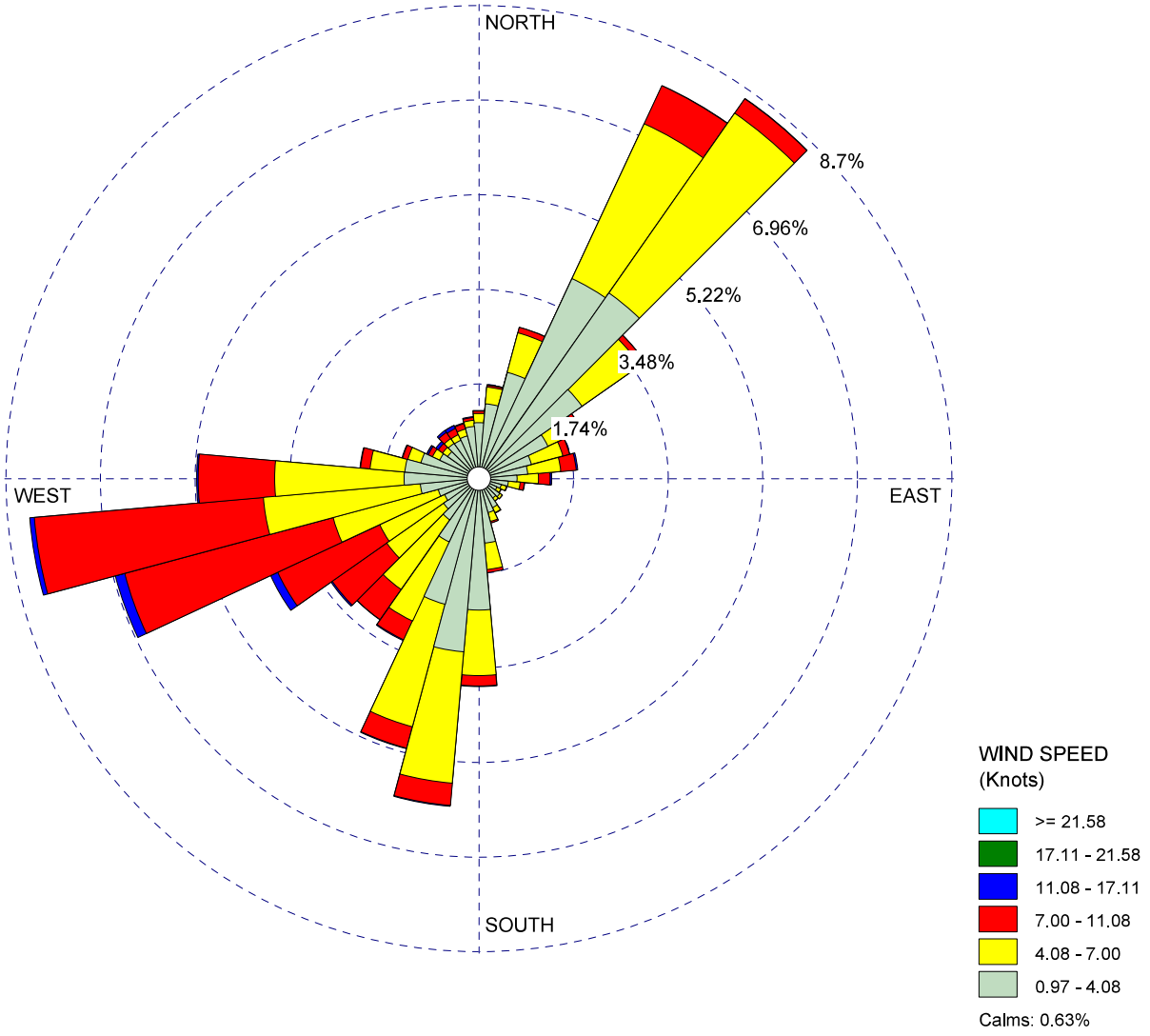
Census Block Centroid Receptors

WIND ROSE PLOT:

Figure 04: 5-Year Wind Rose for Central LA Meteorological Station (2010-2011, 2014-2016)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **Start Date: 1/1/2010 - 00:00** **End Date: 12/31/2016 - 23:59**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **0.63%**	TOTAL COUNT: **43459 hrs.**	
	AVG. WIND SPEED: **4.55 Knots**	DATE: **11/10/2022**	PROJECT NO.:

Facility Boundary

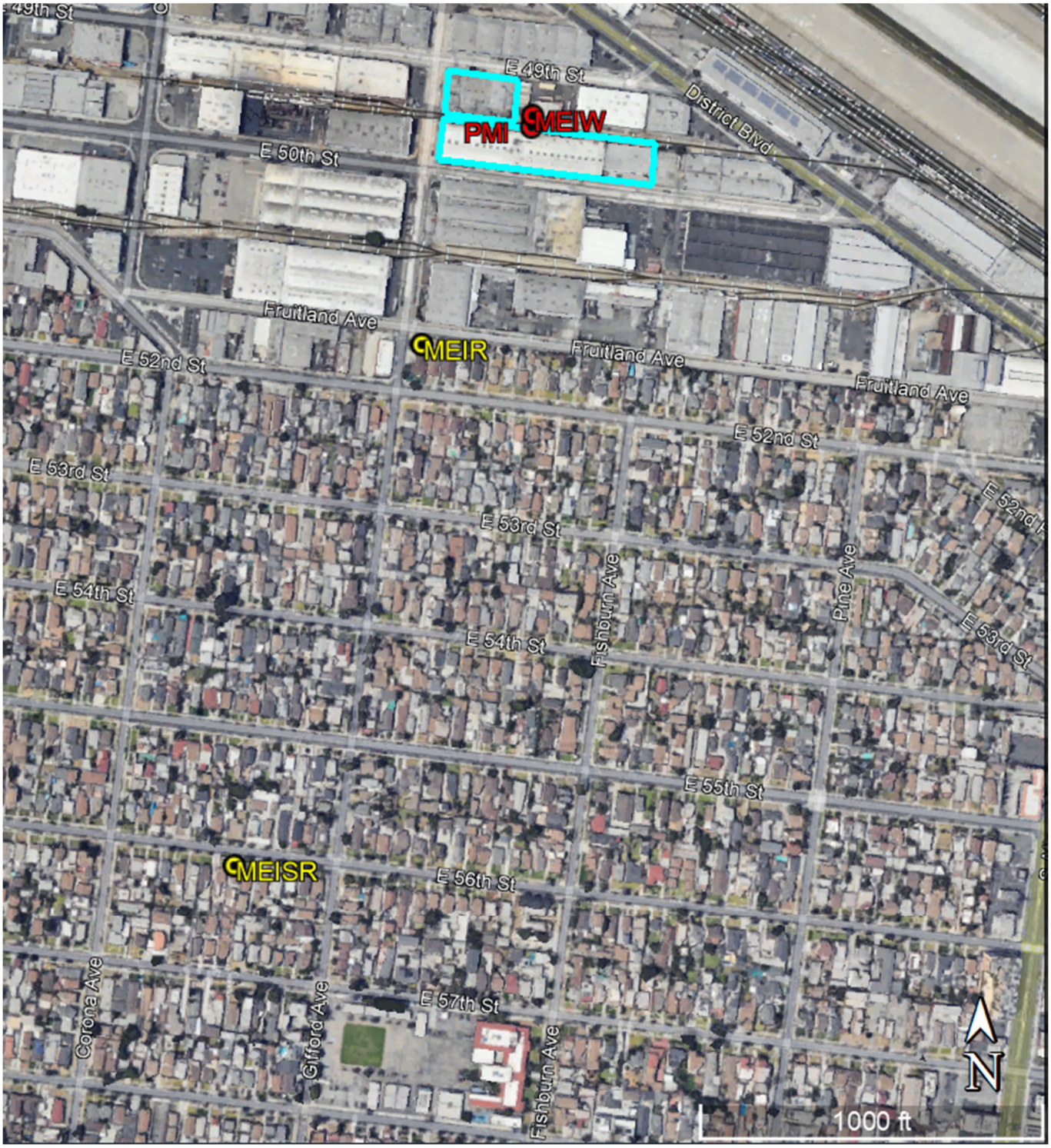
Figure 05:

Locations of PMI, MEIR, MEIW and MEISR for Cancer Risk

Facility Boundary

Figure 06:

Locations of PMI, MEIR, MEIW and MEISR for Chronic Hazard Index



Facility Boundary

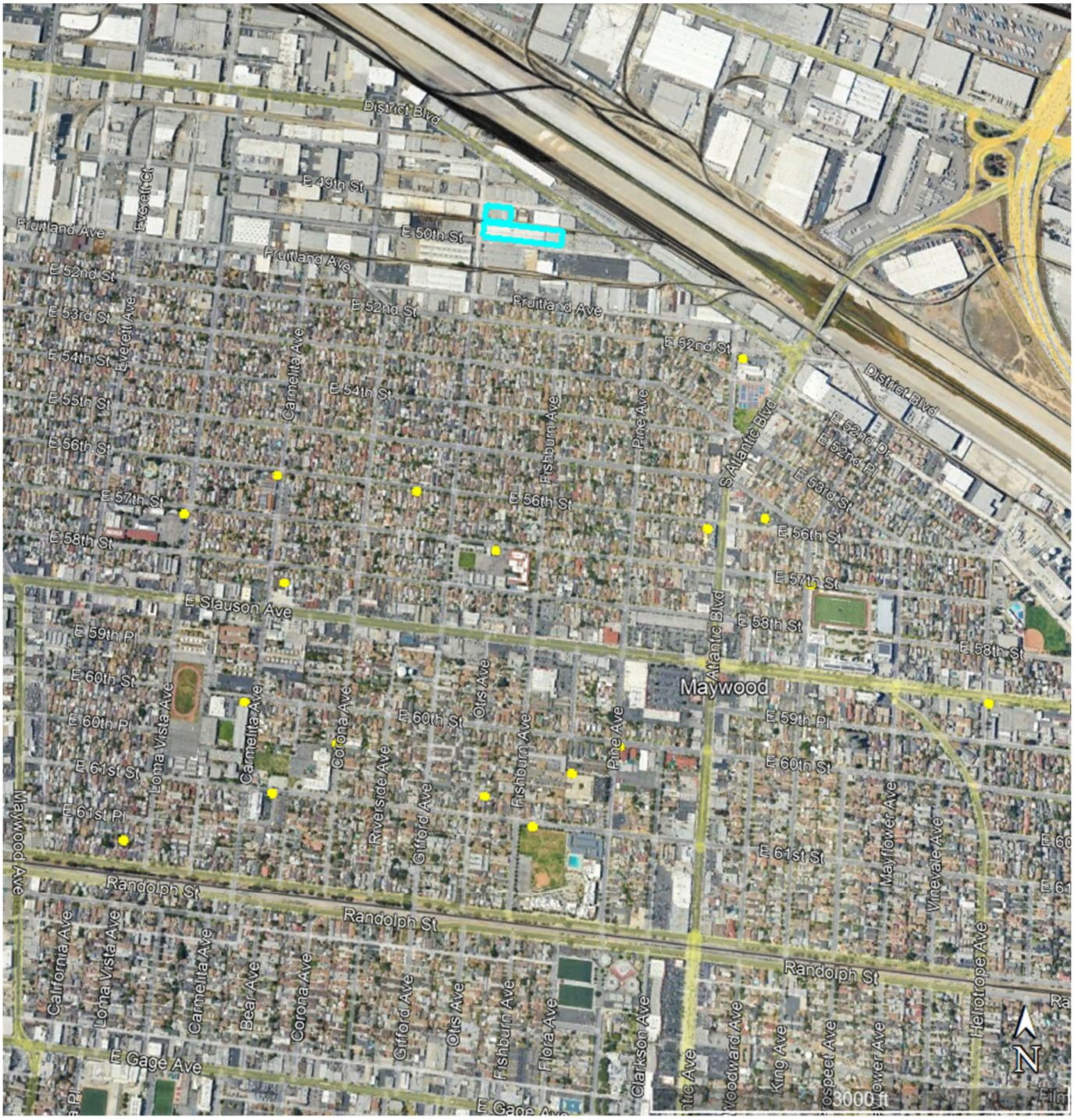
Figure 07:

Locations of PMI, MEIR, MEIW and MEISR for 8-HR Chronic Hazard Index

Facility Boundary

Figure 08:

Locations of PMI, MEIR, MEIW and MEISR for Acute Hazard Index

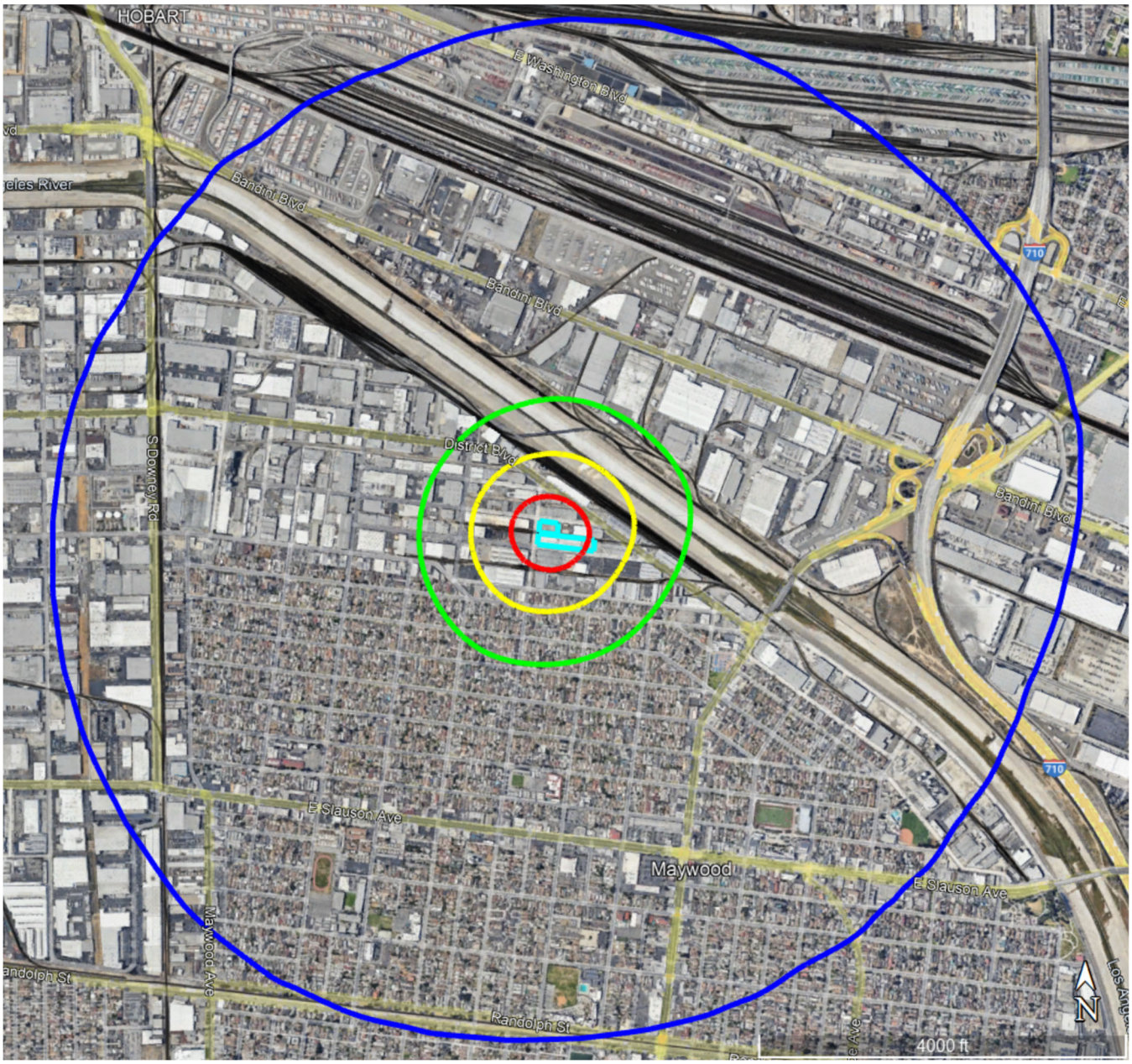


Facility Boundary

Sensitive Receptors

Figure 09:

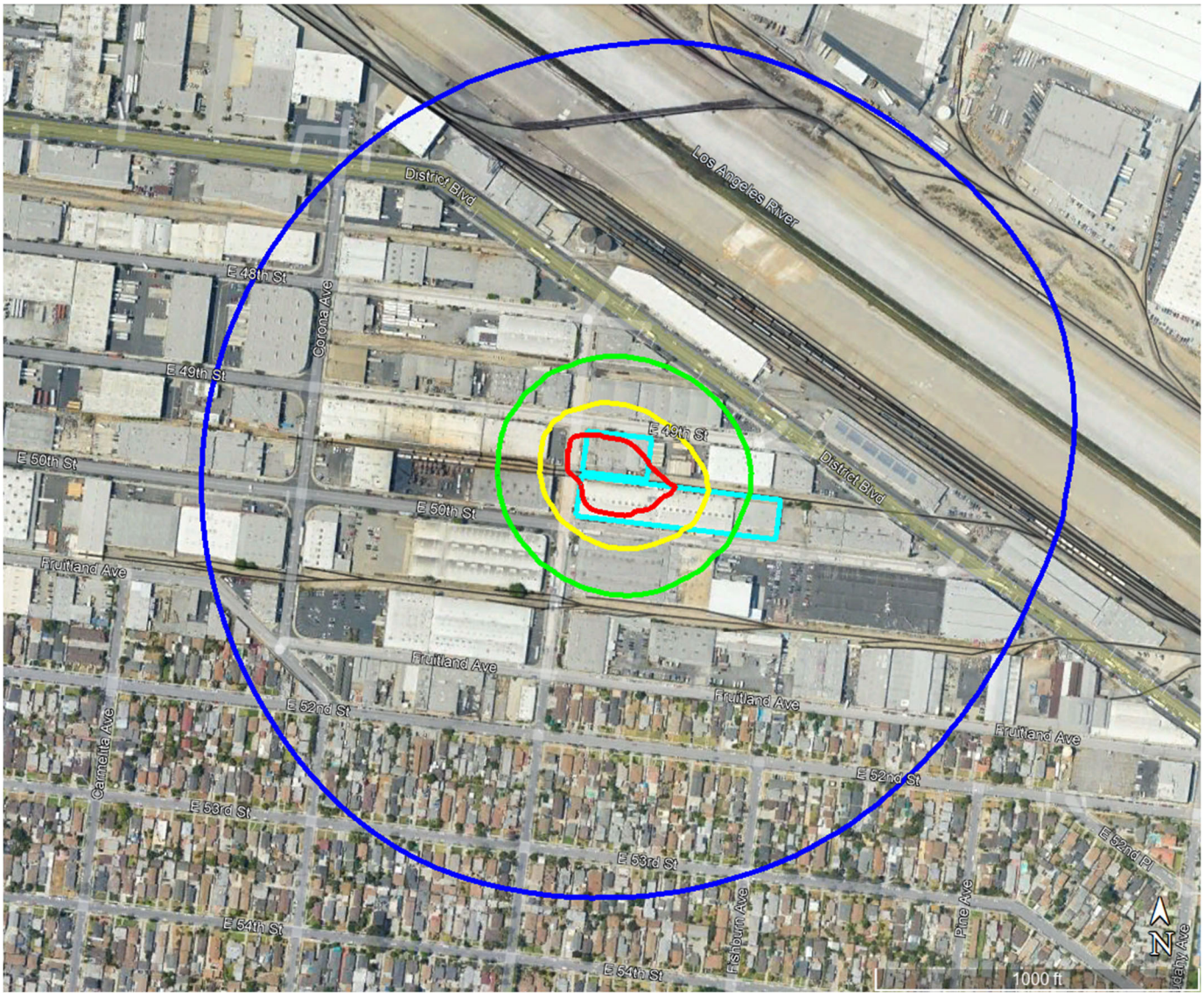
Sensitive Receptors with Cancer Risk > One Chance in-one-Million



Facility Boundary
1 chance in-one-million Cancer Risk
10 chances in-one-million Cancer Risk
25 chances in-one-million Cancer Risk
100 chances in-one-million Cancer Risk

Figure 10:

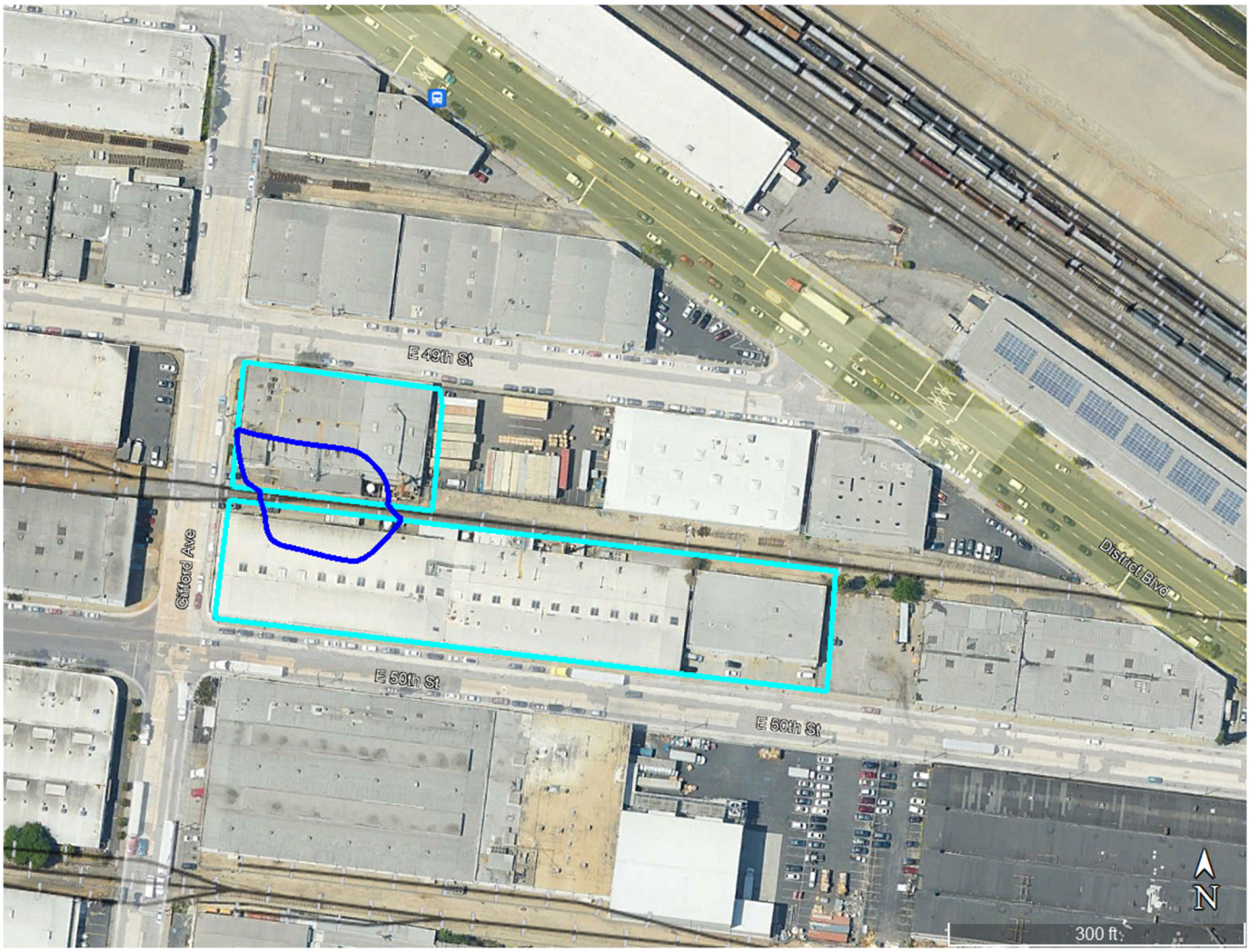
Residential Cancer Isopleths (30-Year Exposure)



Facility Boundary
1 chance in-one-million Cancer Risk
10 chances in-one-million Cancer Risk
25 chances in-one-million Cancer Risk
100 chances in-one-million Cancer Risk

Figure 11:

Worker Cancer Isopleths (25-Year Exposure)



Facility Boundary

Hazard Index of 0.5

Figure 12:

Chronic Risk Isopleth

APPENDIX A
AERMOD MODELING FILES
[PROVIDED ELECTRONICALLY]

APPENDIX B
HARP FILES
[PROVIDED ELECTRONICALLY]