October 28, 2014

BY OVERNIGHT MAIL

Phillip M. Fine, Ph.D.
Assistant Deputy Executive Officer
Planning, Rule Development and Area Sources
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765-4178

REVISED AB2588 HEALTH RISK ASSESSMENT FOR CARLTON FORGE WORKS

Dear Dr. Fine:

As we informed you in our letter dated October 9, 2014, ToxStrategies, Inc., discovered an inadvertent error in the air dispersion modeling submitted on August 18, 2014 in the AB2588 Health Risk Assessment (HRA) for the Carlton Forge Works (CFW) located at 7743 Adams Street in Paramount, California (Facility ID: 22911). During our final modeling run after the air toxics inventory report (ATIR) was submitted on August 6, 2014, the algorithms for the building downwash calculations were not run for the point sources. As a result, the modeling results submitted with the AB2588 HRA on August 18, 2014 do not include building downwash. Along with the October 9, 2014 letter, we submitted the revised modeling files (Appendix D of the AB2588 HRA) to allow SCAQMD to continue their review of the air dispersion modeling for CFW.

This letter transmits the report "Revised AB2588 Human Health Risk Assessment, Carlton Forge Works (SCAQMD Facility ID No. 22911", which reflects the changes in the air dispersion modeling. As provided in our October 9, 2014 letter, Table 1 below compares the revised results with the original results submitted to SCAQMD on August 18, 2014. As shown, the revised results are not significantly different from the original results and do not change the overall conclusions in the AB2588 HRA report. The maximum residential exposure (i.e., MEIR), the maximum worker exposure (i.e., MEIW), and the maximum impact (i.e., PMI) were all below the levels at which SCAQMD requires a risk reduction plan. As concluded previously, only a small area, encompassing just a few address and no sensitive receptors exceeded the notification level based on potential acute exposures.

Table 1: Comparison of AB2588 HRA Results

Person	Risk type	Original Value (receptor #)	Revised Value (receptor #)	Risk Reduction Level	Risk Reduction Level Exceeded?
Resident	Cancer	2.8×10^{-6} (#1046)	2.4×10^{-6} (#1046)	25×10^{-6}	No
	Acute HI	1.1 (#1046)	1.11 (#1046)	3.0	No
	Chronic HI	0.3 (#1046)	0.29 (#1046)	3.0	No
Worker	Cancer	5.6×10^{-7} (#1047)	8.2×10^{-7} (#1006)	NA	No
	Acute HI	0.8 (#1045)	1.01 (#1085)	3.0	No
	Chronic HI	0.2 (#1047)	0.36 (#1006)	3.0	No
Point of Maximum Impact	Cancer	3.3×10^{-6} (#109)	4.2×10^{-6} (#32)	NA	No
	Acute HI	1.8 (#109)	1.82 (#109)	3.0	No
	Chronic HI	0.4 (#109)	0.54 (#32)	3.0	No
Census Tract	Cancer Burden	0.00021 (#275)	0.0013 (#276)	0.5	No

Please contact me if you have any questions.

Sincerely,

Deborah Proctor

Deborah Proctor
Principal Toxicologist

CC: Ian MacMillan (SCAQMD)
Hoshik Yoo (SCAQMD)
Kevin Dahlin (CFW)
Tom Wood (Stoel Rives)

South Coast Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4182
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AB2588 AIR TOXICS DOCUMENT CERTIFICATION & APPLICATION FORM

Please check the appropriate boxes for purpose of submittal:

AIR TOXICS INVENTORY REPORT (ATIR) — INVENTORY YEAR ______

- [ ] FIRST YEAR'S ATIR
- [ ] UPDATE ATIR

HEALTH RISK ASSESSMENT (HRA) — INVENTORY YEAR 2012

- [ ] INITIAL HRA
- [x] REVISED HRA

Facility name	Carlton Forge Works - Paramount Facility	Company name	Carlton Forge Works
Facility address	7743 Adams Street Paramount, California	Mailing address	7743 Adams Street Paramount, California
SCAQMD Facility ID#	022911	Facility SIC #	3463
Contact Person (Company Official)	Kyle Nelson	Telephone (Contact Person)	562-663-1131

Preparer (if different from above)

Name: Deborah Proctor	Title: Principal Toxicologist
Company: ToxStrategies, Inc.	Telephone: 949-459-1676

I SWEAR UNDER PENALTY OF PERJURY THAT THE DATA SUBMITTED WITH THIS DOCUMENT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, AND CONFORM WITH THE INFORMATION REQUESTED BY THE SCAQMD. I FURTHER ACKNOWLEDGE THAT FAILURE TO SUBMIT THE REQUIRED INFORMATION OR KNOWINGLY SUPPLY FALSE INFORMATION IS SUBJECT TO CIVIL PENALTIES PURSUANT TO THE CALIFORNIA HEALTH AND SAFETY CODE SECTIONS 44381(a) AND 44381(b).

Signature Of Responsible Company Official: [signature] 10/23/14	Date: October 24, 2014
Name Of Responsible Company Official (please print): Kevin Dahlin	Title: Vice President - Carlton Forge Works

South Coast Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4182
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HEALTH RISK ASSESSMENT SUMMARY FORM

(Required in Executive Summary of HRA)

Facility Name : Carlton Forge Works

Facility Address: 7743 Adams Street
Paramount, California 90723

Type of Business: Metal forging

SCAQMD ID No.: 22911

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 70 years)

1. Inventory Reporting Year : 2012
2. Maximum Cancer Risk to Receptors :
   a. Offsite 4.2 in a million Location: UTM 392474.7, 3751005 m
   b. Residence 2.4 in a million Location: UTM 392500, 3751000 m
   c. Worker 0.82 in a million Location: UTM 392300, 3750950 m
3. Substances Accounting for 90% of Cancer Risk: Nickel, hexavalent chromium, arsenic, cadmium

   Processes Accounting for 90% of Cancer Risk: North, central, and south baghouses
4. Estimated Population Exposed to Specific Risk Levels
   a. 1 to <10 in a million 4,247
   b. 10 to <100 in a million 0
   c. 100 to <1000 in a million 0
   d. >=1000 in a million 0
   e. Total >= 1 in a million 4,247
5. Cancer Burden: 0.0013

   Cancer Burden = (cancer risk) x (no. of people exposed to specific cancer risk)
6. Maximum Distance to Edge of 1 x 10^{-6} Cancer Risk Isopleth (meters) 195

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: 0.29 Location: 392500, 3751000 toxicological endpoint: Respiratory
   b. Worker HI : 0.36 Location: 392300, 3750950 toxicological endpoint: Respiratory
2. Substances Accounting for 90% of Chronic Hazard Index: Nickel as nickel oxide, arsenic
3. Maximum Acute Hazard Index:
   PMI: 1.82 Location: 392474.7, 3751005 toxicological endpoint: Immune system
4. Substances Accounting for 90% of Acute Hazard Index: Nickel

*Provide Tables listing contribution of each substance to Maximum Cancer Risk, Acute HI, and Chronic HI.

Revised AB2588 Human Health Risk Assessment Carlton Forge Works
(SCAQMD Facility ID No. 22911)

OCTOBER 28, 2014

ToxStrategies

Innovative solutions
Sound science

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AB2588 Human Health Risk Assessment Carlton Forge Works (SCAQMD Facility ID No. 22911)

OCTOBER 28, 2014

PREPARED FOR:
Carlton Forge Works
7743 Adams Street
Paramount, California

PREPARED BY:
ToxStrategies, Inc.
20532 El Toro Road
Suite 206
Mission Viejo, California

Deborah Proctor

Deborah Proctor
Principal Health Scientist

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Definitions and Abbreviations

Definitions

Acute health effects – A health effect that occurs after a relatively short period of exposure (e.g., minutes or hours).

Adverse health effect – A health effect from exposure to air contaminants that may range from relatively mild temporary conditions, such as eye or throat irritation, shortness of breath, or headaches, to permanent and serious conditions, such as birth defects, cancer or damage to lungs, nerves, liver, heart or other organs.

Cancer burden - The estimated number of theoretical cancer cases in a defined population resulting from lifetime exposure to pollutants emitted from a facility.

Cancer potency factor (CPF) – The theoretical upper bound probability of extra cancer cases occurring in an exposed population assuming a lifetime exposure to the chemical when the chemical dose is expressed in exposure units of milligrams/kilogram-day (mg/kg-day).

Carcinogenic risk – A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Centroid locations – The location at which calculated ambient concentration is assumed to represent the entire subarea, typically the geographic centroid of an area.

Chronic health effects – An adverse non-cancer health effect that develops and persists (e.g., months or years) over time after long-term exposure to a substance.

Dispersion Factor (X/Q) – A site-specific quantity defined as a ratio of the ground level concentration in air ($\mu g/m^3$) to the mass emission rate (g/s).

Daily Dose – A calculated amount of a substance estimated to be received by the subject as a result of exposure expressed in terms of chemical mass per unit body weight (mg/kg-day).

Exposure pathway – A route of exposure by which xenobiotics enter the human body (e.g., inhalation, ingestion, dermal absorption).

Fugitive Emissions – Emissions not caught by a capture system, which are often due to equipment leaks, evaporative processes and windblown disturbances.

Hazard Identification – The process of determining whether exposure to an agent can cause an increase in the incidence of an adverse health effect including cancer.

Hazard index – The sum of individual acute or chronic hazard quotients (HQs) for each substance affecting a particular toxicological endpoint.

Hazard quotient – The estimated ground level concentration divided by the reference exposure level of a single substance for a particular endpoint.

Individual excess cancer risk – The theoretical probability of an individual person developing cancer as a result of lifetime exposure to carcinogenic substances. The individual excess cancer risk is calculated by summing the potential cancer risks due to both inhalation and noninhalation routes of exposure.

Inhalation unit risk factor – The theoretical upper bound probability of extra cancer cases occurring in the exposed population assuming a lifetime exposure to the chemical when the air concentration is expressed in exposure units of per microgram/cubic meter $(\mu g/m^3)^{-1}$

Isopleth – A line on a map connecting points of equal value (e.g., risk, concentration)

Noncarcinogenic effects – Noncancer health effects, which may include birth defects, organ damage, irritation, morbidity or death.

Reference exposure level – The REL is an exposure level at or below which noncancer adverse health effects are not anticipated to occur in a human population. The REL is expressed in units of $\mu g/m^3$.

Sensitive receptor – A location such as a hospital or daycare center where the human occupants are considered to be more sensitive to pollutants than "average".

Zone of impact – area within which the cancer risk exceeds one in one million ($1x10^{-6}$) or a hazard index greater than 0.5.

Abbreviations

AB2588 – Assembly Bill 2588

AC – air conditioning

ARB – California Air Resources Board

ATIR – Air Toxics Inventory Report

Cal/EPA – California Environmental Protection Agency

CAS No. – Chemical Abstract Services Registry Number (CAS)

CFW – Carlton Forge Works

CSF – cancer slope factor

DEM – digital elevation model

GLC – ground level concentration

HARP – Hot Spots Analysis and Reporting Program

HRA – health risk assessment

HI – hazard index

HQ – hazard quotient

MEIR – maximum exposed individual resident

MEIW – maximum exposed individual worker

MICR – maximum individual cancer risk

mg/kg-day – milligrams per kilogram per day

$\mu g/m^3$ – microgram per cubic meter

OEHHA – Office of Environmental Health Hazard Assessment

PMI – point of maximum impact

REL – reference exposure level

SCAQMD – South Coast Air Quality Management District

RfD – reference dose

RRP – Risk Reduction Plan

URF – unit risk factor

UTM – universal transverse mercator

ZOI – zone of impact

Executive Summary

In accordance with the California Air Toxics "Hot Spots" Act (AB 2588), this report presents the Revised AB2588 Health Risk Assessment (Revised AB2588 HRA) for the Carlton Forge Works (CFW) Facility. CFW is located at 7743 Adams Street in Paramount, California (SCAQMD Facility ID No. 22911). In a letter dated March 21, 2014 and received on March 24, 2014, the South Coast Air Quality Management District (SCAQMD) requested that CFW prepare an AB2588 HRA within 150 days of receipt of the letter. An Air Toxics Inventory Report (ATIR) for the facility has been prepared, and the most current update, submitted August 6, 2014, included revisions based on comments by SCAQMD. The AB2588 HRA for CFW was submitted on August 18, 2014. In the AB2588 HRA, building downwash calculations inadvertently were not included for point sources. This Revised AB2588 HRA is being submitted to include the updated air dispersion modeling, which includes building downwash calculations.

CFW produces seamless rolled rings and open die forgings for the aerospace, gas turbine, industrial, commercial, and nuclear industries using carbon and alloy steels, aluminum, titanium, nickel, cobalt, chromium and other high-temperature metals. The process requires heating metal to allow it to be forged through mechanical pressure into rings or other specified forms. The parts may be sent to grinding during or after the forging process to remove sharp edges or cracks. Grinding generates metal dust in the form of alloys from operations in the grind building; emissions from these operations are captured and passed through one of three baghouses that have 99.5% control efficiency. The grind building has been verified as a permanent total enclosure using EPA Method 204.

This HRA report has been prepared using the guidelines and tools for AB2588 HRAs published by California regulatory agencies. The goals for the Air Toxics "Hot Spots" Act are to collect emission data, to identify facilities having localized impacts, to ascertain health risks, to notify nearby residents of significant risks, and to reduce those significant risks to acceptable levels. As such, all emissions of AB2588-listed chemicals have been quantified in the ATIR; the subset of these AB2588-listed chemicals for which toxicity criteria are available are included in this HRA. The annual average and maximum hourly emission rates for the AB2588 HRA chemicals emitted by CFW are presented in Table ES-1. These emissions were modeled using the Environmental Protection Agency's AERMOD air dispersion model (version 14134), using detailed information about the facility emission sources and local meteorological data collected by SCAQMD in Compton, CA.

The air dispersion model was used to predict annual average and maximum one-hour airborne concentrations of the chemicals emitted by CFW for the surrounding area. Exposures to CFW emissions at specific receptors located in the area surrounding CFW were quantified. The receptors evaluated in this HRA include 1) fence line receptors surrounding the facility properties, 2) grid receptors located at 50-meter spacing extending 1 kilometer from the site in all direction, and at 100 meter spacing at greater distance from the site, 3) sensitive receptors (i.e., the locations of schools, hospitals, day care centers), and 4) census tract receptors located at the centroid of census tracts in the area surrounding the facility.

The HRA was prepared using the Hotspots Analysis and Reporting Program (HARP) as required by SCAQMD (version 1.4f). All chemicals were evaluated for inhalation exposures. Multi-pathway chemicals are those for which exposure must be assessed by other exposures pathways in addition to inhalation. Chemicals emitted by CFW that are considered multi-pathway chemicals are arsenic, cadmium, hexavalent chromium, lead and nickel.

Given the urban development surrounding the facility, the following exposure pathways were considered relevant for residential exposure in this HRA:

- Inhalation
- Dermal absorption
- Soil ingestion
- Ingestion of home-grown produce

Ingestion of mothers' milk also could have been a complete exposure pathway, but the chemicals emitted from the facility do not concentrate in mothers' milk. For worker exposure scenarios, these same exposure pathways were considered with the exception of ingestion of homegrown produce. Exposure pathways for emitted chemicals are summarized on Table ES-2.

OEHHA has developed toxicity criteria specifically for use in AB2588 HRAs that quantify the relationship between exposure to a chemical and incidence of an adverse health effect in potentially exposed populations (OEHHA, 2014). Toxicity criteria for chemicals that are categorized as carcinogens are called unit risk factors (URFs) for inhalation exposure [expressed in units of inverse micrograms per cubic meter $(\mu g/m^3)^{-1}$] and oral cancer slope factors (CSF_O) for oral and other exposure pathways (expressed in units of inverse milligrams per kilogram per day $[mg/kg\text{-}day]^{-1}$). Examples of non-inhalation exposure pathways relevant to CFW include soil ingestion and dermal contact. Toxicity criteria for noncarcinogenic health effects are called reference exposure levels (RELs) expressed in units of $\mu g/m^3$ for inhalation exposures and oral RELs in units of mg/kg-day for oral exposures. Oral RELs are also referred to as oral reference doses (RfDs). While cancer risk is assumed to be cumulative across all chemicals, chronic and acute health effects are specific to target organs or systems. Table ES-3 presents the target organ systems evaluated in AB2588 HRAs and those relevant to chemicals emitted from CFW.

The results of the exposure assessment and toxicity criteria were used to calculate three different health effects measures: the theoretical lifetime excess cancer risk, the acute hazard index, and the chronic hazard index for each receptor by chemical and by source, and for all chemicals and all sources combined. From these results, the health risk measures for maximum exposed individual resident (MEIR), maximum exposed individual worker (MEIW), and the point of maximum impact (PMI) were identified, as well as the zone of impact (ZOI)—which is the area within which the total excess lifetime cancer risk for a residential exposure scenario is greater than or equal to one in a million (10^{-6}), or an acute or chronic hazard index is greater than or equal to 0.5.

The acute hazard index, chronic hazard index and theoretical excess cancer risk for the MEIR, MEIW and PMI, as well as the locations of these receptors, are provided in Table ES-4 and shown on Figure ES-1. The results are summarized below:

- The maximum acute hazard indices are 1.11 for the MEIR, 1.01 for the MEIW, and 1.82 for the PMI (Tables ES-4; ES-5). The target organ/system with the highest acute hazard index is the immune system.
- The maximum chronic hazard indices are 0.29 for the MEIR, 0.36 for the MEIW, and 0.54 for the PMI (Tables ES-4; ES-6). The target organ/system with the highest chronic hazard index is the respiratory system.
- The maximum excess cancer risk is 2.4×10^{-6} for the MEIR, 8.2×10^{-7} for the MEIW, and 4.2×10^{-6} for the PMI (Table ES-4; ES-7).

Based on the results of the HRA, no remedial measures are required nor is public notice required based on chronic noncancer risk or cancer risk. Public notification is required if the acute or chronic hazard index at a MEIR or MEIW exceeds 1.0 (0.5 for lead) or if the excess cancer risk exceeds 1.0×10^{-5}, and remedial measures are required if the hazard indices exceed 3.0 or if the excess cancer risk exceeds 2.5×10^{-5}. The calculated chronic non-cancer hazard indices and cancer risk at the MEIR, MEIW, and PMI do not exceed the public notification levels (i.e., calculated cancer risk greater than 10^{-5}, hazard index greater than 0.5 for lead or 1.0 for all other chemicals). The acute hazard index for the MEIR (1.11), and the PMI (1.82) slightly exceed the public notification level of 1.0. The acute hazard index for the MEIW (1.01) is essentially at the public notification level and would not trigger notification. The geographical area in which the acute hazard index is greater than 1.0 is a small area, encompassing a very limited number of buildings immediately across the street to the east and west from CFW (Figure ES-1). Only residents living in this limited area would require notification. It should be noted that acute health effects are evaluated based on the maximum off-site concentration in a single hour over the 3-year modeling period and are not representative of long-term conditions.

The ZOIs for acute hazard index and lifetime excess cancer risk are presented in Figure ES-1. The ZOI for lifetime excess cancer risk extends further than the ZOI for the acute hazard index; it is approximately 0.3 miles north to south and 0.3 miles east to west, most of which is over the CFW facility. The ZOI is contained within a single census tract. The estimated cancer burden, which is the cancer risk at the census tract centroid in the ZOI (3.03×10^{-7}) multiplied by the census tract population (4,247), is 1.3×10^{-3}. This value is far less than the risk reduction requirement level of 0.5 (or 5×10^{-1}). No sensitive receptors were located within the ZOI.

In summary, the results of this HRA indicate that the cancer and non-cancer (acute and chronic) health effect measures estimated for air emissions from CFW are below the risk reduction levels that require remedial action. Therefore, a risk reduction plan and remedial actions are not required. CFW's short-term emissions do result in the acute hazard index exceeding the public notice threshold and so public notification is required.

Nickel contributes most significantly to the calculated chronic and acute hazard indices, as well as the increased cancer risk (Tables ES-5, ES-6 and ES-7). CFW emits nickel from the baghouses venting the grinding operations (Sources 163, 231, 232, and 233). The forms of nickel emitted from CFW are thought to be in the form of nickel alloys (e.g., stainless steel) and nickel oxide. Nickel in alloy matrices is highly insoluble and nickel ions are not readily released for absorption from this matrix. As such, the bioaccessibility of nickel in alloys is highly limited (Hillwalker and Anderson, 2014). It is noteworthy that the OEHHA toxicity criteria used for assessing the acute hazard quotient and increased cancer risk for nickel are based on forms of nickel that are expected to be of greater bioavailability and toxicity than the nickel alloys emitted by CFW. The nickel acute reference exposure level (REL) is based on nickel chloride (OEHHA 2012), and the nickel inhalation unit risk factor is based on workers exposed to nickel refinery dust in the nickel refining industry (OEHHA 2009). These forms of nickel are more toxic and more bioavailable than nickel bound in an alloy matrix. As such, the acute hazards and cancer risk estimates presented in this HRA are thought to be over estimated.

Executive Summary Tables and Figures

Table ES-1. Summary of Maximum Hourly and Annual Average Emissions of AB2588-listed Substances

Substance	CAS #	Annual Emissions (lb/yr)	Annual Emissions (g/s)	Maximum Hourly Emissions (lb/hr)	Maximum Hourly Emissions (g/s)
Acetaldehyde	75070	2.65E+00	3.81E-05	3.27E-04	4.12E-05
Acrolein	107028	1.66E+00	2.39E-05	2.05E-04	2.59E-05
Ammonia	7664417	1.97E+03	2.84E-02	2.43E-01	3.07E-02
Arsenic	1016	1.29E-01	1.85E-06	2.57E-05	3.24E-06
Benzene	71432	4.93E+00	7.09E-05	6.08E-04	7.67E-05
Cadmium	7440439	2.59E-01	3.72E-06	5.05E-05	6.37E-06
Copper	7440508	4.63E+00	6.65E-05	9.06E-04	1.14E-04
Ethyl Benzene	100414	2.99E+01	4.30E-04	1.03E-02	1.30E-03
Formaldehyde	50000	1.05E+01	1.51E-04	1.29E-03	1.63E-04
Hexane	110543	3.88E+00	5.59E-05	4.79E-04	6.04E-05
Hexavalent Chromium	18540299	1.85E-02	2.66E-07	3.59E-06	4.53E-07
Lead	1128	2.61E+00	3.76E-05	5.11E-04	6.44E-05
Manganese	7439965	6.29E+00	9.05E-05	1.23E-03	1.54E-04
Methanol	67561	4.50E-01	4.31E-06	1.80E-04	2.27E-05
Naphthalene	91203	1.85E-01	2.66E-06	2.28E-05	2.88E-06
Nickel	7440020	3.03E+01	4.36E-04	5.90E-03	7.43E-04
Silica, crystalline	1175	1.94E+00	2.79E-05	6.96E-04	8.77E-05
Toluene	108883	2.26E+01	3.25E-04	2.78E-03	3.51E-04
Xylene	1330207	6.49E+01	9.33E-04	2.13E-02	2.68E-03

Abbreviations:
lb/yr = pounds per year
lb/hr = pounds per hour
g/s = grams per second

Table ES-2. Exposure Pathways of Emitted Substances

Substance	CAS #	Exposure Pathway				
		Dermal	Home-Grown Produce	Inhalation	Mothers' milk	Soil ingestion
Acetaldehyde	75070	--	--	X	--	--
Acrolein	107028	--	--	X	--	--
Ammonia	7664417	--	--	X	--	--
Arsenic	1016	X	X	X	--	X
Benzene	71432	--	--	X	--	--
Cadmium	7440439	X	X	X	--	X
Chromium, hexavalent	18540299	X	X	X	--	X
Copper	7440508	--	--	X	--	--
Ethyl benzene	100414	--	--	X	--	--
Formaldehyde	50000	--	--	X	--	--
Hexane	110543	--	--	X	--	--
Lead	1128	X	X	X	--	X
Manganese	7439965	--	--	X	--	--
Methanol	67561	--	--	X	--	--
Naphthalene	91203	--	--	X	--	--
Nickel	7440020	X	X	X	--	X
Silica, crystalline	1175	--	--	X	--	--
Toluene	108883	--	--	X	--	--
Xylenes	1330207	--	--	X	--	--

-- = not applicable

Table ES-3. Target Organ Systems Evaluated for Acute and Chronic Health Effects

Substance	CAS #	Target Organ System												
		Bones	Cardio-vascular	Central Nervous System	Develop-mental	Endocrine	Eyes	Gastro-intestinal & Liver	Hematologic	Immune System	Kidneys	Reproductive	Respiratory	Skin
Acetaldehyde	75070	--	--	--	--	--	A	--	--	--	--	--	A C	--
Acrolein	107028	--	--	--	--	--	A	--	--	--	--	--	A C	--
Ammonia	7664417	--	--	--	--	--	A	--	--	--	--	--	A C	--
Arsenic	1016	--	A C	A C	A C	--	--	--	--	--	--	A C	C	C
Benzene	71432	--	--	--	A	--	--	--	A C	A	--	A	--	--
Cadmium	7440439	--	--	--	--	--	--	--	--	--	C	--	C	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	--	--	--	--	C	--
Copper	7440508	--	--	--	--	--	--	--	--	--	--	--	A	--
Ethyl Benzene	100414	--	--	--	C	C	--	C	--	--	C	C	--	--
Formaldehyde	50000	--	--	--	--	--	A	--	--	--	--	--	C	--
Hexane	110543	--	--	C	--	--	--	--	--	--	--	--	--	--
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439965	--	--	C	--	--	--	--	--	--	--	--	--	--
Methanol	67561	--	--	A	C	--	--	--	--	--	--	C	--	--
Naphthalene	91203	--	--	--	--	--	--	--	--	--	--	--	C	--
Nickel	7440020	--	--	--	--	--	--	--	C	A	--	--	C	--
Silica, crystalline	1175	--	--	--	--	--	--	--	--	--	--	--	C	--
Toluene	108883	--	--	A C	A C	--	A	--	--	--	--	A C	A C	--
Xylenes	1330207	--	--	A C	--	--	A C	--	--	--	--	--	A C	--

Abbreviations:
A = acute exposures evaluated for this target organ system
C = chronic exposures evaluated for this target organ system
-- = not applicable

Table ES-4. Cancer Risk, Acute and Chronic Hazard Indices and Locations for the MEIR, MEIW and PMI

Location	Potential Health Effects	Value	Receptor ID	UTM E (m)	UTM N (m)
Maximum exposed individual resident (MEIR)	Chronic non-carcinogenic hazard index	0.29	1046	392500	3751000
	Acute non-carcinogenic hazard index	1.11	1046	392500	3751000
	Cancer risk	2.4E-06	1046	392500	3751000
Maximum exposed indvidual worker (MEIW)	Chronic non-carcinogenic hazard index	0.36	1006	392300	3750950
	Acute non-carcinogenic hazard index	1.01	1085	392300	3751050
	Cancer risk	8.2E-07	1006	392300	3750950
Off-site point of maximum impact (PMI)	Chronic non-carcinogenic hazard index	0.54	32	392336.9	3751006
	Acute non-carcinogenic hazard index	1.82	109	392474.7	3751005
	Cancer risk	4.2E-06	32	392336.9	3751006

Table ES-5. Chemical-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI

Substance	CAS #	Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)		Maximum Exposed Individual Worker (Receptor 1085; 392300, 3751050)		Point of Maximum Impact (Receptor 109; 392474.7, 3751005)	
		Immune System	Percent Contribution to Immune System	Immune System	Percent Contribution to Immune System	Immune System	Percent Contribution to Hazard Index
Acetaldehyde	75070	--	--	--	--	--	--
Acrolein	107028	--	--	--	--	--	--
Ammonia	7664417	--	--	--	--	--	--
Arsenic	1016	--	--	--	--	--	--
Benzene	71432	3.7E-04	0.03%	6.1E-04	0.06%	4.2E-04	0.02%
Cadmium	7440439	--	--	--	--	--	--
Copper	7440508	--	--	--	--	--	--
Ethyl benzene	100414	--	--	--	--	--	--
Formaldehyde	50000	--	--	--	--	--	--
Hexane	110543	--	--	--	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--
Lead	1128	--	--	--	--	--	--
Manganese	7439965	--	--	--	--	--	--
Methanol	67561	--	--	--	--	--	--
Naphthalene	91203	--	--	--	--	--	--
Nickel	7440020	1.11E+00	100.0%	1.01E+00	100.0%	1.82E+00	100.0%
Silica, crystalline	1175	--	--	--	--	--	--
Toluene	108883	--	--	--	--	--	--
Xylenes	1330207	--	--	--	--	--	--
Total		1.11E+00	100%	1.01E+00	100%	1.82E+00	100%

-- = not applicable

Table ES-6. Chemical-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI

Substance	CAS #	Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)		Maximum Exposed Indvidual Worker (Receptor 1006; 392300, 3750950)		Point of Maximum Impact (Receptor 32; 392336.9, 3751006)	
		Respira-tory	**Percent Contribution to Respiratory Hazard Index**	**Respira-tory**	**Percent Contribution to Respiratory Hazard Index**	**Respira-tory**	**Percent Contribution to Respiratory Hazard Index**
Acetaldehyde	75070	5.4E-06	0.002%	4.3E-06	0.001%	7.1E-06	0.0013%
Acrolein	107028	1.4E-03	0.5%	1.1E-03	0.3%	1.8E-03	0.3%
Ammonia	7664417	2.8E-03	1.0%	2.2E-03	0.6%	3.7E-03	0.7%
Arsenic	1016	5.6E-02	19.3%	6.1E-02	16.8%	1.0E-01	18.8%
Benzene	71432	--	--	--	--	--	--
Cadmium	7440439	2.1E-03	0.7%	2.6E-03	0.7%	3.8E-03	0.7%
Copper	7440508	--	--	--	--	--	--
Ethyl benzene	100414	--	--	--	--	--	--
Formaldehyde	50000	3.3E-04	0.1%	2.7E-04	0.1%	4.4E-04	0.1%
Hexane	110543	--	--	--	--	--	--
Chromium, hexavalent	18540299	1.5E-05	0.005%	1.8E-05	0.005%	2.5E-05	0.005%
Lead	1128	--	--	--	--	--	--
Manganese	7439965	--	--	--	--	--	--
Methanol	67561	--	--	--	--	--	--
Naphthalene	91203	5.8E-06	0.002%	4.7E-06	0.001%	7.7E-06	0.001%
Nickel oxide	1313991	2.3E-01	78.4%	3.0E-01	81.5%	4.3E-01	79.4%
Silica, crystalline	1175	2.6E-04	0.1%	2.0E-04	0.1%	3.1E-04	0.1%
Toluene	108883	2.1E-05	0.007%	1.7E-05	0.0%	2.8E-05	0.01%
Xylenes	1330207	1.3E-04	0.04%	3.8E-05	0.0%	7.4E-05	0.01%
Total		2.9E-01	100%	3.6E-01	100%	5.4E-01	100%

-- = not applicable

Table ES-7. Chemical-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI

Substance	CAS #	Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)		Maximum Exposed Indvidual Worker (Receptor 1006; 392300, 3750950)		Point of Maximum Impact (Receptor 32; 392336.9, 3751006)	
		Total	Percent Contribution to Cancer Risk	Total	Percent Contribution to Cancer Risk	Total	Percent Contribution to Cancer Risk
Acetaldehyde	75070	2.2E-09	0.09%	4.8E-10	0.06%	2.9E-09	0.07%
Acrolein	107028	--	--	--	--	--	--
Ammonia	7664417	--	--	--	--	--	--
Arsenic	1016	3.5E-07	14.8%	1.5E-07	17.7%	6.3E-07	15.1%
Benzene	71432	4.1E-08	1.7%	9.0E-09	1.1%	5.4E-08	1.3%
Cadmium	7440439	1.8E-07	7.6%	6.3E-08	7.7%	3.3E-07	7.9%
Copper	7440508	--	--	--	--	--	--
Ethyl benzene	100414	1.1E-07	4.6%	8.8E-09	1.1%	6.3E-08	1.5%
Formaldehyde	50000	1.8E-08	0.8%	4.0E-09	0.5%	2.4E-08	0.6%
Hexane	110543	--	--	--	--	--	--
Hexavalent chromium	18540299	4.4E-07	18.6%	1.5E-07	18.3%	7.6E-07	18.1%
Lead	1128	2.1E-08	0.9%	8.1E-09	1.0%	3.8E-08	0.9%
Manganese	7439965	--	--	--	--	--	--
Methanol	67561	--	--	--	--	--	--
Naphthalene	91203	1.8E-09	0.08%	4.0E-10	0.05%	2.4E-09	0.06%
Nickel	7440020	1.2E-06	50.8%	4.3E-07	52.6%	2.3E-06	54.5%
Silica, crystalline	1175	--	--	--	--	--	--
Toluene	108883	--	--	--	--	--	--
Xylenes	1330207	--	--	--	--	--	--
Total		2.4E-06	100%	8.2E-07	100%	4.2E-06	100%

-- = not applicable

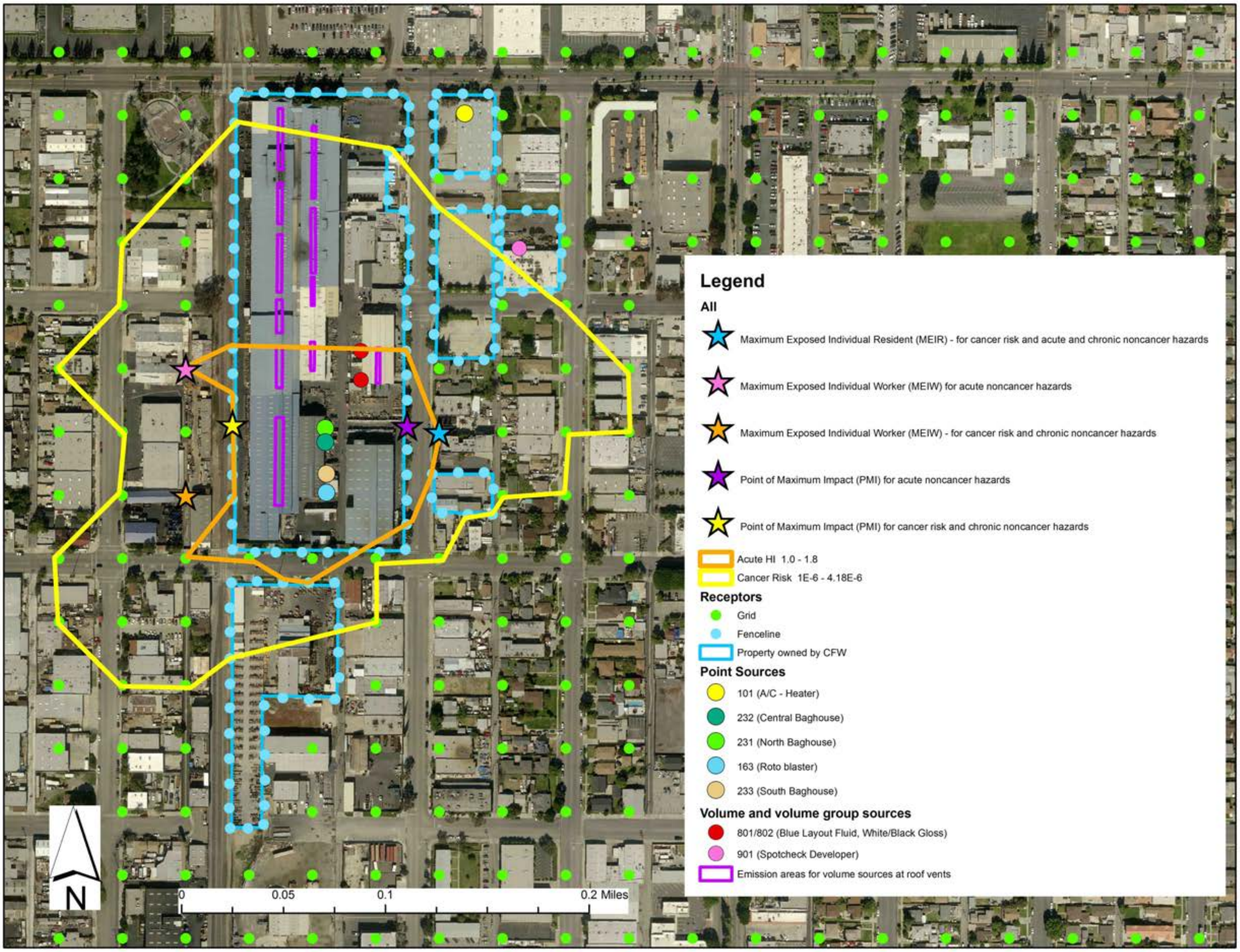

Figure ES-1. Predicted Zones of Impact and Key Receptors with Sources and Nearby Receptors Included in the Air Dispersion Model

1 Introduction

On behalf of Carlton Forge Works (CFW), ToxStrategies, Inc. (ToxStrategies) has prepared this Revised AB2588 health risk assessment (Revised AB2588 HRA) for the CFW facility located at 7743 Adams Street in Paramount, California (SCAQMD Facility ID No. 22911). In a letter dated March 21, 2014 and received by CFW on March 24, 2014, the South Coast Air Quality Management District (SCAQMD) requested that CFW prepare an AB2588 HRA within 150 days of receipt of the letter. The AB2588 HRA for CFW was submitted on August 18, 2014. In the AB2588 HRA, building downwash calculations inadvertently were not included for point sources. This Revised AB2588 HRA is being submitted to include the updated air dispersion modeling, which includes building downwash calculations.

An AB2588[1] HRA is an evaluation of potential off-site health risks associated with airborne emissions from an industrial facility. This Revised AB2588 HRA evaluates whether emissions from CFW may result in off-site exposures subject to notification or risk reduction requirements, and if so, where notification or risk reduction would be required. As described in detail in this document, the potential health effect measures calculated using the AB2588 program HRA guidelines trigger the requirement for notification, but do not trigger the requirements for a risk reduction plan.

This HRA report has been prepared using the guidelines and tools for AB2588 HRAs published by California regulatory agencies, including:

- Office of Environmental Health Hazard Assessment (OEHHA) Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessment (OEHHA, 2003),
- SCAQMD's Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (AB2588) (SCAQMD, 2011), and
- Air Resources Board's Hot Spots Analysis Reporting Program (HARP) developed by the California Air Resources Board (ARB, 2003b).

1.1 Overview of Facility Operations

CFW produces seamless rolled rings and open die forgings for the aerospace, gas turbine, industrial, commercial, and nuclear industries using carbon and alloy steels, aluminum, titanium, nickel, cobalt, chromium and other high-temperature metals. CFW primarily manufactures rolled rings by open-die forging and some forged parts by closed-die

[1] The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, 1987, Connelly) was enacted in 1987, and requires stationary sources to report the types and quantities of certain substances routinely released into the air. The goals of the Air Toxics "Hot Spots" Act are to collect emission data, to identify facilities having localized impacts, to ascertain health risks, to notify nearby residents of significant risks, and to reduce those significant risks to acceptable levels. (ARB, 2014)

forging. CFW receives the alloys and cuts them to the correct weight. After cutting the parts, they are sent to grinding to remove sharp edges. The process requires heating the metals to allow the metal to be formed into rings or other specified forms required by CFW's customers, but the metal is not melted or poured. Once the parts are heated to the appropriate temperature, they are forged into the desired shape. The parts may be sent to grinding during or after the forging process to remove sharp edges or cracks that might develop. After the final forging process, the parts are sent off site for various post-processing operations. The parts are then inspected and shipped to the customer. Grinding generates metal dust at 25 grinding booths in the grind building; emissions from these operations are captured and passed through one of three baghouses that have 99.5% control efficiency. The grind building has been verified to be a permanent total enclosure using EPA Method 204.

1.2 Health Risk Assessment Format and Definitions

HRAs involve a four-step process, which includes hazard identification, dose-response assessment, exposure assessment, and risk characterization. These four steps as incorporated into the AB2588 HRA process are described as follows:

- Hazard identification – Identify whether a potential hazard exists based on the air emissions from a facility. A specific list of chemical emissions has been developed for which potential human health risks are evaluated in an AB2588 HRA. The determination as to whether an AB2588 HRA is required is based on exceeding general emission thresholds and/or at the request of the local air district. The hazard identification for CFW is discussed in Section 2.0.
- Dose-response assessment – Quantify the relationship between exposure to a chemical and incidence of an adverse health effect in potentially exposed populations. OEHHA has developed toxicity criteria that describe the relationship between exposure and potential health effects specifically for use in AB2588 HRAs. The dose-response assessment also is discussed in Section 2.0.
- Exposure assessment – Estimate the extent of public exposure to each substance for which potential cancer risk or acute and chronic noncancer effects will be evaluated. The exposure assessment is specific to the types of chemicals emitted from the facility and the land use around the facility and requires use of an air dispersion model to predict airborne concentrations beyond the facility. The exposure assessment for CFW is discussed in Section 3.0.
- Risk characterization – Characterize the potential for adverse health effects based on the results of the dose-response and exposure assessments. In an AB2588 HRA, potential carcinogenic, acute noncarcinogenic, and chronic noncarcinogenic health effects are quantified and reported. Potential cancer risk estimates quantify the theoretical probability of getting cancer over a lifetime. Potential noncancer health effects range from mild temporary conditions, such as eye or throat irritations, to permanent and serious conditions, such as birth defects or damage to lungs, nerves, etc. Acute noncarcinogenic effects are associated with short-term

exposure, and chronic noncarcinogenic effects are associated with long-term exposure. The risk characterization for CFW is summarized in Section 4.0.

1.3 Significance Criteria and Notification Levels

Under the AB2588 program, the operator of a facility must provide notice to all exposed persons if the facility's HRA indicates that the facility's air toxic emissions result in predicted health risks greater than or equal to any of the following:

- 1 in 100,000 (1×10^{-5}) maximum individual (lifetime) cancer risk (MICR)
- 1.0 acute or chronic hazard index (0.5 for lead)

The facility is also required to develop a risk reduction plan to implement risk reduction measures if the emissions from the facility cause an exceedance of any of the following risk reduction (action) levels:

- MICR of 25 in 1,000,000 (2.5×10^{-5}),
- Cancer burden of 0.5, or
- Total acute or chronic hazard index of 3.0

Separate from the AB2588 program, SCAQMD's Rule 1402 establishes the following significant risk levels:

- MICR of 100 in 1,000,000 (1×10^{-4}), or
- Total acute or chronic hazard index of five (5.0) for any target organ system at any receptor location.

Under Rule 1402, facilities with potential health effects above the significant risk levels are required to successfully implement risk reduction measures within 3 years. Facilities with potential health effects below the significant risk levels, but above the risk reduction (action) levels, may request an extension of up to 2 years to implement risk reduction measures.

2 Hazard Identification and Dose Response Assessment

CFW has prepared an air toxics inventory report (ATIR) documenting which chemicals are emitted from the various processes at the facility (Appendix A). Associates Environmental on behalf of CFW submitted an initial ATIR on February 4, 2014. SCAQMD provided comments to the ATIR in a letter dated March 21, 2014. Associates Environmental on behalf of CFW submitted a revised ATIR on May 28, 2014. Following a conference call on July 3, 2014 among representatives of SCAQMD and ToxStrategies to verify that questions raised by SCAQMD in the March 21, 2014 letter were resolved, a second revised ATIR was submitted on August 6, 2014 (Associates Environmental, 2014). Of the chemicals emitted by CFW as listed in the ATIR, 19 are required to be included in an AB2588 HRA based on the hazard identification for the AB2588 program. Table 1 provides a listing of the chemicals emitted by the facility that are required to be evaluated under the AB2588 program. This section discusses the operations that use listed chemicals, emissions from those operations, and the dose-response assessment for these chemicals.

2.1 Description of General Operations Resulting in Air Emissions

There are five types of operations resulting in emissions of AB2588-listed chemicals at the CFW facility:

- Metal grinding operations
- Combustion of natural gas at the furnaces and at a air conditioning/heating unit
- Developers used during part inspection
- Limited spray painting to label parts
- Application of metal working fluids and other products to reduce wear on metal dies

The facility operates a grinding room with various grinders (hand-held, stationary) that generate metal dust emissions. The metal emissions are captured by 25 grinding booths, which are vented to three baghouses connected to three independent stacks located along the eastern side of the grind building (Figure 1A and 1B). The grinding building is a certified permanent total enclosure as assessed by EPA Method 204. A fourth grinding operation, referred to as abrasive rotoblasting, also operates in this area but is on the southern end of the grinding building. Emissions from the grinding sources are discussed in section 2.2.1.

There are 65 larger furnaces and several smaller furnaces located throughout the forge building at the facility. These furnaces use natural gas as a combustion source to create the heat used to soften metal for the forging process. The byproducts of natural gas combustion, including benzene and naphthalene, are included in the ATIR for these sources. One other combustion source is the furnace used as part of the air conditioning (AC)/heating system at the QA/QC building. This source was modeled as an independent point source at that location.

Additional releases of AB2588 listed chemicals occur when small amounts of developers, spray labeling coatings, and metal working fluids are used. Associates Environmental has obtained the MSDS sheets for these substances, and has included all AB2588-listed substances in the ATIR (Appendix A).

2.2 Sources and Emission Estimates

Table 2 presents a summary of the maximum hourly and annual average emissions for all sources at the facility. The emissions from the grinding operations and use of Thermex 8191 were measured during emissions tests; emissions from other sources were estimated based on product usage (Appendix A). This section provides a brief characterization of each of the sources. Figure 1A presents the locations of each source. Table 3A, 3B and 3C summarize source characteristics relevant to air dispersion modeling. Tables 4A and 4B summarize maximum hourly emissions in pounds per hour and grams per second, respectively. Tables 4C and 4D summarize annual average emissions in pounds per hour and grams per second, respectively. Emission calculations are provided in the ATIR (Appendix A).

2.2.1 Point Sources

Emissions from five point sources are evaluated in this Revised AB2588 HRA:

- North baghouse at grind building (Source 231)
- Central baghouse at grind building (Source 232)
- South baghouse at grind building (Source 233)
- Rotoblast baghouse at grind building (Source 163)
- AC/Heating system vent (Source 101)

Grinding operations are vented through the north, central and south baghouses, and the rotoblast baghouse. Ferro glass frit, which may include crystalline silica, is used to coat products; when the coating is blasted off the part, those emissions are assumed to contain crystalline silica and vented through the rotoblast baghouse. Developers are used in the vicinity of vents to the central baghouse, and so emissions from the use of developers are assumed to be emitted through the central baghouse. Table 3A summarizes modeling parameters for point sources.

2.2.2 Volume Sources

Three volume sources were modeled at CFW (Table 3B). Two sources (sources 801 and 802) represented doors on the shipping/receiving building where white gloss, black gloss, and blue layout fluid are used. One-third of the total emissions from use of these products are assumed to be emitted through each of the doors, and the final one-third is assumed to be emitted through the roof monitor (see Section 2.2.3). The third volume source is a door on the pottery building where a spot-check developer is used (source 901).

2.2.3 Volume Group Sources

The volume group sources were used to characterize emissions through building roof monitors, which run along the entire roofline of the buildings. The roof of the forge building varies in height along its length as a result of the incremental construction of the building over time. Emissions from combustion and fugitive sources in the forge building (Sources 300 to 309) and from the use of spray coatings at the shipping/receiving building (Source 310) were modeled as grouped volume sources.

In order to capture the spatial distribution of the sources, the forge building roof monitor was divided into ten areas, and each forge was assigned to an area (Table 3C). An eleventh volume group source was used to characterize emissions from the roof monitor on the shipping/receiving building. For the purpose of air dispersion modeling, each of the eleven grouped volume sources was modeled as a series of volume sources, which were then grouped by area in the air dispersion model to produce one result for each area. For example, roof monitor source 300 was composed of 11 volume sources. Table 3C summarizes modeling parameters for volume group sources.

In addition to the forge combustion emissions, Thermex 8191 is applied in the forge building at the three ring rollers (R-50, R-120, and R-180). As described in Appendix I of the ATIR, possible crystalline silica emissions generated through the use of Thermex 8191 were quantified in an emissions simulation conducted by Air Kinetics. Consistent with the locations of the ring rollers in the forge building, the emissions from this application are vented through volume group sources 301, 307 and 308.

Emissions from the use of spray coatings to label parts (white gloss, black gloss, and blue layout fluid) occur from the shipping/receiving building through two doors (Section 2.2.2) and the roof monitor (vent). Emissions from the roof monitor are estimated to be one-third of the total emissions from the use of spray coatings. The other two-thirds are split evenly between the two doors (Section 2.2.2).

2.3 Dose Response Assessment

The quantitative relationships between dose and response for each of the chemicals emitted from the facility have been assessed by the Office of Environmental Health Hazard Assessment (OEHHA) and are quantified as toxicity criteria (OEHHA, 2014). Table 1 presents a summary of the toxicity criteria developed for carcinogenic, chronic noncarcinogenic, and acute health effects.

Toxicity criteria for chemicals that are categorized as carcinogens are called unit risk factors (URFs) for inhalation exposure [expressed in units of inverse micrograms per cubic meter $(\mu g/m^3)^{-1}$] and oral cancer slope factors (CSF_O) for oral and other exposure pathways (expressed in units of inverse milligrams per kilogram per day $[mg/kg\text{-}day]^{-1}$). Examples of non-inhalation exposure pathways relevant to CFW include soil ingestion and dermal contact. Toxicity criteria for noncarcinogenic health effects are called reference exposure levels (RELs) expressed in units of $\mu g/m^3$ for inhalation exposures and oral RELs in units of mg/kg-day for oral exposures. Oral RELs are also referred to as oral reference doses (RfDs). Oral CSFs and RELs were applied to other non-inhalation exposures such as dermal absorption. OEHHA has developed RELs for acute (short-term) and chronic (long-term) exposure scenarios for most of the chemicals of interest for this assessment.

OEHHA has developed inhalation URFs for ten chemicals emitted by CFW, and three are considered to pose a potential cancer risk via non-inhalation exposure pathways (e.g., soil ingestion, dermal contact). These chemicals are arsenic, hexavalent chromium and lead and are called multi-pathway chemicals. OEHHA has developed inhalation chronic RELs for eighteen chemicals, and acute RELs for eleven chemicals (Table 1). Additionally, four noncarcinogenic chemicals are considered to be multi-pathway chemicals. The multi-pathway chemicals for chronic noncarcinogenic health effects are arsenic, cadmium, hexavalent chromium, and nickel.

OEHHA has set chronic inhalation RELs for nickel and nickel compounds and for nickel oxide. The potential toxicity of nickel in metal alloys emitted from CFW is more appropriately related to nickel oxide than the more bioavailable forms used in the toxicity testing for nickel (e.g., nickel sulfate hexahydrate). To assess nickel emissions from CFW based on the toxicity of nickel oxide, the measured emissions of elemental nickel were scaled to account for the additional oxygen molecule in nickel oxide. This nickel oxide emission rate was then used in the Hotspots Analysis and Reporting Program (HARP) (details in Section 4) – instead of the nickel emission rate – so that the nickel oxide toxicity criteria would be correctly applied to the predicted air concentrations. The chronic REL for nickel and nickel compounds is 14 $\mu g/m^3$, and for nickel oxide (measured as nickel) is 20 $\mu g/m^3$. OEHHA has not set an inhalation unit risk, oral REL or acute REL for nickel oxide, so the values developed for nickel and nickel compounds were used for evaluating cancer risk, the potential for acute health effects by inhalation, and chronic effects by non-inhalation exposure pathways.

3 Exposure Assessment

Detailed air dispersion modeling was performed using AERMOD software to estimate the ambient air concentrations of chemicals in the vicinity of the CFW facility. The model included all sources of AB2588-listed substances from the facility. Concentrations were estimated at various receptor points, including fence line receptors (Figure 2B), gridded receptors (Figures 2A and 2B), and a set of discrete receptors representing schools, hospitals, daycare facilities, and census tract centroids (Figure 2C). The domain of the gridded receptors is: 2.3 kilometer to the west, 6.2 kilometer to the east, 1.7 kilometer to the south, and 1.5 kilometer to the north. This domain was established to conservatively capture the ZOI

3.1 Site Characterization

Figure 1A illustrates the CFW facility (SCAQMD ID #22911) and surrounding area. Land use in the immediate vicinity of the facility is primarily commercial/industrial with limited residential use in close proximity to CFW (Figure 1A). Based on an inspection of the Digital Elevation Models, the topography in the area is primarily flat. Aerial photography (2011) was obtained from United States Geological Survey (USGS) Earth Explorer (http://earthexplorer.usgs.gov/).

On-site and off-site building dimensions and heights were provided by CFW on a plot plan. This plot plan was digitized using ArcMap, and UTM coordinates for building corners were obtained. Building coordinate data, along with heights provided on the plot plan were used to run BPIP Prime to obtain a building downwash file. A total of 32 buildings (14 on site and 18 off site) were modeled. Buildings included in the model are presented in Figure 1B.

3.2 Source Parameters

AERMOD utilizes several parameters specific to each emissions source, including:

- Location
- Emission rate
- Stack height
- Stack inner diameter
- Stack exit velocity
- Stack gas temperature

Tables 3A, 3B, and 3C provide the relevant information for each of the source types discussed in Section 2.2: point sources, volume sources and volume group sources. Each source parameter used in the model was provided by CFW, with the exception of emission rate.

Facility operating hours of 108 hours per week were used in the model. These operational hours were obtained from CFW, and operating hours are summarized below.

Day of the week	Hours of operation
Monday	5 am – midnight
Tuesday	midnight to 1 am, 5 am to midnight
Wednesday	midnight to 1 am, 5 am to midnight
Thursday	midnight to 1 am, 5 am to midnight
Friday	midnight to 1 am, 5 am – 9 pm
Saturday	5 am to 1 pm
Sunday	None

Two modeling scenarios and sets of emissions rates were run to calculate maximum hourly and annual average air concentrations. For the maximum hourly scenario, each source was modeled with a unit emission rate. For point sources and single volume sources, 1 g/s was run. For grouped volume sources (i.e., roof monitors) the emission rate was 1/n g/s for each volume source in a group, where n is equal to the total number of volume sources in a group. For this scenario, the model was run for 24-hours per day for 365 days per year.

For the annual average scenario, air dispersion modeling was carried out using the facility schedule outlined above. Over the course of a full 52-week year, this amounts to 5,408 hours. To account for the daily operating schedule, the unit emission rates in AERMOD were scaled by a factor of 1.62 (8,760 total hours divided by 5,408 operational hours per year). A second adjustment was made to account for annual closures for holidays and other periods. The ATIR reports 5200 operating hours per year (including closures). These periods of closure (approximately 2 weeks per year) cannot be accommodated in AERMOD. Emission rates in HARP On-Ramp model were adjusted to address the longer operating period in the air dispersion model (5408 hours compared to 5200 operating hours per year) by increasing the ATIR annual emission rates by a factor of 1.1 (5408 hours /5200 hours). The total annual emission rates appeared higher in HARP than reported in the ATIR, but the grams per second emission rates remained the same.

3.3 Meteorology

AERMOD-ready meteorological data were obtained from the SCAQMD website (http://www.aqmd.gov/home/library/air-quality-data-studies/meteorological-data/aermod-table-1, accessed 7/21/14). The meteorological station located at Compton, CA was chosen because it is just slightly less than 2.5 miles from the CFW facility, and the land use is also urban with a residential/industrial mix. There are no large topographical features between the Compton station and the site. There are three years of meteorology available at this site (2009, 2010, and 2012). Therefore, full period average results (which are used in this assessment to estimate long-term average) represent results averaged over a three-year period of meteorological data.

3.4 Description of Receptors

Receptors are locations at which air concentrations are estimated. Four receptor sets were included in the model:

- Fence line receptors: A receptor spacing of 20 meters was used along the border of the CFW facility, surrounding six non-contiguous parcels comprising the CFW facility (Figure 2B). This information was obtained from the facility plot plan provided by CFW. A total of 131 fence line receptors were modeled.
- Grid receptors: The initial grid receptors were based on a 50 meter grid spacing extending 1 kilometer from the site in all direction (Figure 2A). There were 1,640 receptor nodes in this set (each receptor grid node X and Y coordinate ends in either 50 or 00). Beyond this radius, receptors were chosen with 100 meter spacing extending to the edge of the domain. This extended grid includes 2,560 receptors.
- Sensitive receptors: For an AB2588 HRA, sensitive receptors are schools, hospitals, and day care centers. Sensitive receptors within an approximately 2-mile radius were identified to be included in the modeling domain. Schools were identified from the Paramount and Bellflower school district websites. Daycare centers were identified using the Community Care Licensing Division (CCLD) of the California Department of Social Services website (http://secure.dss.cahwnet.gov/ccld/securenet/ccld_search). Hospitals were identified using Google maps. These sensitive receptors include 20 schools, 6 hospitals, and 57 childcare facilities (Figure 2C).
- Census tract receptors: Census tracts for 2010 census data were obtained from the U.S. Census Bureau TIGER service (https://www.census.gov/geo/maps-data/). These were imported into ESRI ArcMap, and the centroids were determined (geographic centers). There were 81 census tract centroid receptors used in our model (Figure 2C).

In total, air dispersion analysis was performed for 4,495 receptors.

3.5 Terrain Data

Digital elevation models (DEMs) used to determine source and receptor elevation, and receptor hill heights were purchased from Micropath (www.micropath.com). The modeling domain was composed of six DEMs: Los Alamitos, Long Beach, Torrance, Whittier, South Gate, and Inglewood. Of the 4,495 receptors modeled, there were only 12 for which the hill height was greater than the receptor elevation, an indication of flat terrain.

A surface roughness parameter of 0.547 meters was used, following SCAQMD guidelines (http://www.aqmd.gov/home/library/air-quality-data-studies/meteorological-data/aermod-table-2, accessed 7/21/2014). This value is specific to the Compton meteorological station, located less than 2.5 miles from the CFW facility.

3.6 Coordinate System

ToxStrategies used the Universal Transverse Mercator (UTM) system of coordinates (Zone 11), GCS North American Datum (1983) as the location basis for the coordinates of model objects (sources, boundaries, receptors, etc.).

3.7 Air Dispersion Modeling

Air dispersion modeling was conducted using EPA AERMOD air dispersion modeling program for all sources of AB2588 substances at the CFW facility. AERMOD is a steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources and both simple and complex terrain. AERMOD was selected because it is a preferred model by EPA. The most recent version was used (AERMOD – Version 14134).

Per SCAQMD AB2588 guidelines, the following options were selected in the AERMOD model:

- Urban area
- Buoyancy induced dispersion
- Stack tip downwash
- Building downwash
- No gradual plume rise
- No calms processing
- No missing data processing
- No deposition
- Lowbound option not used
- Regulatory default not used

The AERMOD model was run in six batches, covering two emissions scenarios and each of the three types of emission sources: point, volume group (roof vent), and volume sources. Each run modeled all 4,495 receptors. The first emissions scenario, used to compute maximum hourly air concentrations, modeled the facility operating 24 hours per day and 365 days per year over the entire model period. In this case, each emissions source (point, volume, or the collective volume group) was modeled at an emission rate of 1 g/s, operating constantly. The second emissions scenario, used to compute annual average air concentrations, modeled the actual facility-operating schedule. In this case, each emissions source (point, volume, or the collective volume group) was modeled at an emission rate of 1.62 g/s (equal to the 8760 hours per year divided by 5408 hours per year, the modeled operating hours of the facility). Source emission rates were applied to the air modeling results using the HARP model, and resulting air concentrations were calculated for the exposure assessment phase of this health risk assessment (Section 4.0). Air concentrations for key receptors for each chemical are presented in Table 5A for maximum hourly emissions and Table 5B for annual average emissions. Air concentrations for other receptors for maximum hourly and annual average emissions are provided in Appendix B-1 and B-2, respectively. Alternate averaging periods were also run using AERMOD (four-, six-, and eight-hours, and monthly); the results are provided in the electronic files in Appendix D.

4 Health Risk Assessment Modeling

This Revised AB2588 HRA was prepared using HARP as required by SCAQMD. This program uses the estimated emissions rates from the facility and the results of the air dispersion analysis to compute the estimated air concentrations, exposure, and risk at each receptor location for all chemical emissions.

4.1 HARP Risk Analysis Module

The most recent version of HARP (Version 1.4f) and HARP On-Ramp (Version 1) were used to prepare this HRA. HARP was updated with the July 3, 2014 release of the health table (http://www.arb.ca.gov/toxics/harp/software/health.mdb, last accessed 7/18/14).

ToxStrategies used the HARP On-Ramp module to prepare AERMOD files and facility data for use in HARP. The following types of files were imported to On-Ramp.[2]

- Sources (sources.csv)
- Emissions estimates from each source (emissions.csv)
- AERMOD air concentration output files (*.GRF), one for each source type (point, volume, volume groups) and emission scenario. All receptors from AERMOD were labeled as grid receptors for simplicity.

HARP On-Ramp generated the following file types to be imported into HARP:

- The source-receptor file, which listed all sources, receptors, and their coordinates. (*.SRC)
- The emissions file, which listed the maximum hourly and annual average emissions from each source by substance. (*.EMS)
- The X/Q summary file, containing annual average and hourly maximum X/Q values[3] for every source-receptor pair. (*.XOQ)

To complete the risk analysis, these files were imported into HARP's risk analysis module. HARP computed the annual average and maximum hourly ground level concentrations for all AB2588-listed substances from all emission sources at all receptors. HARP then used this information and its database of toxicity values and exposure assumptions to estimate the potential cancer risk, chronic hazard index, and acute hazard index at each receptor location.

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[2] All files are included on the CD.

[3] X/Q values represent the predicted air concentration at each receptor for each source assuming a 1 gram per second emission rate except where adjusted as described previously for volume group sources and estimates of annual average air concentrations.

Two iterations of analysis were performed consistent with the two modeling scenarios discussed in Section 3.0. First, to compute acute hazard indices, air concentrations were calculated from an air dispersion model in which the facility was assumed to operate 24 hours per day for 365 days per year. This approach was used to predict the maximum hourly air concentration over 3 years of meteorological data, which is used to predict the associated acute hazard index at each receptor location. Second, to compute chronic hazard indices and cancer risks, we used an air dispersion model output based on the actual operational hours of the facility (Section 3.2). The air dispersion model predicted off-site X/Q values assuming 108 hours of operation per week or 5,408 hours per year. The annual average concentration predicted by the model is also based on 3 years of meteorological data.

Consistent with SCAQMD guidance, background concentrations of toxics were not included in this HRA.

4.2 Exposure Pathways

The following exposure pathways are included in the AB2588 program and were evaluated for their relevance in the vicinity of CFW: inhalation, dermal exposure, water ingestion, crop ingestion (direct deposition and root uptake), soil ingestion, mother's milk ingestion, fish ingestion, dairy products ingestion, and meat and egg ingestion. Given the urban development surrounding the facility, the following exposure pathways were considered relevant for residential exposure in this HRA:

- Inhalation
- Dermal absorption
- Soil ingestion
- Ingestion of homegrown produce: The urban default setting was used, where the portion of produce consumed from the contaminated area is 5.2%.
- Ingestion of mother's milk

Because the drinking water supply in the vicinity is not derived from local surface water, the water ingestion pathway is not relevant in this case. Also, since the CFW facility is located in an urban area, exposure through ingestion of fish, dairy, meat, eggs, and agricultural products is negligible for populations surrounding the facility.

Arsenic, cadmium, hexavalent chromium, lead, and nickel are the multi-pathway chemicals emitted from CFW that are assessed for non-inhalation exposures (dermal adsorption, soil ingestion, ingestion of homegrown produce, and ingestion of mother's milk). None of these chemicals are considered to accumulate in mother's milk, so no exposures were calculated via this pathway.

For multi-pathway chemicals, HARP calculates deposition of the particles to soil and subsequent accumulation in soil over 70 years of operation. As recommended by SCAQMD for urban areas and controlled emission sources, the deposition rate was assumed to be 0.2 meters per second (m/s).

4.3 Receptors and Exposure Assumptions

AB2588 HRAs evaluate two types of receptors: a resident and a worker. Residential exposure assumptions are used to estimate residential exposure, define the ZOI, evaluate sensitive receptors, and estimate exposure at census tract centroids. Worker exposures are used to estimate exposure for off-site workers at facilities neighboring CFW.

4.3.1 Residential Exposure Assumptions

In an AB2588 HRA, residential exposure is assumed to occur for a 70-year lifetime. Alternate exposure durations of 30-years or 9-years can be considered in separate calculations in an AB2588 HRA to provide a more likely estimate of residential exposure based on USEPA's estimate for high-end and median duration at a residence. The 30- and 9-year exposure durations were not used in this Revised AB2588 HRA because predicted lifetime exposures were low. Exposure frequency for a resident is assumed to be 350 days/year. Because of the complexity, inhalation exposure assumptions are explained in more detail below. Default exposure assumptions for the remaining exposure pathways are provided in OEHHA's guidelines (OEHHA, 2003) and are implemented through HARP. HARP modeling files in Appendix D present the exposure information.

For the purpose of estimating carcinogenic exposure for a resident, calculations in HARP are based on "Derived(Adjusted)" exposure assumptions, which means:

- To calculate total exposure the two highest exposure pathways are included using maximum exposure assumptions and the remaining exposure pathways are included using average exposure assumptions.
- Per the Air Resources Board's Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (ARB, 2003a), the 80th percentile inhalation rate should be used to estimate cancer risk when inhalation is one of the two highest exposure pathways for evaluating cancer risk. The 80th percentile inhalation rate is 302 liters per kilogram per day (l/kg-day) (OEHHA, 2003).

For the purpose of estimating noncarcinogenic chronic exposures for a resident in HARP, calculations are based on "Derived(OEHHA)" exposure assumptions, which means:

- Similar to carcinogenic exposures, to calculate total exposure the two highest exposure pathways are included using maximum exposure assumptions and the remaining exposure pathways are included using average exposure assumptions.
- The 95th percentile inhalation rate recommended in OEHHA's guidance is used (393 l/kg-day) (OEHHA, 2003).

Residential acute exposures are based on only inhalation exposures using the 95th percentile inhalation rate.

4.3.2 Worker Exposure

Worker exposure is assumed to occur over a 40-year exposure duration. Workers are assumed to attend their jobs for 5 days per week for 8 hours per day for 49 weeks per year. The inhalation rate assumed for workers is 149 l/kg-day for both carcinogenic and noncarcinogenic health effects.

Annual average air concentrations predicted using the air dispersion model are averaged over a 24-hour period, but in the case of CFW, operations do not occur during some nighttime hours. As such, the annual average concentrations are lower than the concentrations that a worker might be exposed to during the day when the facility is operating, and they are at work. Based on the facility's operating schedule (Section 3.2), the annual average air concentration is increased by a factor of 1.4 (SCAQMD, 2011) to account for the fact that some off-site workers will only be at work while CFW is operating.

4.4 Exposure Quantification

The HARP model quantifies exposures for each receptor modeled, representing residents, workers, sensitive receptors, and census tract centroids. The resulting chemical doses are evaluated separately for inhalation and non-inhalation exposures in the risk characterization.

5 Risk Characterization

Risk characterization, the final step in health risk analysis, utilizes information from previous steps to describe any theoretically increased health risk that may result from exposure to chemicals emitted from CFW. Carcinogenic risks, chronic noncarcinogenic health effects, and acute noncarcinogenic health effects are evaluated separately. Results are reported for all receptors in the electronic files (Appendix D).

The results reported in this section are focused on the maximum exposed individual resident (MEIR), maximum exposed individual worker (MEIW), and the point of maximum impact (PMI). The MEIR and MEIW are located in areas where residents live or workers are present, respectively. The PMI represents the maximum estimated risk at a location that is not used for residential or commercial/industrial purposes, such as the fence line receptors at CFW, which are at the property boundary and across major streets from the nearest actual off-site receptors. Tables 5A and 5B present the model-predicted maximum hourly concentrations and annual average concentrations of chemicals emitted from CFW, respectively, for the MEIR, MEIW and PMI. These airborne concentrations are used to calculate health-based measures including the acute and chronic noncancer hazard indices and potential cancer risk as discussed in Sections 5.1, 5.2 and 5.3, respectively.

5.1 Acute Noncarcinogenic Health Effects

The potential acute noncarcinogenic effects were evaluated by comparing inhalation exposure (in this case air concentration) to the REL. This ratio of exposure concentration to toxicity is referred to as a hazard quotient (HQ), which is calculated as follows:

$$HQ_i = MHACi/REL_i$$

where:
MHACi maximum hourly air concentration for chemical “i” ($\mu g/m^3$)
RELi reference exposure level for chemical “i” ($\mu g/m^3$)

In cases where individual chemicals potentially act on the same organs or result in the same health endpoint (e.g., respiratory irritants), potential additive effects may be addressed by calculating a hazard index as follows:

$$HI = Sum\ (HQ_1, HQ_2, HQ_3 \ldots HQ_i)$$

where:
HI = hazard index
HQ_i = hazard quotient for chemical “i” with the same health endpoint

A hazard index less than or equal to 1 indicates levels of exposure without adverse health effects for all chemicals having an additive effect.

5.1.1 Potential Acute Hazard Indexes Estimated for Residential Exposures

The potential acute hazard index estimated for the MEIR is 1.11 (Table 6A), which occurred at receptor #1046 located across Vermont Avenue from the facility (Figure 3). The associated target organ is the immune system. The primary sources contributing to the acute hazard index are the three main baghouses (Table 6B) accounting for almost 100 percent of the hazard index. The only chemical contributing significantly to the acute hazard index is nickel (essentially 100 percent). The acute REL for nickel is based on a study of the toxicity of nickel chloride, which is freely water-soluble (OEHHA 2012). The relevance of this REL to the nickel alloys emitted from CFW is not known, but it is expected that nickel chloride is more bioavailable than nickel bound in alloys and, therefore, of greater potential toxicity. As a result, it is likely that the potential health for health effects related to emissions nickel from the facility is overstated. Appendix C presents the predicted acute hazard index for all receptors within the ZOI shown on Figure 3.

5.1.2 Potential Acute Hazard Indexes Estimated for Worker Exposures

The potential acute hazard index estimated for the MEIW is 1.01 (Table 6A), which occurred at receptor #1085 located to the west of the facility (Figure 3). The primary sources contributing to the acute hazard index are the three main baghouses (almost 100 percent) (Table 6B). The only chemical contributing significantly to the acute hazard index is nickel (essentially 100 percent), and the associated target organ is the immune system.

5.1.3 Potential Acute Hazard Indexes Estimated at the Point of Maximum Impact

The potential acute hazard index estimated for the PMI is 1.82 (Table 6A), which occurred at receptor #109 on the eastern facility fence line (Figure 3). The primary sources contributing to the acute hazard index are the three main baghouses (almost 100 percent) (Table 6B). The only chemical contributing significantly to the acute hazard index is nickel (essentially 100 percent), and the associated target organ is the immune system.

5.2 Chronic Non-Carcinogenic Health Effects

Potential chronic noncarcinogenic effects are evaluated similarly to acute hazard index using a hazard quotient/index. However, chronic health effects are evaluated based on inhalation and non-inhalation exposures. Chronic health effects were evaluated by comparing exposure concentration or dose to the REL appropriate for the type of exposure (inhalation or oral RELs). This ratio of exposure to toxicity is referred to as a HQ, which is calculated for inhalation and non-inhalation exposures.

For inhalation exposures, the HQ is calculated as follows:

$$HQ_i = AACi/REL_i$$

where:
AACi = annual average concentration for chemical “i” (µg/m^3)
RELi inhalation reference exposure level for chemical “i” (mg/kg-day)

For non-inhalation exposures, the HQ is calculated as follows:

$$HQ_i = AADD_i/REL_{oral}$$

where:
$AADD_i$ annual average non-inhalation daily dose for chemical “i” (mg/kg-day)
RELi oral reference exposure level for chemical “i” (mg/kg-day)

Similar to acute hazard indexes, cases where individual chemicals potentially act on the same organs or result in the same health endpoint (e.g., respiratory irritants), potential additive effects may be addressed by calculating a hazard index as follows:

$$HI = Sum\ (HQ_1, HQ_2, HQ_3 \ldots HQ_i)$$

where:
HI = hazard index
HQ_i = hazard quotient for chemical “i” with the same health endpoint

An hazard index less than or equal to 1 indicates levels of exposure without adverse health effects for all chemicals having an additive effect. As described below the chronic hazard indexes for the MEIR, MEIW and PMI were all less than one.

5.2.1 Potential Chronic Hazard Indexes Estimated for Residential Exposures
The potential chronic hazard index estimated for the MEIR is 0.29 (Table 7A), which occurred at receptor #1046 located to the east across Vermont Avenue from the facility (Figure 4). The primary sources contributing to the chronic hazard index are the three main baghouses of the grind building (96.9%) (Table 7B). The primary chemical contributing to the chronic hazard index is nickel (78.4%). The associated target organ is the respiratory system.

OEHHA has set a chronic REL for nickel oxide of 0.02 µg/m^3 (OEHHA 2012). The chronic REL for nickel and nickel compounds, except nickel oxide, is 0.014 µg/m^3, and is based on the toxicity of nickel sulfate hexahydrate (OEHHA 2012). CFW emits nickel from its grinding operations in the form of alloys and oxides. Thus the OEHHA REL for nickel oxide is the most applicable to nickel emitted by CFW and is used in this assessment to calculate the chronic hazard quotient for nickel.

5.2.2 Potential Chronic Hazard Indexes Estimated for Worker Exposures
The potential chronic hazard index estimated for the MEIW is 0.36 (Table 7A), which occurred at receptor #1006 located to the west across the railroad right-of-way from the

facility (Figure 4). The primary sources contributing to the chronic hazard index were the three main baghouses of the grind building (98.0%) (Table 7B). The primary chemical contributing to the chronic hazard index was nickel (81.5%). The associated target organ is the respiratory system.

5.2.3 Potential Chronic Hazard Indexes Estimated at the Point of Maximum Impact
The potential chronic hazard index estimated for the PMI is 0.54 (Table 7A), which occurred at receptor #32 located at the facility fence line (Figure 4). The primary sources contributing to the chronic hazard index were the three main baghouses on the grind building (98.1%) (Table 7B). The primary chemical contributing to the chronic hazard index was nickel (79.4%). The associated target organ is the respiratory system.

5.3 Potential Cancer Risk

Carcinogenic risks are calculated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen, and are calculated using conservative modeling approaches generally expected to overestimate risk in the low exposure range. The oral and inhalation cancer slope factors are used to calculate the theoretical increased risk of an individual developing cancer based on the estimated daily exposure or dose, averaged over a lifetime.

Cancer risk for non-inhalation exposure is calculated as follows:

$$\text{Lifetime Excess Cancer Risk}_i = LADD_i \times CSF_i$$

where:

$LADD_i$	lifetime average daily dose for chemical "i" (mg/kg-day)
SF_i	cancer slope factor (inhalation or oral as appropriate) for chemical "i" $(mg/kg\text{-}day)^{-1}$

The estimated excess cancer risks for each chemical and exposure route are summed regardless of toxic endpoint to estimate the total excess cancer risk for the exposed individual. For AB2588 HRAs, a cancer risk of $1x10^{-6}$ is used to define the ZOI and a cancer risk of $1x10^{-5}$ is used to define the level above which notification is required. It should be noted that cancer risks of 1×10^{-6} or 1×10^{-5} or higher do not mean that adverse health effects or an increase in cancer will be observed because of the conservative assumptions used to develop the toxicity criteria and exposure estimates.

Figure 5A presents the estimated ZOI for the CFW facility, defined as the area within the $1x10^{-6}$ isopleth. The ZOI extends approximately 1.5 blocks to the west of the facility, 1.5 blocks to the east of the facility, and less than a block to the south of the facility. The area of the ZOI is approximately 0.3 miles from east to west and north to south including the facility property. Appendix C presents the predicted cancer risks for all receptors within the ZOI.

Nickel emissions from the grinding operations are the primary contributor to cancer risk, and nickel is only considered carcinogenic by the inhalation pathway. The nickel inhalation unit risk factor is based on increased risk of lung cancer observed among workers exposed to nickel subsulfide and refinery dust in the primary nickel refining industry (OEHHA 2009). Studies of workers exposed to nickel in the ferrro metals, nickel alloys and stainless steel industries have not observed an increased lung cancer risk (Huvinen and Pukkala et al. 2013; Sorahan 2004). The extent to which the lung cancer risk associated with occupational exposure to bioavailable nickel in the nickel refining industry can be extrapolated to environmental exposures to nickel alloys from CFW is uncertain, but it is expected that nickel in the form of alloys will have low bioavailability and decreased ability to cause respiratory tissue damage and increased cancer risk (Stockmann-Juvala et al. 2013). For these reasons, the lung cancer risk, if any, associated with exposure to nickel emissions from CFW is expected to be lower than that estimated under the constructs of this Revised AB2588 HRA.

Nickel concentrations have been measured in ambient air in the vicinity of CFW by SCAQMD and CFW. Appendix E presents a brief summary of this monitoring data and compares the data to the modeled results in this HRA. Overall, these comparisons demonstrate that the levels of ambient nickel monitored in ambient air near CFW include a significant contribution from upwind sources, and that the AERMOD-estimated concentrations of nickel downwind of CFW are reasonably consistent with measured levels of nickel at SCAQMD and CFW monitoring locations near CFW given that a portion of measured nickel appears to come from upwind sources.

5.3.1 Potential Cancer Risk Estimated for Residential Exposures

The potential lifetime excess cancer risk calculated for the MEIR is 2.4×10^{-6}, which occurred at receptor #1046 located across Vermont Avenue from the facility (Table 8A, Figure 5A). The primary sources contributing to the predicted risk are the north, central and south baghouses at the grind building (Sources 231, 232 and 233; Table 8B), which account for 91.4% of the predicted excess cancer risk. The chemical contributing most significantly to the predicted cancer risk is nickel (50.8%), with hexavalent chromium and arsenic contributing 18.6% and 14.8%, respectively.

5.3.2 Potential Cancer Risk Estimated for Worker Exposures

The potential excess cancer risk estimated for the MEIW is 8.2×10^{-7}, which occurs at receptor #1006 located across Vermont Avenue from the facility (Table 8A, Figure 5A). The primary sources contributing to the predicted risk are the three north, central and south baghouses at the grind building (Sources 231, 232 and 233; Table 8B), which account for 96.3% of the predicted excess cancer risk. The chemical contributing most significantly to the predicted cancer risk is nickel (52.6%), with hexavalent chromium and arsenic contributing 18.3% and 17.7%, respectively.

5.3.3 Potential Cancer Risk Estimated at the Point of Maximum Impact

The potential excess cancer risk estimated for the PMI is 4.2×10^{-6}, which occurs at receptor #32 at the eastern facility fence line (Table 8A, Figure 5A). The primary sources contributing to the predicted risk are the three north, central and south baghouses at the grind building (Sources 231, 232 and 233; Table 8B), which account for 95.8% of the predicted excess cancer risk. The chemical contributing most significantly to the predicted cancer risk is nickel (54.5%), with hexavalent chromium and arsenic contributing 18.1% and 15.1%, respectively.

5.3.4 Sensitive Receptors

None of the sensitive receptors were within the CFW ZOI (Figure 5B).

5.4 Population Cancer Burden

The ZOI for CFW was within a single census tract (5538.01). According to the 2008-2012 American Community Survey, accessed using the United States Census Bureau's American FactFinder, this census tract has a population of 4,247 (Figure 5B) (United States Census Bureau, 2014). To estimate population cancer burden, the predicted cancer risk at the centroid is multiplied times the population. The estimated cancer burden is 0.0013, which is significantly lower than SCAQMD's public notification level of 0.5.

Table 9 Predicted Cancer Risk and Population Cancer Burden

Estimated Cancer Risk	Population	Estimated Cancer Burden
3.03×10^{-7}	4,247	0.0013

6 Conclusions

The calculated chronic non-cancer hazard indices and cancer risk at the PMI, MEIR and MEIW do not exceed the public notification levels (i.e., calculated cancer risk greater than 10^{-5}, hazard index greater than 1 or 0.5 for lead); however the acute hazard index for the MEIR (1.11) slightly exceeds the public notification level of 1.0 by 11% (Table 6A). The estimated cancer burden is 0.0013, which is well below the risk reduction requirement level of 0.5.

In summary, the results of this HRA indicate that the cancer and non-cancer (acute and chronic) risk posed by CFW is below the risk reduction levels. Therefore, a risk reduction plan and remedial actions are not required. CFW's short-term emissions result in the acute hazard index slightly exceeding the public notification threshold and so public notification is required.

Nickel is the chemical that contributes most significantly to the calculated chronic and acute hazard indices, as well as the increased cancer risk (Tables 6A, 7A, and 8A). CFW emits nickel from its grinding operations. The forms of nickel emitted from CFW are thought to be in the form of nickel alloys (e.g., stainless steel) and nickel oxide. Nickel in alloy matrices is highly insoluble and nickel ions are not readily released for absorption from this matrix. As such, the bioaccessibility of nickel in alloys is highly limited (Hillwalker and Anderson, 2014). It is noteworthy that the OEHHA toxicity criteria used for assessing the acute hazard quotient and increased cancer risk for nickel are based on forms of nickel that are expected to be of greater bioavailability and toxicity than the nickel alloys emitted by CFW. The nickel acute reference exposure level (REL) is based on nickel chloride (OEHHA 2012), and the nickel inhalation unit risk factor is based on workers exposed to nickel refinery in the nickel refining industry (OEHHA 2009). These forms of nickel are more toxic and more bioavailable than nickel bound in an alloy matrix. As such, the acute hazards and cancer risk estimates presented in this HRA are thought to be overestimated.

7 References

Air Resources Board, 2003a. Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk, October.

Air Resources Board, 2003b. HARP User Guide, December. http://www.arb.ca.gov/toxics/harp/harp.htm.

ARB, 2014. Overview of the Air Toxics "Hot Spots" Information and Assessment Act, October. http://www.arb.ca.gov/ab2588/overview.htm.

Associates Environmental, 2014. South Coast Air Quality Management District Air Toxics Inventory Report Covering Carlton Forge Works Paramount Facility, Facility ID 022911, July.

Hillwalker and Anderson, 2014. Bioaccessibility of metals in alloys: Evaluation of three surrogate biofluids, Environ. Pollution, 185:52-58.

Huvinen, M. and E. Pukkala, 2013. Cancer incidence among Finnish ferrochromium and stainless steel production workers in 1967-2011: a cohort study. BMJ Open 3(11) :e003819. doi: 10.1136/bmjopen-2013-003819.

OEHHA, 2003. "Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessment," August.

OEHHA, 2009. "Chemical specific summaries of the information used to derive unit risk and cancer potency values." Appendix B. http://oehha.ca.gov/air/hot_spots/2009/AppendixB.pdf

OEHHA, 2012. Nickel Reference Exposure Levels. Nickel and nickel compounds, Nickel oxide, reference exposure levels (RELs). February 2012. http://oehha.ca.gov/air/chronic_rels/pdf/032312NiREL_Final.pdf

OEHHA, 2014. All OEHHA Acute, 8-hour and Chronic Reference Exposure Levels (chRELs) as of June 2014 (http://www.oehha.ca.gov/air/Allrels.html)

SCAQMD, 2011. "Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act (AB2588)." June.

Sorahan, T. 2004. Mortality of workers at a plant manufacturing nickel alloys, 1958-2000. Occup. Med (Lond)54(1):28-54.

Stockmann-Juvala, H., Y. Hedberg, N.K.Dhinsa, D.R. Griffiths, P.N. Brooks, A. Zitting, I. Odenvall Wallinder and T. Santonen. 2013. Inhalation toxicity of 316L stainless steel powder in relation to bioaccessibility. *Human Experiment. Toxicol.* 32(11): 1137-1154.

Table 1. Toxicity Criteria for Chemicals Emitted from CFW Operations

Substance	CAS #	Toxicity Criteria by Health Effect					
		Carcinogenic Health Effects			Acute Health Effects	Chronic Health Effects	
		Inhalation cancer URF $(\mu g/m^3)^{-1}$	Inhalation cancer slope factor $(mg/kg\text{-}day)^{-1}$	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$	Acute REL $\mu g/m^3$	Inhalation chronic REL $\mu g/m^3$	Oral chronic REL mg/kg-day
Acetaldehyde	75070	0.0000027	0.01	--	470	140	--
Acrolein	107028	--	--	--	2.5	0.35	--
Ammonia	7664417	--	--	--	3200	200	--
Arsenic	1016	0.0033	12	1.5	0.2	0.015	0.0000035
Benzene	71432	0.000029	0.1	--	27	3	--
Cadmium	7440439	0.0042	15	--	--	0.02	0.0005
Chromium, hexavalent	18540299	0.15	510	0.5	--	0.2	0.02
Copper	7440508	--	--	--	100	--	--
Ethyl Benzene	100414	0.0000025	0.0087	--	--	2000	--
Formaldehyde	50000	0.000006	0.021	--	55	9	--
Hexane	110543	--	--	--	--	7000	--
Lead	1128	0.000012	0.042	0.0085	--	--	--
Manganese	7439965	--	--	--	--	0.09	--
Methanol	67561	--	--	--	28000	4000	--
Naphthalene	91203	0.000034	0.12	--	--	9	--
Nickel	7440020	0.00026	0.91	--	0.2	0.02*	0.011
Silica, crystalline	1175	--	--	--	--	3	--
Toluene	108883	--	--	--	37000	300	--
Xylenes	1330207	--	--	--	22000	700	--

Abbreviations
-- = not applicable
$\mu g/m^3$ = microgram per cubic meter
mg/kg-day = milligrams per kilogram per day
REL = Reference exposure level
* Note: the chronic inhalation REL for nickel is the value developed by OEHHA for nickel oxide.

Table 2. Summary of Maximum Hourly and Annual Average Emissions

Substance	CAS #	Annual Emissions (lb/yr)	Annual Emissions (g/s)	Maximum Hourly Emissions (lb/hr)	Maximum Hourly Emissions (g/s)
Acetaldehyde	#REF!	2.65E+00	3.81E-05	3.27E-04	4.12E-05
Acrolein	#REF!	1.66E+00	2.39E-05	2.05E-04	2.59E-05
Ammonia	#REF!	1.97E+03	2.84E-02	2.43E-01	3.07E-02
Arsenic	#REF!	1.29E-01	1.85E-06	2.57E-05	3.24E-06
Benzene	#REF!	4.93E+00	7.09E-05	6.08E-04	7.67E-05
Cadmium	#REF!	2.59E-01	3.72E-06	5.05E-05	6.37E-06
Copper	#REF!	4.63E+00	6.65E-05	9.06E-04	1.14E-04
Ethyl Benzene	#REF!	2.99E+01	4.30E-04	1.03E-02	1.30E-03
Formaldehyde	#REF!	1.05E+01	1.51E-04	1.29E-03	1.63E-04
Hexane	#REF!	3.88E+00	5.59E-05	4.79E-04	6.04E-05
Hexavalent Chromium	#REF!	1.85E-02	2.66E-07	3.59E-06	4.53E-07
Lead	#REF!	2.61E+00	3.76E-05	5.11E-04	6.44E-05
Manganese	#REF!	6.29E+00	9.05E-05	1.23E-03	1.54E-04
Methanol	#REF!	4.50E-01	4.31E-06	1.80E-04	2.27E-05
Naphthalene	#REF!	1.85E-01	2.66E-06	2.28E-05	2.88E-06
Nickel	7440020	3.03E+01	4.36E-04	5.90E-03	7.43E-04
Silica, crystalline	#REF!	1.94E+00	2.79E-05	6.96E-04	8.77E-05
Toluene	#REF!	2.26E+01	3.25E-04	2.78E-03	3.51E-04
Xylene	#REF!	6.49E+01	9.33E-04	2.13E-02	2.68E-03

Abbreviations:
lb/yr = pounds per year
lb/hr = pounds per hour
g/s = grams per second

Table 3A. Summary of Source Parameters for Point Sources

Source Description	Source ID	UTM E (m)	UTM N (m)	Base Elevation (m)	Stack Height (m)	Stack Temperature (K)	Stack Exit Velocity (m/sec)	Stack Diameter (m)	Modeled emission rate, acute health effects (g/s)	Modeled emission rate, cancer and chronic health effects (g/s)
North Baghouse	231	392410	3751003	20.0	6.28	295.37	19.60	1.37	1	1.62
Central Baghouse	232	392410	3750992	20.0	6.28	294.71	17.68	1.37	1	1.62
South Baghouse	233	392411	3750967	20.1	6.28	294.26	22.63	1.37	1	1.62
Rotoblast Baghouse	163	392411	3750952	20.9	3.51	299.32	13.46	0.46	1	1.62
A/C Heater	101	392520.1	3751251.6	19.0	12.41	344.26	1.02E-03	0.07	1	1.62

Abbreviations:
g - grams
K - Kelvin
m - meters
sec - second

Table 3B. Summary of Source Parameters for Volume Sources

Source Description	Source ID	UTM E (m)	UTM N (m)	Base elevation (m)	Release height (m)	Initial size Y (m)	Initial size Z (m)	Modeled Emission Rate for Acute Health Effects (g/s)	Modeled Emission Rate for Cancer Risk and Chronic Health Effects (g/s)
Developer - Fugutive/ Evaporative Emissions	901	392438	3751041	18.6	1.83	0.64	1.7	1	1.62
Paint labeling - Fugitive losses	801	392438	3751064	18.9	1.83	0.64	1.7	1	1.62
Paint labeling - Fugitive losses	802	392563	3751145	18.9	1.83	0.64	1.7	1	1.62

Abbreviations:
g - grams
K - Kelvin
m - meters
sec - second

Table 3C. Summary of Source Parameters for Volume Sources Grouped by Area

Source ID	Source Description	AERMOD Source ID	UTM E (m)	UTM N (m)	Base Elevation (m)	Release Height (m)	Initial Y (m)	Initial Z (m)	Modeled Emission Rate for Acute Health Effects (g/s)	Modeled Emission Rate for Cancer Risk and Chronic Health Effects (g/s)
300	Building Roof Area 1	300_1	392373.1	3750945.0	18.0	18.4	2.9	7.2	0.09	0.15
		300_2	392373.1	3750951.3	18.0	18.4	2.9	7.2	0.09	0.15
		300_3	392373.1	3750957.6	18.0	18.4	2.9	7.2	0.09	0.15
		300_4	392373.1	3750963.9	18.0	18.4	2.9	7.2	0.09	0.15
		300_5	392373.1	3750970.2	18.0	18.4	2.9	7.2	0.09	0.15
		300_6	392373.1	3750976.5	18.0	18.4	2.9	7.2	0.09	0.15
		300_7	392373.1	3750982.8	18.0	18.4	2.9	7.2	0.09	0.15
		300_8	392373.1	3750989.1	18.0	18.4	2.9	7.2	0.09	0.15
		300_9	392373.1	3750995.4	18.0	18.4	2.9	7.2	0.09	0.15
		300_10	392373.1	3751001.7	18.0	18.4	2.9	7.2	0.09	0.15
		300_11	392373.1	3751008.0	18.0	18.4	2.9	7.2	0.09	0.15
301	Building Roof Area 2	301_1	392373.4	3751037.0	18.5	16.49	2.21	6.27	0.14	0.23
		301_2	392373.4	3751041.8	18.6	16.49	2.21	6.27	0.14	0.23
		301_3	392373.4	3751046.5	18.8	16.49	2.21	6.27	0.14	0.23
		301_4	392373.4	3751051.3	18.9	16.49	2.21	6.27	0.14	0.23
		301_5	392373.4	3751056.0	18.9	16.49	2.21	6.27	0.14	0.23
		301_6	392373.4	3751060.8	18.9	16.49	2.21	6.27	0.14	0.23
		301_7	392373.4	3751065.5	18.9	16.49	2.21	6.27	0.14	0.23
302	Building Roof Area 3	302_1	392374.4	3751079.1	18.9	14.57	2.21	5.38	0.17	0.27
		302_2	392374.4	3751083.9	19.1	14.57	2.21	5.38	0.17	0.27
		302_3	392374.4	3751088.6	19.2	14.57	2.21	5.38	0.17	0.27
		302_4	392374.4	3751093.4	19.4	14.57	2.21	5.38	0.17	0.27
		302_5	392374.4	3751098.1	19.6	14.57	2.21	5.38	0.17	0.27
		302_6	392374.4	3751102.9	19.8	14.57	2.21	5.38	0.17	0.27
303	Building Roof Area 4	303_1	392373.9	3751111.2	20.1	12.65	1.74	4.49	0.08	0.12
		303_2	392373.9	3751115.0	19.9	12.65	1.74	4.49	0.08	0.12
		303_3	392373.9	3751118.8	19.8	12.65	1.74	4.49	0.08	0.12
		303_4	392373.9	3751122.5	19.6	12.65	1.74	4.49	0.08	0.12
		303_5	392373.9	3751126.2	19.5	12.65	1.74	4.49	0.08	0.12
		303_6	392373.9	3751130.0	19.3	12.65	1.74	4.49	0.08	0.12
		303_7	392373.9	3751133.8	19.2	12.65	1.74	4.49	0.08	0.12
		303_8	392373.9	3751137.5	19.0	12.65	1.74	4.49	0.08	0.12
		303_9	392373.9	3751141.2	18.9	12.65	1.74	4.49	0.08	0.12
		303_10	392373.9	3751145.0	18.9	12.65	1.74	4.49	0.08	0.12
		303_11	392373.9	3751148.8	18.9	12.65	1.74	4.49	0.08	0.12
		303_12	392373.9	3751152.5	18.9	12.65	1.74	4.49	0.08	0.12
		303_13	392373.9	3751156.2	18.9	12.65	1.74	4.49	0.08	0.12

Table 3C. Summary of Source Parameters for Volume Sources Grouped by Area

Source ID	Source Description	AERMOD Source ID	UTM E (m)	UTM N (m)	Base Elevation (m)	Release Height (m)	Initial Y (m)	Initial Z (m)	Modeled Emission Rate for Acute Health Effects (g/s)	Modeled Emission Rate for Cancer Risk and Chronic Health Effects (g/s)
304	Building Roof Area 5	304_1	392373.8	3751164.1	18.9	12.65	1.63	4.49	0.10	0.16
		304_2	392373.8	3751167.6	18.9	12.65	1.63	4.49	0.10	0.16
		304_3	392373.8	3751171.1	18.9	12.65	1.63	4.49	0.10	0.16
		304_4	392373.8	3751174.6	18.8	12.65	1.63	4.49	0.10	0.16
		304_5	392373.8	3751178.1	18.6	12.65	1.63	4.49	0.10	0.16
		304_6	392373.8	3751181.6	18.5	12.65	1.63	4.49	0.10	0.16
		304_7	392373.8	3751185.1	18.4	12.65	1.63	4.49	0.10	0.16
		304_8	392373.8	3751188.6	18.3	12.65	1.63	4.49	0.10	0.16
		304_9	392373.8	3751192.1	18.2	12.65	1.63	4.49	0.10	0.16
		304_10	392373.8	3751195.6	18.1	12.65	1.63	4.49	0.10	0.16
305	Building Roof Area 6	305_1	392374.9	3751208.5	17.8	12.65	1.74	4.49	0.08	0.12
		305_2	392374.9	3751212.2	17.7	12.65	1.74	4.49	0.08	0.12
		305_3	392374.9	3751216.0	17.6	12.65	1.74	4.49	0.08	0.12
		305_4	392374.9	3751219.8	17.5	12.65	1.74	4.49	0.08	0.12
		305_5	392374.9	3751223.5	17.4	12.65	1.74	4.49	0.08	0.12
		305_6	392374.9	3751227.2	17.3	12.65	1.74	4.49	0.08	0.12
		305_7	392374.9	3751231.0	17.2	12.65	1.74	4.49	0.08	0.12
		305_8	392374.9	3751234.8	17.0	12.65	1.74	4.49	0.08	0.12
		305_9	392374.9	3751238.5	16.9	12.65	1.74	4.49	0.08	0.12
		305_10	392374.9	3751242.2	16.7	12.65	1.74	4.49	0.08	0.12
		305_11	392374.9	3751246.0	16.6	12.65	1.74	4.49	0.08	0.12
		305_12	392374.9	3751249.8	16.4	12.65	1.74	4.49	0.08	0.12
		305_13	392374.9	3751253.5	16.3	12.65	1.74	4.49	0.08	0.12
306	Building Roof Area 7	306_1	392400.5	3751185.5	18.4	14.23	1.4	5.22	0.05	0.09
		306_2	392400.5	3751188.5	18.3	14.23	1.4	5.22	0.05	0.09
		306_3	392400.5	3751191.5	18.2	14.23	1.4	5.22	0.05	0.09
		306_4	392400.5	3751194.5	18.2	14.23	1.4	5.22	0.05	0.09
		306_5	392400.5	3751197.5	18.1	14.23	1.4	5.22	0.05	0.09
		306_6	392400.5	3751200.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_7	392400.5	3751203.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_8	392400.5	3751206.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_9	392400.5	3751209.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_10	392400.5	3751212.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_11	392400.5	3751215.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_12	392400.5	3751218.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_13	392400.5	3751221.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_14	392400.5	3751224.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_15	392400.5	3751227.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_16	392400.5	3751230.5	18.0	14.23	1.4	5.22	0.05	0.09
		306_17	392400.5	3751233.5	17.9	14.23	1.4	5.22	0.05	0.09
		306_18	392400.5	3751236.5	17.8	14.23	1.4	5.22	0.05	0.09
		306_19	392400.5	3751239.5	17.7	14.23	1.4	5.22	0.05	0.09

Table 3C. Summary of Source Parameters for Volume Sources Grouped by Area

Source ID	Source Description	AERMOD Source ID	UTM E (m)	UTM N (m)	Base Elevation (m)	Release Height (m)	Initial Y (m)	Initial Z (m)	Modeled Emission Rate for Acute Health Effects (g/s)	Modeled Emission Rate for Cancer Risk and Chronic Health Effects (g/s)
307	Building Roof Area 8	307_1	392400.8	3751127.0	19.4	14.23	1.63	5.22	0.07	0.11
		307_2	392400.8	3751130.5	19.3	14.23	1.63	5.22	0.07	0.11
		307_3	392400.8	3751134.0	19.1	14.23	1.63	5.22	0.07	0.11
		307_4	392400.8	3751137.5	19.0	14.23	1.63	5.22	0.07	0.11
		307_5	392400.8	3751141.0	18.9	14.23	1.63	5.22	0.07	0.11
		307_6	392400.8	3751144.5	18.9	14.23	1.63	5.22	0.07	0.11
		307_7	392400.8	3751148.0	18.9	14.23	1.63	5.22	0.07	0.11
		307_8	392400.8	3751151.5	18.9	14.23	1.63	5.22	0.07	0.11
		307_9	392400.8	3751155.0	18.9	14.23	1.63	5.22	0.07	0.11
		307_10	392400.8	3751158.5	18.9	14.23	1.63	5.22	0.07	0.11
		307_11	392400.8	3751162.0	18.9	14.23	1.63	5.22	0.07	0.11
		307_12	392400.8	3751165.5	18.9	14.23	1.63	5.22	0.07	0.11
		307_13	392400.8	3751169.0	18.9	14.23	1.63	5.22	0.07	0.11
		307_14	392400.8	3751172.5	18.8	14.23	1.63	5.22	0.07	0.11
		307_15	392400.8	3751176.0	18.7	14.23	1.63	5.22	0.07	0.11
308	Building Roof Area 9	308_1	392400.2	3751101.2	19.8	14.23	1.16	5.22	0.11	0.18
		308_2	392400.2	3751103.8	19.9	14.23	1.16	5.22	0.11	0.18
		308_3	392400.2	3751106.2	20.0	14.23	1.16	5.22	0.11	0.18
		308_4	392400.2	3751108.8	20.1	14.23	1.16	5.22	0.11	0.18
		308_5	392400.2	3751111.2	20.1	14.23	1.16	5.22	0.11	0.18
		308_6	392400.2	3751113.8	20.0	14.23	1.16	5.22	0.11	0.18
		308_7	392400.2	3751116.2	19.9	14.23	1.16	5.22	0.11	0.18
		308_8	392400.2	3751118.8	19.8	14.23	1.16	5.22	0.11	0.18
		308_9	392400.2	3751121.2	19.7	14.23	1.16	5.22	0.11	0.18
309	Building Roof Area 10	309_1	392400.5	3751048.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_2	392400.5	3751051.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_3	392400.5	3751054.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_4	392400.5	3751057.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_5	392400.5	3751060.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_6	392400.5	3751063.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_7	392400.5	3751066.8	18.9	14.23	1.4	5.22	0.13	0.20
		309_8	392400.5	3751069.8	18.9	14.23	1.4	5.22	0.13	0.20
803	Paint labelling - fugitive losses	803_1	392451.5	3751039.4	18.6	14.23	1.4	5.22	0.10	0.16
		803_2	392451.5	3751042.4	18.7	14.23	1.4	5.22	0.10	0.16
		803_3	392451.5	3751045.4	18.8	14.23	1.4	5.22	0.10	0.16
		803_4	392451.5	3751048.4	18.8	14.23	1.4	5.22	0.10	0.16
		803_5	392451.5	3751051.4	18.9	14.23	1.4	5.22	0.10	0.16
		803_6	392451.5	3751054.4	18.9	14.23	1.4	5.22	0.10	0.16
		803_7	392451.5	3751057.4	18.9	14.23	1.4	5.22	0.10	0.16
		803_8	392451.5	3751060.4	18.9	14.23	1.4	5.22	0.10	0.16
		803_9	392451.5	3751063.4	18.9	14.23	1.4	5.22	0.10	0.16

Abbreviations:
g - grams
K - Kelvin
m - meters
sec - second

Table 4A. Summary of Maximum Hourly Emissions for Point, Volume, and Volume Sources Grouped by Area (pounds per hour)

Substance	CAS #	Maximum Hourly Emissions Rates by Source and Substance (lb/hr)							
		Point Sources (Baghouses, AC/Heating Unit, Ferro Glass Frit)					Volume sources (fugitive releases)		
		101	163	231	232	233	801	802	901
		A/C Heater	Rotoblast Baghouse	North Baghouse	Central Baghouse	South Baghouse	Paint Labelling	Paint Labelling	Developer
Acetaldehyde	75070	2.91E-07	--	--	--	--	--	--	--
Acrolein	107028	1.83E-07	--	--	--	--	--	--	--
Ammonia	7664417	2.16E-04	--	--	--	--	--	--	--
Arsenic	1016	--	1.14E-06	8.20E-06	8.20E-06	8.15E-06	--	--	--
Benzene	71432	5.41E-07	--	--	--	--	--	--	--
Cadmium	7440439	--	9.22E-07	1.89E-05	1.50E-05	1.57E-05	--	--	--
Copper	7440508	--	1.99E-05	3.31E-04	2.62E-04	2.93E-04	--	--	--
Ethyl Benzene	100414	6.42E-07	--	--	--	--	3.21E-03	3.21E-03	--
Formaldehyde	50000	1.15E-06	--	--	--	--	--	--	--
Hexane	110543	4.26E-07	--	--	--	--	--	--	--
Hexavalent chromium	18540299	--	4.16E-08	6.00E-07	4.93E-07	2.46E-06	--	--	--
Lead	1128	--	1.03E-05	1.45E-04	1.36E-04	2.20E-04	--	--	--
Manganese	7439965	--	2.01E-05	3.06E-04	3.39E-04	5.61E-04	--	--	--
Methanol	67561	--	--	--	--	--	6.00E-05	6.00E-05	--
Naphthalene	91203	2.03E-08	--	--	--	--	--	--	--
Nickel	7440020	--	7.26E-05	4.29E-03	8.19E-04	7.14E-04	--	--	--
Silica, crystalline	1175	--	5.77E-05	--	--	--	--	--	--
Toluene	108883	2.47E-06	--	--	--	--	--	--	--
Xylene	1330207	1.84E-06	--	--	--	--	6.41E-03	6.41E-03	--

Abbreviations:
lb/hr = pounds per hour
-- = not applicable

Table 4A. Summary of Maximum Hourly Emissions for Point, Volume, and Volume Sources Grouped by Area (pounds per hour) (continued)

Substance	CAS #	Maximum Hourly Emissions Rates by Source and Substance (lb/hr)											
		Volume Sources Grouped by Area (Furnaces and Fugitive Releases)											Total Facility Emissions (lb/hr)
		300	301	302	303	304	305	306	307	308	309	803	
		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Paint Labelling	
Acetaldehyde	75070	4.41E-05	2.76E-05	2.38E-05	3.51E-05	2.93E-05	5.73E-05	5.44E-05	3.13E-05	1.23E-05	1.16E-05	--	3.27E-04
Acrolein	107028	2.77E-05	1.73E-05	1.49E-05	2.20E-05	1.84E-05	3.60E-05	3.42E-05	1.96E-05	7.75E-06	7.30E-06	--	2.05E-04
Ammonia	7664417	3.28E-02	2.05E-02	1.77E-02	2.61E-02	2.18E-02	4.26E-02	4.05E-02	2.33E-02	9.19E-03	8.65E-03	--	2.43E-01
Arsenic	1016	--	--	--	--	--	--	--	--	--	--	--	2.57E-05
Benzene	71432	8.20E-05	5.13E-05	4.42E-05	6.53E-05	5.45E-05	1.07E-04	1.01E-04	5.82E-05	2.30E-05	2.16E-05		6.08E-04
Cadmium	7440439	--	--	--	--	--	--	--	--	--	--	--	5.05E-05
Copper	7440508	--	--	--	--	--	--	--	--	--	--	--	9.06E-04
Ethyl Benzene	100414	9.74E-05	6.10E-05	5.25E-05	7.76E-05	6.47E-05	1.27E-04	1.20E-04	6.91E-05	2.73E-05	2.57E-05	3.21E-03	1.03E-02
Formaldehyde	50000	1.74E-04	1.09E-04	9.39E-05	1.39E-04	1.16E-04	2.26E-04	2.15E-04	1.24E-04	4.88E-05	4.59E-05	--	1.29E-03
Hexane	110543	6.46E-05	4.04E-05	3.48E-05	5.14E-05	4.29E-05	8.39E-05	7.97E-05	4.58E-05	1.81E-05	1.70E-05	--	4.79E-04
Hexavalent chromium	18540299	--	--	--	--	--	--	--	--	--	--	--	3.59E-06
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	5.11E-04
Manganese	7439965	--	--	--	--	--	--	--	--	--	--	--	1.23E-03
Methanol	67561	--	--	--	--	--	--	--	--	--	--	6.00E-05	1.80E-04
Naphthalene	91203	3.07E-06	1.93E-06	1.66E-06	2.45E-06	2.04E-06	4.00E-06	3.80E-06	2.18E-06	8.61E-07	8.11E-07	--	2.28E-05
Nickel	7440020	--	--	--	--	--	--	--	--	--	--	--	5.90E-03
Silica, crystalline	1175	--	2.28E-04	--	--	--	--	--	1.82E-04	2.28E-04	--	--	6.96E-04
Toluene	108883	3.75E-04	2.35E-04	2.02E-04	2.99E-04	2.49E-04	4.88E-04	4.63E-04	2.66E-04	1.05E-04	9.89E-05	--	2.78E-03
Xylene	1330207	2.79E-04	1.75E-04	1.50E-04	2.22E-04	1.85E-04	3.62E-04	3.44E-04	1.98E-04	7.81E-05	7.35E-05	6.41E-03	2.13E-02

Abbreviations:
lb/hr = pounds per hour
-- = not applicable

Table 4B. Summary of Maximum Hourly Emissions for Point, Volume, and Volume Sources Grouped by Area (grams/second)

Substance	CAS #	Maximum Hourly Emissions Rates by Source and Substance (g/s)							
		Point Sources (Baghouses, AC/Heating Unit, Ferro Glass Frit)					Volume sources (fugitive releases)		
		101	163	231	232	233	801	802	901
		A/C Heater	Rotoblast Baghouse	North Baghouse	Central Baghouse	South Baghouse	Paint Labelling	Paint Labelling	Developer
Acetaldehyde	75070	3.66E-08	--	--	--	--	--	--	--
Acrolein	107028	2.30E-08	--	--	--	--	--	--	--
Ammonia	7664417	2.73E-05	--	--	--	--	--	--	--
Arsenic	1016	--	1.44E-07	1.03E-06	1.03E-06	1.03E-06	--	--	--
Benzene	71432	6.82E-08	--	--	--	--	--	--	--
Cadmium	7440439	--	1.16E-07	2.38E-06	1.89E-06	1.98E-06	--	--	--
Copper	7440508	--	2.51E-06	4.17E-05	3.30E-05	3.69E-05	--	--	--
Ethyl Benzene	100414	8.09E-08	--	--	--	--	4.04E-04	4.04E-04	--
Formaldehyde	50000	1.45E-07	--	--	--	--	--	--	--
Hexane	110543	5.37E-08	--	--	--	--	--	--	--
Hexavalent chromium	18540299	--	5.24E-09	7.56E-08	6.21E-08	3.10E-07	--	--	--
Lead	1128	--	1.30E-06	1.83E-05	1.71E-05	2.77E-05	--	--	--
Manganese	7439965	--	2.53E-06	3.86E-05	4.27E-05	7.07E-05	--	--	--
Methanol	67561	--	--	--	--	--	7.56E-06	7.56E-06	--
Naphthalene	91203	2.56E-09	--	--	--	--	--	--	--
Nickel	7440020	--	9.15E-06	5.41E-04	1.03E-04	9.00E-05	--	--	--
Silica, crystalline	1175	--	7.27E-06	--	--	--	--	--	--
Toluene	108883	3.12E-07	--	--	--	--	--	--	--
Xylene	1330207	2.32E-07	--	--	--	--	8.08E-04	8.08E-04	--

Abbreviations:
g/s = grams per second
-- = not applicable

Table 4B. Summary of Maximum Hourly Emissions for Point, Volume, and Volume Sources Grouped by Area (grams per second) (continued)

Substance	CAS #	Maximum Hourly Emissions Rates by Source and Substance (g/s)											
		Volume Sources Grouped by Area (Furnaces and Fugitive Releases)											Total Facility Emissions g/s)
		300	301	302	303	304	305	306	307	308	309	803	
		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Paint Labelling	
Acetaldehyde	75070	5.55E-06	3.48E-06	2.99E-06	4.42E-06	3.69E-06	7.22E-06	6.86E-06	3.94E-06	1.56E-06	1.46E-06	--	4.12E-05
Acrolein	107028	3.49E-06	2.18E-06	1.88E-06	2.78E-06	2.32E-06	4.53E-06	4.31E-06	2.47E-06	9.77E-07	9.19E-07	--	2.59E-05
Ammonia	7664417	4.13E-03	2.59E-03	2.23E-03	3.29E-03	2.75E-03	5.37E-03	5.10E-03	2.93E-03	1.16E-03	1.09E-03	--	3.07E-02
Arsenic	1016	--	--	--	--	--	--	--	--	--	--	--	3.24E-06
Benzene	71432	1.03E-05	6.47E-06	5.57E-06	8.23E-06	6.87E-06	1.34E-05	1.28E-05	7.33E-06	2.89E-06	2.72E-06	0.00E+00	7.67E-05
Cadmium	7440439	--	--	--	--	--	--	--	--	--	--	--	6.37E-06
Copper	7440508	--	--	--	--	--	--	--	--	--	--	--	1.14E-04
Ethyl Benzene	100414	1.23E-05	7.68E-06	6.61E-06	9.77E-06	8.16E-06	1.59E-05	1.51E-05	8.71E-06	3.44E-06	3.23E-06	4.04E-04	1.30E-03
Formaldehyde	50000	2.20E-05	1.37E-05	1.18E-05	1.75E-05	1.46E-05	2.85E-05	2.71E-05	1.56E-05	6.15E-06	5.79E-06	--	1.63E-04
Hexane	110543	8.14E-06	5.10E-06	4.38E-06	6.48E-06	5.41E-06	1.06E-05	1.00E-05	5.77E-06	2.28E-06	2.15E-06	--	6.04E-05
Hexavalent chromium	18540299	--	--	--	--	--	--	--	--	--	--	--	4.53E-07
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	6.44E-05
Manganese	7439965	--	--	--	--	--	--	--	--	--	--	--	1.54E-04
Methanol	67561	--	--	--	--	--	--	--	--	--	--	7.56E-06	2.27E-05
Naphthalene	91203	3.87E-07	2.43E-07	2.09E-07	3.09E-07	2.58E-07	5.04E-07	4.78E-07	2.75E-07	1.09E-07	1.02E-07	--	2.88E-06
Nickel	7440020	--	--	--	--	--	--	--	--	--	--	--	7.43E-04
Silica, crystalline	1175	--	2.87E-05	--	--	--	--	--	2.30E-05	2.87E-05	--	--	8.77E-05
Toluene	108883	4.73E-05	2.96E-05	2.55E-05	3.77E-05	3.14E-05	6.14E-05	5.84E-05	3.35E-05	1.32E-05	1.25E-05	--	3.51E-04
Xylene	1330207	3.51E-05	2.20E-05	1.89E-05	2.80E-05	2.34E-05	4.57E-05	4.34E-05	2.49E-05	9.84E-06	9.26E-06	8.08E-04	2.68E-03

Abbreviations:
g/s = grams per second
-- = not applicable

Table 4C. Summary of Annual Average Emissions for Point, Volume, and Volume Sources Grouped by Area (pounds per year)

Substance	CAS #	Annual Emissions Rates by Source and Substance (lb/yr)							
		Point Sources (Baghouses and AC/Heating Unit)					Volume sources (fugitive releases)		
		101	163	231	232	233	801	802	901
		A/C Heater	Rotoblast Baghouse	North Baghouse	Central Baghouse	South Baghouse	Paint Labelling	Paint Labelling	Developer
Acetaldehyde	75070	2.05E-04	--	--	--	--	--	--	--
Acrolein	107028	1.29E-04	--	--	--	--	--	--	--
Ammonia	7664417	1.52E-01	--	--	--	--	--	--	--
Arsenic	1016	--	1.02E-03	4.26E-02	4.26E-02	4.24E-02	--	--	--
Benzene	71432	3.81E-04	--	--	--	--	--	--	--
Cadmium	7440439	--	8.26E-04	9.83E-02	7.80E-02	8.16E-02	--	--	--
Copper	7440508	--	1.78E-02	1.72E+00	1.36E+00	1.52E+00	--	--	--
Ethyl Benzene	100414	4.52E-04	--	--	--	--	8.01E+00	8.01E+00	--
Formaldehyde	50000	8.09E-04	--	--	--	--	--	--	--
Hexane	110543	3.00E-04	--	--	--	--	--	--	--
Hexavalent Chromium	18540299	--	3.73E-05	3.10E-03	2.56E-03	1.28E-02	--	--	--
Lead	1128	--	9.23E-03	7.54E-01	7.07E-01	1.14E+00	--	--	--
Manganese	7439965	--	1.80E-02	1.59E+00	1.76E+00	2.92E+00	--	--	--
Methanol	67561	--	--	--	--	--	1.50E-01	1.50E-01	--
Naphthalene	91203	1.43E-05	--	--	--	--	--	--	--
Nickel	7440020	--	6.51E-02	2.23E+01	4.26E+00	3.71E+00	--	--	--
Silica, crystalline	1175	--	3.00E-01	--	--	--	--	--	--
Toluene	108883	1.74E-03	--	--	--	--	--	--	--
Xylene	1330207	1.29E-03	--	--	--	--	1.60E+01	1.60E+01	--

Abbreviations:
lb/yr = pounds per year
-- = not applicable

Table 4C. Summary of Annual Average Emissions for Point, Volume, and Volume Sources Grouped by Area (pounds per year) ***(continued)***

Substance	CAS #	Annual Emissions Rates by Source and Substance (lb/yr)											
		Volume Sources Grouped by Area (Furnaces and Fugitive Releases)											Total Facility Emissions (lb/yr)
		300	301	302	303	304	305	306	307	308	309	803	
		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Paint Labelling	
Acetaldehyde	75070	3.57E-01	2.24E-01	1.93E-01	2.85E-01	2.38E-01	4.65E-01	4.41E-01	2.54E-01	1.00E-01	9.43E-02	--	2.65
Acrolein	107028	2.24E-01	1.41E-01	1.21E-01	1.79E-01	1.49E-01	2.92E-01	2.77E-01	1.59E-01	6.29E-02	5.92E-02	--	1.66
Ammonia	7664417	2.66E+02	1.67E+02	1.43E+02	2.12E+02	1.77E+02	3.46E+02	3.29E+02	1.89E+02	7.45E+01	7.01E+01	--	1973
Arsenic	1016	--	--	--	--	--	--	--	--	--	--	--	0.13
Benzene	71432	6.65E-01	4.17E-01	3.58E-01	5.30E-01	4.42E-01	8.65E-01	8.21E-01	4.72E-01	1.86E-01	1.75E-01	--	4.93
Cadmium	7440439	--	--	--	--	--	--	--	--	--	--	--	0.26
Copper	7440508	--	--	--	--	--	--	--	--	--	--	--	4.63
Ethyl Benzene	100414	7.90E-01	4.95E-01	4.26E-01	6.29E-01	5.25E-01	1.03E+00	9.75E-01	5.61E-01	2.21E-01	2.08E-01	8.01E+00	29.9
Formaldehyde	50000	1.41E+00	8.85E-01	7.62E-01	1.13E+00	9.40E-01	1.84E+00	1.75E+00	1.00E+00	3.96E-01	3.73E-01	--	10.5
Hexane	110543	5.24E-01	3.28E-01	2.82E-01	4.17E-01	3.48E-01	6.81E-01	6.47E-01	3.72E-01	1.47E-01	1.38E-01	--	3.88
Hexavalent Chromium	18540299	--	--	--	--	--	--	--	--	--	--	--	0.02
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	2.61
Manganese	7439965	--	--	--	--	--	--	--	--	--	--	--	6.29
Methanol	67561	--	--	--	--	--	--	--	--	--	--	--	0.30
Naphthalene	91203	2.49E-02	1.56E-02	1.34E-02	1.99E-02	1.66E-02	3.24E-02	3.08E-02	1.77E-02	6.99E-03	6.58E-03	--	0.18
Nickel	7440020	--	--	--	--	--	--	--	--	--	--	--	30.3
Silica, crystalline	1175	--	5.47E-01	--	--	--	--	--	5.47E-01	5.47E-01	--	--	1.94
Toluene	108883	3.04E+00	1.91E+00	1.64E+00	2.42E+00	2.02E+00	3.96E+00	3.76E+00	2.16E+00	8.52E-01	8.02E-01	--	22.6
Xylene	1330207	2.26E+00	1.42E+00	1.22E+00	1.80E+00	1.50E+00	2.94E+00	2.79E+00	1.61E+00	6.33E-01	5.96E-01	1.60E+01	64.9

Abbreviations:

lb/yr = pounds per year

-- = not applicable

Table 4D. Summary of Annual Average Emissions for Point, Volume, and Volume Sources Grouped by Area (grams/second)

Substance	CAS #	Annual Emissions Rates by Source and Substance (g/s)							
		Point Sources (Baghouses and AC/Heating Unit)					Volume sources (fugitive releases)		
		101	163	231	232	233	801	802	901
		A/C Heater	Rotoblast Baghouse	North Baghouse	Central Baghouse	South Baghouse	Paint Labelling	Paint Labelling	Developer
Acetaldehyde	75070	2.94E-09	--	--	--	--	--	--	--
Acrolein	107028	1.85E-09	--	--	--	--	--	--	--
Ammonia	7664417	2.19E-06	--	--	--	--	--	--	--
Arsenic	1016	--	1.47E-08	6.13E-07	6.13E-07	6.10E-07	--	--	--
Benzene	71432	5.48E-09	--	--	--	--	--	--	--
Cadmium	7440439	--	1.19E-08	1.41E-06	1.12E-06	1.17E-06	--	--	--
Copper	7440508	--	2.56E-07	2.48E-05	1.96E-05	2.19E-05	--	--	--
Ethyl Benzene	100414	6.50E-09	--	--	--	--	1.15E-04	1.15E-04	--
Formaldehyde	50000	1.16E-08	--	--	--	--	--	--	--
Hexane	110543	4.31E-09	--	--	--	--	--	--	--
Hexavalent Chromium	18540299	--	5.36E-10	4.46E-08	3.68E-08	1.84E-07	--	--	--
Lead	1128	--	1.33E-07	1.08E-05	1.02E-05	1.65E-05	--	--	--
Manganese	7439965	--	2.59E-07	2.29E-05	2.54E-05	4.20E-05	--	--	--
Methanol	67561	--	--	--	--	--	2.16E-06	2.16E-06	--
Naphthalene	91203	2.05E-10	--	--	--	--	--	--	--
Nickel	7440020	--	9.36E-07	3.21E-04	6.13E-05	5.34E-05	--	--	--
Silica, crystalline	1175	--	4.31E-06	--	--	--	--	--	--
Toluene	108883	2.51E-08	--	--	--	--	--	--	--
Xylene	1330207	1.86E-08	--	--	--	--	2.31E-04	2.31E-04	--

Abbreviations:
g/s = grams per second
-- = not applicable

Table 4D. Summary of Annual Average Emissions for Point, Volume, and Volume Sources Grouped by Area (grams/second) (continued)

Substance	CAS #	Annual Emissions Rates by Source and Substance (lb/yr)											
		Volume Sources Grouped by Area (Furnaces and Fugitive Releases)											Total Facility Emissions (lb/hr)
		300	301	302	303	304	305	306	307	308	309	803	
		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7	Area 8	Area 9	Area 10	Paint Labelling	
Acetaldehyde	75070	5.14E-06	3.22E-06	2.77E-06	4.10E-06	3.42E-06	6.68E-06	6.35E-06	3.65E-06	1.44E-06	1.36E-06	--	3.81E-05
Acrolein	107028	3.23E-06	2.02E-06	1.74E-06	2.57E-06	2.15E-06	4.20E-06	3.99E-06	2.29E-06	9.04E-07	8.51E-07	--	2.39E-05
Ammonia	7664417	3.83E-03	2.40E-03	2.06E-03	3.05E-03	2.54E-03	4.97E-03	4.72E-03	2.72E-03	1.07E-03	1.01E-03	--	2.84E-02
Arsenic	1016	--	--	--	--	--	--	--	--	--	--	--	1.85E-06
Benzene	71432	9.57E-06	5.99E-06	5.16E-06	7.62E-06	6.36E-06	1.24E-05	1.18E-05	6.79E-06	2.68E-06	2.52E-06	--	7.09E-05
Cadmium	7440439	--	--	--	--	--	--	--	--	--	--	--	3.72E-06
Copper	7440508	--	--	--	--	--	--	--	--	--	--	--	6.65E-05
Ethyl Benzene	100414	1.14E-05	7.11E-06	6.12E-06	9.05E-06	7.55E-06	1.48E-05	1.40E-05	8.06E-06	3.18E-06	3.00E-06	1.15E-04	4.30E-04
Formaldehyde	50000	2.03E-05	1.27E-05	1.10E-05	1.62E-05	1.35E-05	2.64E-05	2.51E-05	1.44E-05	5.69E-06	5.36E-06	--	1.51E-04
Hexane	110543	7.53E-06	4.72E-06	4.06E-06	6.00E-06	5.01E-06	9.79E-06	9.30E-06	5.35E-06	2.11E-06	1.99E-06	--	5.59E-05
Hexavalent Chromium	18540299	--	--	--	--	--	--	--	--	--	--	--	2.66E-07
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	3.76E-05
Manganese	7439965	--	--	--	--	--	--	--	--	--	--	--	9.05E-05
Methanol	67561	--	--	--	--	--	--	--	--	--	--	--	4.31E-06
Naphthalene	91203	3.59E-07	2.25E-07	1.93E-07	2.86E-07	2.39E-07	4.66E-07	4.43E-07	2.55E-07	1.00E-07	9.46E-08	--	2.66E-06
Nickel	7440020	--	--	--	--	--	--	--	--	--	--	--	4.36E-04
Silica, crystalline	1175	--	7.87E-06	--	--	--	--	--	7.87E-06	7.87E-06	--	--	2.79E-05
Toluene	108883	4.38E-05	2.74E-05	2.36E-05	3.49E-05	2.91E-05	5.69E-05	5.40E-05	3.11E-05	1.23E-05	1.15E-05	--	3.25E-04
Xylene	1330207	3.25E-05	2.04E-05	1.75E-05	2.59E-05	2.16E-05	4.23E-05	4.02E-05	2.31E-05	9.11E-06	8.58E-06	2.31E-04	9.33E-04

Abbreviations:
g/s = grams per second
-- = not applicable

Table 5A. Maximum Hourly Air Concentrations (ug/m^3) for MEIR, MEIW, PMI.

Substance	CAS #	MEIW Receptor 1085 (392300, 3751050)	MEIR Receptor 1046 (392500, 3751000)	PMI Receptor 109 (392474.7, 3751005)
Acetaldehyde	75070	8.79E-03	5.31E-03	6.11E-03
Acrolein	107028	5.52E-03	3.34E-03	3.83E-03
Ammonia	7664417	6.54E+00	3.95E+00	4.54E+00
Arsenic	1016	1.00E-03	9.74E-04	1.54E-03
Benzene	71432	1.64E-02	9.88E-03	1.14E-02
Cadmium	7440439	1.85E-03	1.88E-03	3.00E-03
Copper	7440508	3.34E-02	3.38E-02	5.37E-02
Ethyl Benzene	100414	2.03E-01	4.82E-01	7.37E-01
Formaldehyde	50000	3.48E-02	2.10E-02	2.41E-02
Hexane	110543	1.29E-02	7.78E-03	8.94E-03
Hexavalent Chromium	18540299	1.29E-04	1.29E-04	1.97E-04
Lead	1128	1.88E-02	1.89E-02	2.96E-02
Manganese	7439965	4.50E-02	4.50E-02	7.05E-02
Methanol	67561	3.43E-03	8.79E-03	1.35E-02
Naphthalene	91203	6.14E-04	3.71E-04	4.26E-04
Nickel	7440020	2.03E-01	2.22E-01	3.64E-01
Silica, crystalline	1175	2.93E-02	1.55E-02	1.85E-02
Toluene	108883	7.48E-02	4.52E-02	5.20E-02
Xylene	1330207	4.22E-01	9.73E-01	1.48E+00

Abbreviations:
MEIW = Maximum exposed individual worker
MEIR = Maximum exposed individual worker
PMI = Point of maximum impact (off site)
ug/m^3 = micrograms per cubic meter

Table 5B. Annual Average Air Concentrations (ug/m^3) for MEIR, MEIW, PMI.

Substance	CAS #	MEIW Receptor 1006 (392300, 3750950)	MEIR Receptor 1046 (392500, 3751000)	PMI Receptor 32 (392336.9, 3751006)
Acetaldehyde	75070	6.03E-04	7.54E-04	9.94E-04
Acrolein	107028	3.78E-04	4.73E-04	6.24E-04
Ammonia	7664417	4.49E-01	5.61E-01	7.39E-01
Arsenic	1016	2.65E-05	2.11E-05	3.81E-05
Benzene	71432	1.12E-03	1.40E-03	1.85E-03
Cadmium	7440439	5.24E-05	4.12E-05	7.57E-05
Copper	7440508	9.37E-04	7.40E-04	1.35E-03
Ethyl Benzene	100414	1.26E-02	4.29E-02	2.49E-02
Formaldehyde	50000	2.38E-03	2.98E-03	3.93E-03
Hexane	110543	8.84E-04	1.11E-03	1.46E-03
Hexavalent Chromium	18540299	3.60E-06	2.95E-06	5.07E-06
Lead	1128	5.27E-04	4.20E-04	7.54E-04
Manganese	7439965	1.27E-03	1.01E-03	1.81E-03
Methanol	67561	2.11E-04	7.73E-04	4.25E-04
Naphthalene	91203	4.21E-05	5.26E-05	6.93E-05
Nickel	7440020	5.92E-03	4.56E-03	8.64E-03
Silica, crystalline	1175	6.06E-04	7.84E-04	9.27E-04
Toluene	108883	5.13E-03	6.42E-03	8.46E-03
Xylene	1330207	2.64E-02	8.75E-02	5.18E-02

Abbreviations:
MEIW = Maximum exposed individual worker
MEIR = Maximum exposed individual worker
PMI = Point of maximum impact (offsite)
ug/m^3 = micrograms per cubic meter

Table 6A. Chemical-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI

Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)															
Substance	CAS #	Target Organ System													Percent Contribution to Immune System Hazard Index
		Cardio-vascular	Central Nervous System	Bone	Develop-ment	Endo-crine	Eyes	Gastro-intestinal & Liver	Immune System	Kidneys	Repro-ductive	Respira-tory	Skin	Blood	
Acetaldehyde	75070	--	--	--	--	--	1.1E-05	--	--	--	--	1.1E-05	--	--	--
Acrolein	107028	--	--	--	--	--	1.3E-03	--	--	--	--	1.3E-03	--	--	--
Ammonia	7664417	--	--	--	--	--	1.2E-03	--	--	--	--	1.2E-03	--	--	--
Arsenic	1016	4.9E-03	4.9E-03	--	4.9E-03	--	--	--	--	--	4.9E-03	--	--	--	--
Benzene	71432	--	--	--	3.7E-04	--	--	--	**3.7E-04**	--	3.7E-04	--	--	3.7E-04	0.03%
Cadmium	7440439	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Copper	7440508	--	--	--	--	--	--	--	--	--	--	3.4E-04	--	--	--
Ethyl benzene	100414	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Formaldehyde	50000	--	--	--	--	--	3.8E-04	--	--	--	--	--	--	--	--
Hexane	110543	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439965	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methanol	67561	--	3.1E-07	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	91203	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	7440020	--	--	--	--	--	--	--	**1.1E+00**	--	--	--	--	--	100%
Silica, crystalline	1175	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	108883	--	1.2E-06	--	1.2E-06	--	1.2E-06	--	--	--	1.2E-06	1.2E-06	--	--	--
Xylenes	1330207	--	4.4E-05	--	--	--	4.4E-05	--	--	--	--	4.4E-05	--	--	--
Total		4.9E-03	4.9E-03	--	5.2E-03	--	7.9E-03	--	**1.1E+00**	--	5.2E-03	7.8E-03	--	3.7E-04	100%

Bold indicates endpoint with highest hazard index.

-- = not applicable

Table 6A. Chemical-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI (continued)

Maximum Exposed Individual Worker (Receptor 1085; 392300, 3751050)															
Substance	CAS #	Target Organ System													Percent Contribution to Immune System Hazard Index
		Cardio-vascular	Central Nervous System	Bone	Develop-ment	Endo-crine	Eyes	Gastro-intestinal & Liver	Immune System	Kidneys	Repro-ductive	Respira-tory	Skin	Blood	
Acetaldehyde	75070	--	--	--	--	--	1.9E-05	--	**--**	--	--	1.9E-05	--	--	--
Acrolein	107028	--	--	--	--	--	2.2E-03	--	**--**	--	--	2.2E-03	--	--	--
Ammonia	7664417	--	--	--	--	--	2.0E-03	--	**--**	--	--	2.0E-03	--	--	--
Arsenic	1016	5.0E-03	5.0E-03	--	5.0E-03	--	--	--	**--**	--	5.0E-03	--	--	--	--
Benzene	71432	--	--	--	6.1E-04	--	--	--	**6.1E-04**	--	6.1E-04	--	--	6.1E-04	0.06%
Cadmium	7440439	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Copper	7440508	--	--	--	--	--	--	--	**--**	--	--	3.3E-04	--	--	--
Ethyl benzene	100414	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Formaldehyde	50000	--	--	--	--	--	6.3E-04	--	**--**	--	--	--	--	--	--
Hexane	110543	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Lead	1128	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Manganese	7439965	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Methanol	67561	--	1.2E-07	--	--	--	--	--	**--**	--	--	--	--	--	--
Naphthalene	91203	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Nickel	7440020	--	--	--	--	--	--	--	**1.01E+00**	--	--	--	--	--	100%
Silica, crystalline	1175	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Toluene	108883	--	2.0E-06	--	2.0E-06	--	2.0E-06	--	**--**	--	2.0E-06	2.0E-06	--	--	--
Xylenes	1330207	--	1.9E-05	--	--	--	1.9E-05	--	**--**	--	--	1.9E-05	--	--	--
Total		5.0E-03	5.0E-03	--	5.6E-03	--	9.6E-03	--	**1.01E+00**	--	5.6E-03	9.3E-03	--	6.1E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 6A. Chemical-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI (continued)

Point of Maximum Impact (Receptor 109; 392474.7, 3751005)															
Substance	CAS	Target Organ System													Percent Contribution to Immune System Hazard Index
		Cardio-vascular	Central Nervous System	Bone	Develop-ment	Endo-crine	Eyes	Gastro-intestinal & Liver	Immune System	Kidneys	Repro-ductive	Respira-tory	Skin	Blood	
Acetaldehyde	75070	--	--	--	--	--	1.3E-05	--	**--**	--	--	1.3E-05	--	--	--
Acrolein	107028	--	--	--	--	--	1.5E-03	--	**--**	--	--	1.5E-03	--	--	--
Ammonia	7664417	--	--	--	--	--	1.4E-03	--	**--**	--	--	1.4E-03	--	--	--
Arsenic	1016	7.7E-03	7.7E-03	--	7.7E-03	--	--	--	**--**	--	7.7E-03	--	--	--	--
Benzene	71432	--	--	--	4.2E-04	--	--	--	**4.2E-04**	--	4.2E-04	--	--	4.2E-04	0.02%
Cadmium	7440439	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Copper	7440508	--	--	--	--	--	--	--	**--**	--	--	5.4E-04	--	--	--
Ethyl benzene	100414	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Formaldehyde	50000	--	--	--	--	--	4.4E-04	--	**--**	--	--	--	--	--	--
Hexane	110543	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Lead	1128	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Manganese	7439965	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Methanol	67561	--	4.8E-07	--	--	--	--	--	**--**	--	--	--	--	--	--
Naphthalene	91203	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Nickel	7440020	--	--	--	--	--	--	--	**1.82E+00**	--	--	--	--	--	100%
Silica, crystalline	1175	--	--	--	--	--	--	--	**--**	--	--	--	--	--	--
Toluene	108883	--	1.4E-06	--	1.4E-06	--	1.4E-06	--	**--**	--	1.4E-06	1.4E-06	--	--	--
Xylenes	1330207	--	6.8E-05	--	--	--	6.8E-05	--	**--**	--	--	6.8E-05	--	--	--
Total		7.7E-03	7.8E-03	--	8.1E-03	--	1.1E-02	--	**1.82E+00**	--	8.1E-03	1.1E-02	--	4.2E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 6B. Source-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI

Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)														
Source ID	**Target organ system**													**Percent Contribution to Immune System Hazard Index**
	Cardio-vascular	**Central Nervous System**	**Bone**	**Develop-ment**	**Endo-crine**	**Eyes**	**Gastro-intestinal & Liver**	**Immune System**	**Kidneys**	**Repro-ductive**	**Respira-tory**	**Skin**	**Blood**	
101	--	1.5E-08	--	2.0E-06	--	1.6E-05	--	**2.0E-06**	--	2.0E-06	1.4E-05	--	2.0E-06	0.0002%
163	3.7E-04	3.7E-04	--	3.7E-04	--	8.7E-06	--	**2.4E-02**	--	3.7E-04	2.2E-05	--	--	2.1%
231	1.6E-03	1.6E-03	--	1.6E-03	--	4.9E-04	--	**8.1E-01**	--	1.6E-03	6.1E-04	--	--	73.0%
232	1.5E-03	1.5E-03	--	1.5E-03	--	3.7E-03	--	**1.5E-01**	--	1.5E-03	3.8E-03	--	--	13.8%
233	1.4E-03	1.4E-03	--	1.4E-03	--	6.0E-05	--	**1.2E-01**	--	1.4E-03	1.6E-04	--	--	11.2%
300	--	5.0E-07	--	6.7E-05	--	5.4E-04	--	**6.7E-05**	--	6.7E-05	4.7E-04	--	6.7E-05	0.006%
301	--	3.2E-07	--	4.3E-05	--	3.5E-04	--	**4.3E-05**	--	4.3E-05	3.0E-04	--	4.3E-05	0.004%
302	--	2.5E-07	--	3.3E-05	--	2.7E-04	--	**3.3E-05**	--	3.3E-05	2.3E-04	--	3.3E-05	0.003%
303	--	2.6E-07	--	3.4E-05	--	2.8E-04	--	**3.4E-05**	--	3.4E-05	2.4E-04	--	3.4E-05	0.003%
304	--	1.9E-07	--	2.6E-05	--	2.1E-04	--	**2.5E-05**	--	2.6E-05	1.8E-04	--	2.5E-05	0.002%
305	--	3.7E-07	--	5.0E-05	--	4.0E-04	--	**4.9E-05**	--	5.0E-05	3.5E-04	--	4.9E-05	0.004%
306	--	3.3E-07	--	4.4E-05	--	3.6E-04	--	**4.4E-05**	--	4.4E-05	3.1E-04	--	4.4E-05	0.004%
307	--	2.1E-07	--	2.8E-05	--	2.2E-04	--	**2.8E-05**	--	2.8E-05	1.9E-04	--	2.8E-05	0.002%
308	--	1.2E-07	--	1.6E-05	--	1.3E-04	--	**1.6E-05**	--	1.6E-05	1.1E-04	--	1.6E-05	0.001%
309	--	1.9E-07	--	2.5E-05	--	2.0E-04	--	**2.5E-05**	--	2.5E-05	1.8E-04	--	2.5E-05	0.002%
801	--	1.6E-05	--	--	--	5.4E-05	--	**--**	--	--	5.4E-05	--	--	--
802	--	1.2E-05	--	--	--	4.0E-05	--	**--**	--	--	4.0E-05	--	--	--
803	--	1.5E-05	--	--	--	4.7E-05	--	**--**	--	--	4.7E-05	--	--	--
901	--	--	--	--	--	4.6E-04	--	**--**	--	--	4.6E-04	--	--	--
Total	4.9E-03	4.9E-03	--	5.2E-03	--	7.9E-03	--	**1.11E+00**	--	5.2E-03	7.8E-03	--	3.7E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 6B. Source-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI (continued)

Maximum Exposed Individual Worker (Receptor 1085; 392300, 3751050)														
Source ID	Target organ system													Percent Contribution to Immune System Hazard Index
	Cardio-vascular	Central Nervous System	Bone	Develop-ment	Endo-crine	Eyes	Gastro-intestinal & Liver	Immune System	Kidneys	Repro-ductive	Respira-tory	Skin	Blood	
101	--	1.5E-08	--	2.0E-06	--	1.7E-05	--	**2.0E-06**	--	2.0E-06	1.4E-05	--	2.0E-06	0.0002%
163	6.4E-04	6.4E-04	--	6.4E-04	--	1.5E-05	--	**4.1E-02**	--	6.4E-04	3.7E-05	--	--	4.0%
231	1.3E-03	1.3E-03	--	1.3E-03	--	4.1E-04	--	**6.9E-01**	--	1.3E-03	5.2E-04	--	--	67.9%
232	1.6E-03	1.6E-03	--	1.6E-03	--	4.0E-03	--	**1.6E-01**	--	1.6E-03	4.1E-03	--	--	16.2%
233	1.4E-03	1.4E-03	--	1.4E-03	--	5.9E-05	--	**1.2E-01**	--	1.4E-03	1.6E-04	--	--	12.2%
300	--	3.5E-07	--	4.7E-05	--	3.8E-04	--	**4.7E-05**	--	4.7E-05	3.3E-04	--	4.7E-05	0.005%
301	--	5.2E-07	--	7.0E-05	--	5.6E-04	--	**7.0E-05**	--	7.0E-05	4.9E-04	--	7.0E-05	0.007%
302	--	6.1E-07	--	8.1E-05	--	6.6E-04	--	**8.1E-05**	--	8.1E-05	5.7E-04	--	8.1E-05	0.008%
303	--	8.5E-07	--	1.1E-04	--	9.2E-04	--	**1.1E-04**	--	1.1E-04	8.0E-04	--	1.1E-04	0.01%
304	--	3.6E-07	--	4.9E-05	--	3.9E-04	--	**4.9E-05**	--	4.9E-05	3.4E-04	--	4.9E-05	0.005%
305	--	4.3E-07	--	5.7E-05	--	4.6E-04	--	**5.7E-05**	--	5.7E-05	4.0E-04	--	5.7E-05	0.006%
306	--	4.6E-07	--	6.1E-05	--	4.9E-04	--	**6.1E-05**	--	6.1E-05	4.3E-04	--	6.1E-05	0.006%
307	--	5.3E-07	--	7.1E-05	--	5.7E-04	--	**7.1E-05**	--	7.1E-05	5.0E-04	--	7.1E-05	0.007%
308	--	2.4E-07	--	3.2E-05	--	2.6E-04	--	**3.2E-05**	--	3.2E-05	2.2E-04	--	3.2E-05	0.003%
309	--	1.9E-07	--	2.5E-05	--	2.0E-04	--	**2.5E-05**	--	2.5E-05	1.8E-04	--	2.5E-05	0.002%
801	--	5.8E-06	--	--	--	1.9E-05	--	**--**	--	--	1.9E-05	--	--	--
802	--	5.7E-06	--	--	--	1.9E-05	--	**--**	--	--	1.9E-05	--	--	--
803	--	5.2E-06	--	--	--	1.7E-05	--	**--**	--	--	1.7E-05	--	--	--
901	--	--	--	--	--	1.3E-04	--	**--**	--	--	1.3E-04	--	--	--
Total	5.0E-03	5.0E-03	--	5.6E-03	--	9.6E-03	--	**1.01E+00**	--	5.6E-03	9.3E-03	--	6.1E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 6B. Source-Specific Contribution to Acute Hazard Index for MEIR, MEIW, and PMI (continued)

Point of Maximum Impact (Receptor 109; 392474.7, 3751005)														
Source ID	Target organ system													Percent Contribution to Immune System Hazard Index
	Cardio-vascular	Central Nervous System	Bone	Develop-ment	Endo-crine	Eyes	Gastro-intestinal & Liver	Immune System	Kidneys	Repro-ductive	Respira-tory	Skin	Blood	
101	--	1.5E-08	--	2.0E-06	--	1.6E-05	--	**2.0E-06**	--	2.0E-06	1.4E-05	--	2.0E-06	0.0001%
163	4.9E-04	4.9E-04	--	4.9E-04	--	1.2E-05	--	**3.1E-02**	--	4.9E-04	2.9E-05	--	--	1.7%
231	2.6E-03	2.6E-03	--	2.6E-03	--	8.1E-04	--	**1.4E+00**	--	2.6E-03	1.0E-03	--	--	74.2%
232	2.5E-03	2.5E-03	--	2.5E-03	--	6.1E-03	--	**2.5E-01**	--	2.5E-03	6.3E-03	--	--	13.8%
233	2.1E-03	2.1E-03	--	2.1E-03	--	8.8E-05	--	**1.8E-01**	--	2.1E-03	2.4E-04	--	--	10.1%
300	--	5.6E-07	--	7.5E-05	--	6.1E-04	--	**7.5E-05**	--	7.5E-05	5.3E-04	--	7.5E-05	0.004%
301	--	4.0E-07	--	5.3E-05	--	4.3E-04	--	**5.3E-05**	--	5.3E-05	3.7E-04	--	5.3E-05	0.003%
302	--	3.1E-07	--	4.2E-05	--	3.4E-04	--	**4.2E-05**	--	4.2E-05	2.9E-04	--	4.2E-05	0.002%
303	--	2.8E-07	--	3.7E-05	--	3.0E-04	--	**3.7E-05**	--	3.7E-05	2.6E-04	--	3.7E-05	0.002%
304	--	2.0E-07	--	2.7E-05	--	2.2E-04	--	**2.7E-05**	--	2.7E-05	1.9E-04	--	2.7E-05	0.001%
305	--	3.9E-07	--	5.2E-05	--	4.2E-04	--	**5.2E-05**	--	5.2E-05	3.6E-04	--	5.2E-05	0.003%
306	--	3.8E-07	--	5.1E-05	--	4.1E-04	--	**5.1E-05**	--	5.1E-05	3.6E-04	--	5.1E-05	0.003%
307	--	2.4E-07	--	3.2E-05	--	2.6E-04	--	**3.2E-05**	--	3.2E-05	2.3E-04	--	3.2E-05	0.002%
308	--	1.3E-07	--	1.7E-05	--	1.4E-04	--	**1.7E-05**	--	1.7E-05	1.2E-04	--	1.7E-05	0.001%
309	--	2.6E-07	--	3.4E-05	--	2.8E-04	--	**3.4E-05**	--	3.4E-05	2.4E-04	--	3.4E-05	0.002%
801	--	3.1E-05	--	--	--	1.0E-04	--	**--**	--	--	1.0E-04	--	--	--
802	--	1.8E-05	--	--	--	6.0E-05	--	**--**	--	--	6.0E-05	--	--	--
803	--	1.7E-05	--	--	--	5.6E-05	--	**--**	--	--	5.6E-05	--	--	--
901	--	--	--	--	--	4.7E-04	--	**--**	--	--	4.7E-04	--	--	--
Total	7.7E-03	7.8E-03	--	8.1E-03	--	1.1E-02	--	**1.82E+00**	--	8.1E-03	1.1E-02	--	4.2E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 7A. Chemical-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI

Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)															
Substance	**CAS #**	**Target organ system**													**Percent Contribution to Respiratory Hazard Index**
		Cardio-vascular	**Central Nervous System**	**Bone**	**Develop-ment**	**Endo-crine**	**Eyes**	**Gastro-intestinal & Liver**	**Immune System**	**Kidneys**	**Repro-ductive**	**Respira-tory**	**Skin**	**Blood**	
Acetaldehyde	75070	--	--	--	--	--	--	--	--	--	--	**5.4E-06**	--	--	0.002%
Acrolein	107028	--	--	--	--	--	--	--	--	--	--	**1.4E-03**	--	--	0.5%
Ammonia	7664417	--	--	--	--	--	--	--	--	--	--	**2.8E-03**	--	--	1.0%
Arsenic	1016	5.6E-02	5.6E-02	--	5.6E-02	--	--	--	--	--	5.6E-02	**5.6E-02**	5.6E-02	--	19.3%
Benzene	71432	--	--	--	--	--	--	--	--	--	--	--	--	4.7E-04	--
Cadmium	7440439	--	--	--	--	--	--	--	--	3.1E-03	--	**2.1E-03**	--	--	0.7%
Copper	7440508	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethyl benzene	100414	--	--	--	2.2E-05	2.2E-05	--	2.2E-05	--	2.2E-05	2.2E-05	--	--	--	--
Formaldehyde	50000	--	--	--	--	--	--	--	--	--	--	**3.3E-04**	--	--	0.1%
Hexane	110543	--	1.6E-07	--	--	--	--	--	--	--	--	--	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	--	--	--	**1.5E-05**	--	7.0E-07	0.005%
Lead	1128	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439965	--	1.1E-02	--	--	--	--	--	--	--	--	--	--	--	--
Methanol	67561	--	--	--	1.9E-07	--	--	--	--	--	1.9E-07	--	--	--	--
Naphthalene	91203	--	--	--	--	--	--	--	--	--	--	**5.8E-06**	--	--	0.002%
Nickel oxide	1313991	--	--	--	5.2E-03	--	--	--	--	--	5.2E-03	**2.3E-01**	--	--	78.4%
Silica, crystalline	1175	--	--	--	--	--	--	--	--	--	--	**2.6E-04**	--	--	0.09%
Toluene	108883	--	2.1E-05	--	2.1E-05	--	--	--	--	--	2.1E-05	**2.1E-05**	--	--	0.007%
Xylenes	1330207	--	1.3E-04	--	--	--	1.3E-04	--	--	--	--	**1.3E-04**	--	--	0.04%
Total		5.6E-02	6.8E-02	--	6.2E-02	2.2E-05	1.3E-04	2.2E-05	--	3.2E-03	6.2E-02	**2.9E-01**	5.6E-02	4.7E-04	100%

Bold indicates endpoint with highest hazard index.

-- = not applicable

Table 7A. Chemical-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI (continued)

Maximum Exposed Indvidual Worker (Receptor 1006; 392300, 3750950)															
Substance	**CAS #**	**Target organ system**													**Percent Contribution to Respiratory Hazard Index**
		Cardio-vascular	**Central Nervous System**	**Bone**	**Develop-ment**	**Endo-crine**	**Eyes**	**Gastro-intestinal & Liver**	**Immune System**	**Kidneys**	**Repro-ductive**	**Respira-tory**	**Skin**	**Blood**	
Acetaldehyde	75070	--	--	--	--	--	--	--	--	--	--	**4.3E-06**	--	--	0.001%
Acrolein	107028	--	--	--	--	--	--	--	--	--	--	**1.1E-03**	--	--	0.3%
Ammonia	7664417	--	--	--	--	--	--	--	--	--	--	**2.2E-03**	--	--	0.6%
Arsenic	1016	6.1E-02	6.1E-02	--	6.1E-02	--	--	--	--	--	6.1E-02	**6.1E-02**	6.1E-02	--	16.8%
Benzene	71432	--	--	--	--	--	--	--	--	--	--	**--**	--	3.7E-04	--
Cadmium	7440439	--	--	--	--	--	--	--	--	2.9E-03	--	**2.6E-03**	--	--	0.7%
Copper	7440508	--	--	--	--	--	--	--	--	--	--	**--**	--	--	--
Ethyl benzene	100414	--	--	--	6.3E-06	6.3E-06	--	6.3E-06	--	6.3E-06	6.3E-06	**--**	--	--	--
Formaldehyde	50000	--	--	--	--	--	--	--	--	--	--	**2.7E-04**	--	--	0.07%
Hexane	110543	--	1.3E-07	--	--	--	--	--	--	--	--	**--**	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	--	--	--	**1.8E-05**	--	6.7E-07	0.005%
Lead	1128	--	--	--	--	--	--	--	--	--	--	**--**	--	--	--
Manganese	7439965	--	1.4E-02	--	--	--	--	--	--	--	--	**--**	--	--	--
Methanol	67561	--	--	--	5.3E-08	--	--	--	--	--	5.3E-08	**--**	--	--	--
Naphthalene	91203	--	--	--	--	--	--	--	--	--	--	**4.7E-06**	--	--	0.001%
Nickel oxide	1313991	--	--	--	4.2E-03	--	--	--	--	--	4.2E-03	**3.0E-01**	--	--	81.5%
Silica, crystalline	1175	--	--	--	--	--	--	--	--	--	--	**2.0E-04**	--	--	0.06%
Toluene	108883	--	1.7E-05	--	1.7E-05	--	--	--	--	--	1.7E-05	**1.7E-05**	--	--	0.005%
Xylenes	1330207	--	3.8E-05	--	--	--	3.8E-05	--	--	--	--	**3.8E-05**	--	--	0.01%
Total		6.1E-02	7.5E-02	--	6.5E-02	6.3E-06	3.8E-05	6.3E-06	--	2.9E-03	6.5E-02	**3.6E-01**	6.1E-02	3.8E-04	100%

Bold indicates endpoint with highest hazard index.

-- = not applicable

Table 7A. Chemical-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI (continued)

Point of Maximum Impact (Receptor 32; 392336.9, 3751006)															
		Target organ system													Percent Contribution to Respiratory Hazard Index
Substance	**CAS #**	**Cardio-vascular**	**Central Nervous System**	**Bone**	**Develop-ment**	**Endo-crine**	**Eyes**	**Gastro-intestinal & Liver**	**Immune System**	**Kidneys**	**Repro-ductive**	**Respira-tory**	**Skin**	**Blood**	
Acetaldehyde	75070	--	--	--	--	--	--	--	--	--	--	**7.1E-06**	--	--	0.001%
Acrolein	107028	--	--	--	--	--	--	--	--	--	--	**1.8E-03**	--	--	0.3%
Ammonia	7664417	--	--	--	--	--	--	--	--	--	--	**3.7E-03**	--	--	0.7%
Arsenic	1016	1.0E-01	1.0E-01	--	1.0E-01	--	--	--	--	--	1.0E-01	**1.0E-01**	1.0E-01	--	18.8%
Benzene	71432	--	--	--	--	--	--	--	--	--	--	**--**	--	6.2E-04	--
Cadmium	7440439	--	--	--	--	--	--	--	--	5.7E-03	--	**3.8E-03**	--	--	0.7%
Copper	7440508	--	--	--	--	--	--	--	--	--	--	**--**	--	--	--
Ethyl benzene	100414	--	--	--	1.2E-05	1.2E-05	--	1.2E-05	--	1.2E-05	1.2E-05	**--**	--	--	--
Formaldehyde	50000	--	--	--	--	--	--	--	--	--	--	**4.4E-04**	--	--	0.08%
Hexane	110543	--	2.1E-07	--	--	--	--	--	--	--	--	**--**	--	--	--
Chromium, hexavalent	18540299	--	--	--	--	--	--	--	--	--	--	**2.5E-05**	--	1.2E-06	0.005%
Lead	1128	--	--	--	--	--	--	--	--	--	--	**--**	--	--	--
Manganese	7439965	--	2.0E-02	--	--	--	--	--	--	--	--	**--**	--	--	--
Methanol	67561	--	--	--	1.1E-07	--	--	--	--	--	1.1E-07	**--**	--	--	--
Naphthalene	91203	--	--	--	--	--	--	--	--	--	--	**7.7E-06**	--	--	0.001%
Nickel oxide	1313991	--	--	--	9.8E-03	--	--	--	--	--	9.8E-03	**4.3E-01**	--	--	79.4%
Silica, crystalline	1175	--	--	--	--	--	--	--	--	--	--	**3.1E-04**	--	--	0.06%
Toluene	108883	--	2.8E-05	--	2.8E-05	--	--	--	--	--	2.8E-05	**2.8E-05**	--	--	0.005%
Xylenes	1330207	--	7.4E-05	--	--	--	7.4E-05	--	--	--	--	**7.4E-05**	--	--	0.01%
Total		1.0E-01	1.2E-01	--	1.1E-01	1.2E-05	7.4E-05	1.2E-05	--	5.8E-03	1.1E-01	**5.4E-01**	1.0E-01	6.2E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 7B. Source-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI

Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)														
Source ID	**Target Organ Systems**													**Percent Contribution to Respiratory Hazard Index**
	Cardio-vascular	**Central Nervous System**	**Bone**	**Develop-ment**	**Endo-crine**	**Eyes**	**Gastro-intestinal & Liver**	**Immune System**	**Kidneys**	**Repro-ductive**	**Respira-tory**	**Skin**	**Blood**	
101	--	2.5E-09	--	2.0E-09	7.5E-11	6.1E-10	7.5E-11	--	7.5E-11	2.0E-09	**4.1E-07**	--	4.2E-08	0.0001%
163	2.3E-03	2.4E-03	--	2.3E-03	--	--	--	--	5.1E-05	2.3E-03	**5.0E-03**	2.3E-03	7.2E-09	1.7%
231	1.6E-02	1.9E-02	--	2.0E-02	--	--	--	--	1.0E-03	2.0E-02	**1.8E-01**	1.6E-02	1.0E-07	60.5%
232	2.0E-02	2.3E-02	--	2.1E-02	--	--	--	--	1.1E-03	2.1E-02	**5.8E-02**	2.0E-02	1.1E-07	19.9%
233	1.8E-02	2.3E-02	--	1.9E-02	--	--	--	--	9.7E-04	1.9E-02	**4.8E-02**	1.8E-02	4.8E-07	16.5%
300	--	5.7E-06	--	4.4E-06	1.7E-07	1.4E-06	1.7E-07	--	1.7E-07	4.4E-06	**9.0E-04**	--	9.3E-05	0.3%
301	--	3.1E-06	--	2.4E-06	9.1E-08	7.4E-07	9.1E-08	--	9.1E-08	2.4E-06	**5.6E-04**	--	5.1E-05	0.2%
302	--	2.5E-06	--	1.9E-06	7.3E-08	5.9E-07	7.3E-08	--	7.3E-08	1.9E-06	**3.9E-04**	--	4.1E-05	0.1%
303	--	3.4E-06	--	2.7E-06	1.0E-07	8.1E-07	1.0E-07	--	1.0E-07	2.7E-06	**5.4E-04**	--	5.6E-05	0.2%
304	--	2.1E-06	--	1.7E-06	6.2E-08	5.1E-07	6.2E-08	--	6.2E-08	1.7E-06	**3.4E-04**	--	3.5E-05	0.1%
305	--	3.0E-06	--	2.4E-06	8.9E-08	7.3E-07	8.9E-08	--	8.9E-08	2.4E-06	**4.8E-04**	--	5.0E-05	0.2%
306	--	3.0E-06	--	2.4E-06	8.8E-08	7.2E-07	8.8E-08	--	8.8E-08	2.4E-06	**4.8E-04**	--	5.0E-05	0.2%
307	--	2.5E-06	--	2.0E-06	7.5E-08	6.1E-07	7.5E-08	--	7.5E-08	2.0E-06	**4.5E-04**	--	4.2E-05	0.2%
308	--	1.3E-06	--	1.0E-06	3.9E-08	3.2E-07	3.9E-08	--	3.9E-08	1.0E-06	**2.7E-04**	--	2.2E-05	0.09%
309	--	1.8E-06	--	1.4E-06	5.2E-08	4.3E-07	5.2E-08	--	5.2E-08	1.4E-06	**2.8E-04**	--	2.9E-05	0.1%
801	--	5.8E-05	--	1.2E-05	1.0E-05	5.8E-05	1.0E-05	--	1.2E-05	1.2E-05	**5.8E-05**	--	--	0.02%
802	--	4.2E-05	--	8.8E-06	7.3E-06	4.2E-05	7.3E-06	--	8.7E-06	8.8E-06	**4.2E-05**	--	--	0.01%
803	--	1.8E-05	--	3.8E-06	3.1E-06	1.8E-05	3.1E-06	--	3.7E-06	3.8E-06	**1.8E-05**	--	--	0.006%
901	--	--	--	1.3E-05	--	--	--	--	1.3E-05	1.3E-05	**--**	--	--	--
Total	5.6E-02	6.8E-02	--	6.2E-02	2.2E-05	1.3E-04	2.2E-05	--	3.2E-03	6.2E-02	**2.9E-01**	5.6E-02	4.7E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 7B. Source-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI (continued)

Maximum Exposed Indvidual Worker (Receptor 1006; 392300, 3750950)														
Source ID	**Target Organ Systems**													**Percent Contribution to Respiratory Hazard Index**
	Cardio-vascular	**Central Nervous System**	**Bone**	**Develop-ment**	**Endo-crine**	**Eyes**	**Gastro-intestinal & Liver**	**Immune System**	**Kidneys**	**Repro-ductive**	**Respira-tory**	**Skin**	**Blood**	
101	--	1.5E-09	--	1.2E-09	4.4E-11	3.6E-10	4.4E-11	--	4.4E-11	1.2E-09	**2.4E-07**	--	2.5E-08	0.00007%
163	1.6E-03	1.8E-03	--	1.7E-03	--	--	--	--	3.1E-05	1.7E-03	**3.9E-03**	1.6E-03	4.7E-09	1.1%
231	1.8E-02	2.2E-02	--	2.1E-02	--	--	--	--	1.0E-03	2.1E-02	**2.3E-01**	1.8E-02	1.1E-07	63.1%
232	2.3E-02	2.7E-02	--	2.3E-02	--	--	--	--	1.1E-03	2.3E-02	**7.3E-02**	2.3E-02	1.1E-07	20.1%
233	1.8E-02	2.4E-02	--	1.9E-02	--	--	--	--	8.4E-04	1.9E-02	**5.4E-02**	1.8E-02	4.4E-07	14.8%
300	--	4.7E-06	--	3.7E-06	1.4E-07	1.1E-06	1.4E-07	--	1.4E-07	3.7E-06	**7.6E-04**	--	7.8E-05	0.2%
301	--	2.5E-06	--	1.9E-06	7.2E-08	5.9E-07	7.2E-08	--	7.2E-08	1.9E-06	**4.5E-04**	--	4.1E-05	0.1%
302	--	2.1E-06	--	1.7E-06	6.2E-08	5.0E-07	6.2E-08	--	6.2E-08	1.7E-06	**3.3E-04**	--	3.5E-05	0.09%
303	--	2.9E-06	--	2.3E-06	8.5E-08	7.0E-07	8.5E-08	--	8.5E-08	2.3E-06	**4.6E-04**	--	4.8E-05	0.1%
304	--	1.8E-06	--	1.4E-06	5.2E-08	4.3E-07	5.2E-08	--	5.2E-08	1.4E-06	**2.8E-04**	--	2.9E-05	0.08%
305	--	2.5E-06	--	2.0E-06	7.4E-08	6.1E-07	7.4E-08	--	7.4E-08	2.0E-06	**4.0E-04**	--	4.2E-05	0.1%
306	--	2.3E-06	--	1.8E-06	6.7E-08	5.5E-07	6.7E-08	--	6.7E-08	1.8E-06	**3.7E-04**	--	3.8E-05	0.1%
307	--	1.9E-06	--	1.5E-06	5.4E-08	4.5E-07	5.4E-08	--	5.4E-08	1.5E-06	**3.3E-04**	--	3.1E-05	0.09%
308	--	9.3E-07	--	7.3E-07	2.7E-08	2.2E-07	2.7E-08	--	2.7E-08	7.3E-07	**1.9E-04**	--	1.5E-05	0.05%
309	--	1.1E-06	--	8.8E-07	3.3E-08	2.7E-07	3.3E-08	--	3.3E-08	8.8E-07	**1.8E-04**	--	1.8E-05	0.05%
801	--	1.4E-05	--	2.9E-06	2.4E-06	1.4E-05	2.4E-06	--	2.9E-06	2.9E-06	**1.4E-05**	--	--	0.004%
802	--	1.2E-05	--	2.5E-06	2.1E-06	1.2E-05	2.1E-06	--	2.5E-06	2.5E-06	**1.2E-05**	--	--	0.003%
803	--	6.2E-06	--	1.3E-06	1.1E-06	6.2E-06	1.1E-06	--	1.3E-06	1.3E-06	**6.2E-06**	--	--	0.002%
901	--	--	--	3.7E-06	--	--	--	--	3.7E-06	3.7E-06	**--**	--	--	--
Total	6.1E-02	7.5E-02	--	6.5E-02	6.3E-06	3.8E-05	6.3E-06	--	2.9E-03	6.5E-02	**3.6E-01**	6.1E-02	3.8E-04	100%

Bold indicates endpoint with highest hazard index.

-- = not applicable

Table 7B. Source-Specific Contribution to Chronic Hazard Index for MEIR, MEIW, and PMI (continued)

Point of Maximum Impact (Receptor 32; 392336.9, 3751006)														
Source ID	Target Organ Systems													Percent Contribution to Respiratory Hazard Index
	Cardio-vascular	Central Nervous System	Bone	Develop-ment	Endo-crine	Eyes	Gastro-intestinal & Liver	Immune System	Kidneys	Repro-ductive	Respira-tory	Skin	Blood	
101	--	2.0E-09	--	1.6E-09	5.9E-11	4.9E-10	5.9E-11	--	5.9E-11	1.6E-09	**3.2E-07**	--	3.3E-08	0.00006%
163	1.9E-03	2.0E-03	--	1.9E-03	--	--	--	--	4.2E-05	1.9E-03	**4.2E-03**	1.9E-03	6.0E-09	0.8%
231	3.2E-02	3.6E-02	--	3.9E-02	--	--	--	--	2.0E-03	3.9E-02	**3.4E-01**	3.2E-02	2.0E-07	62.7%
232	3.9E-02	4.6E-02	--	4.1E-02	--	--	--	--	2.1E-03	4.1E-02	**1.1E-01**	3.9E-02	2.1E-07	21.0%
233	2.9E-02	3.8E-02	--	3.0E-02	--	--	--	--	1.6E-03	3.0E-02	**7.8E-02**	2.9E-02	7.8E-07	14.4%
300	--	7.7E-06	--	6.1E-06	2.3E-07	1.9E-06	2.3E-07	--	2.3E-07	6.1E-06	**1.2E-03**	--	1.3E-04	0.2%
301	--	5.2E-06	--	4.1E-06	1.5E-07	1.2E-06	1.5E-07	--	1.5E-07	4.1E-06	**9.4E-04**	--	8.5E-05	0.2%
302	--	3.8E-06	--	3.0E-06	1.1E-07	9.1E-07	1.1E-07	--	1.1E-07	3.0E-06	**6.0E-04**	--	6.2E-05	0.1%
303	--	4.8E-06	--	3.8E-06	1.4E-07	1.2E-06	1.4E-07	--	1.4E-07	3.8E-06	**7.7E-04**	--	8.0E-05	0.1%
304	--	2.7E-06	--	2.1E-06	7.8E-08	6.4E-07	7.8E-08	--	7.8E-08	2.1E-06	**4.3E-04**	--	4.4E-05	0.08%
305	--	3.5E-06	--	2.7E-06	1.0E-07	8.4E-07	1.0E-07	--	1.0E-07	2.7E-06	**5.6E-04**	--	5.8E-05	0.1%
306	--	3.2E-06	--	2.5E-06	9.4E-08	7.7E-07	9.4E-08	--	9.4E-08	2.5E-06	**5.1E-04**	--	5.3E-05	0.09%
307	--	2.8E-06	--	2.2E-06	8.3E-08	6.8E-07	8.3E-08	--	8.3E-08	2.2E-06	**5.1E-04**	--	4.7E-05	0.09%
308	--	1.6E-06	--	1.2E-06	4.5E-08	3.7E-07	4.5E-08	--	4.5E-08	1.2E-06	**3.2E-04**	--	2.6E-05	0.06%
309	--	2.1E-06	--	1.6E-06	6.1E-08	5.0E-07	6.1E-08	--	6.1E-08	1.6E-06	**3.3E-04**	--	3.4E-05	0.06%
801	--	3.0E-05	--	6.2E-06	5.2E-06	3.0E-05	5.2E-06	--	6.2E-06	6.2E-06	**3.0E-05**	--	--	0.005%
802	--	2.6E-05	--	5.4E-06	4.5E-06	2.6E-05	4.5E-06	--	5.3E-06	5.4E-06	**2.6E-05**	--	--	0.005%
803	--	9.6E-06	--	2.0E-06	1.7E-06	9.6E-06	1.7E-06	--	2.0E-06	2.0E-06	**9.6E-06**	--	--	0.002%
901	--	--	--	5.2E-06	--	--	--	--	5.2E-06	5.2E-06	**--**	--	--	--
Total	1.0E-01	1.2E-01	--	1.1E-01	1.2E-05	7.4E-05	1.2E-05	--	5.8E-03	1.1E-01	**5.4E-01**	1.0E-01	6.2E-04	100%

Bold indicates endpoint with highest hazard index.
-- = not applicable

Table 8A. Chemical-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI

Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)							
Substance	**CAS #**	**Exposure Pathway**				**Total**	**Percent Contribution to Cancer Risk**
		Inhalation	**Dermal**	**Soil Ingestion**	**Home-Grown Vegetables**		
Acetaldehyde	75070	2.2E-09	--	--	--	2.2E-09	0.09%
Acrolein	107028	--	--	--	--	--	--
Ammonia	7664417	--	--	--	--	--	--
Arsenic	1016	7.3E-08	1.8E-07	8.5E-08	1.6E-08	3.5E-07	14.8%
Benzene	71432	4.1E-08	--	--	--	4.1E-08	1.7%
Cadmium	7440439	1.8E-07	--	--	--	1.8E-07	7.6%
Copper	7440508	--	--	--	--	--	--
Ethyl benzene	100414	1.1E-07	--	--	--	1.1E-07	4.6%
Formaldehyde	50000	1.8E-08	--	--	--	1.8E-08	0.8%
Hexane	110543	--	--	--	--	--	--
Hexavalent chromium	18540299	4.4E-07	1.2E-10	4.0E-09	6.6E-10	4.4E-07	18.6%
Lead	1128	4.6E-09	2.9E-10	9.6E-09	6.9E-09	2.1E-08	0.9%
Manganese	7439965	--	--	--	--	--	--
Methanol	67561	--	--	--	--	--	--
Naphthalene	91203	1.8E-09	--	--	--	1.8E-09	0.08%
Nickel	7440020	1.2E-06	--	--	--	1.2E-06	50.8%
Silica, crystalline	1175	--	--	--	--	--	--
Toluene	108883	--	--	--	--	--	--
Xylenes	1330207	--	--	--	--	--	--
Total		2.1E-06	1.8E-07	9.9E-08	2.3E-08	2.4E-06	100%

-- = not applicable

Table 8A. Chemical-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI (continued)

Maximum Exposed Indvidual Worker (Receptor 1006; 392300, 3750950)						
Substance	CAS #	Exposure pathway			Total	Percent Contribution to Cancer Risk
		Inhalation	Dermal	Soil Ingestion		
Acetaldehyde	75070	4.8E-10	--	--	4.8E-10	0.06%
Acrolein	107028	--	--	--	--	--
Ammonia	7664417	--	--	--	--	--
Arsenic	1016	2.6E-08	8.4E-08	3.5E-08	1.5E-07	17.7%
Benzene	71432	9.0E-09	--	--	9.0E-09	1.1%
Cadmium	7440439	6.3E-08	--	--	6.3E-08	7.7%
Copper	7440508	--	--	--	--	--
Ethyl benzene	100414	8.8E-09	--	--	8.8E-09	1.1%
Formaldehyde	50000	4.0E-09	--	--	4.0E-09	0.5%
Hexane	110543	--	--	--	--	--
Hexavalent chromium	18540299	1.5E-07	9.5E-10	1.6E-09	1.5E-07	18.3%
Lead	1128	1.8E-09	2.4E-09	4.0E-09	8.1E-09	1.0%
Manganese	7439965	--	--	--	--	--
Methanol	67561	--	--	--	--	--
Naphthalene	91203	4.0E-10	--	--	4.0E-10	0.05%
Nickel	7440020	4.3E-07	--	--	4.3E-07	52.6%
Silica, crystalline	1175	--	--	--	--	--
Toluene	108883	--	--	--	--	--
Xylenes	1330207	--	--	--	--	--
Total		6.9E-07	8.7E-08	4.1E-08	8.2E-07	100%

-- = not applicable

Table 8A. Chemical-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI (continued)

Point of Maximum Impact (Receptor 32; 392336.9, 3751006)							
Substance	CAS #	Exposure pathway				Total	Percent Contribution to Cancer Risk
		Inhalation	Dermal	Soil Ingestion	Home-Grown Vegetables		
Acetaldehyde	75070	2.9E-09	--	--	--	2.9E-09	0.07%
Acrolein	107028	--	--	--	--	--	--
Ammonia	7664417	--	--	--	--	--	--
Arsenic	1016	1.3E-07	3.2E-07	1.5E-07	2.8E-08	6.3E-07	15.1%
Benzene	71432	5.4E-08	--	--	--	5.4E-08	1.3%
Cadmium	7440439	3.3E-07	--	--	--	3.3E-07	7.9%
Copper	7440508	--	--	--	--	--	--
Ethyl benzene	100414	6.3E-08	--	--	--	6.3E-08	1.5%
Formaldehyde	50000	2.4E-08	--	--	--	2.4E-08	0.6%
Hexane	110543	--	--	--	--	--	--
Hexavalent chromium	18540299	7.5E-07	2.1E-10	6.8E-09	1.1E-09	7.6E-07	18.1%
Lead	1128	8.2E-09	5.3E-10	1.7E-08	1.2E-08	3.8E-08	0.9%
Manganese	7439965	--	--	--	--	--	--
Methanol	67561	--	--	--	--	--	--
Naphthalene	91203	2.4E-09	--	--	--	2.4E-09	0.06%
Nickel	7440020	2.3E-06	--	--	--	2.3E-06	54.5%
Silica, crystalline	1175	--	--	--	--	--	--
Toluene	108883	--	--	--	--	--	--
Xylenes	1330207	--	--	--	--	--	--
Total		3.6E-06	3.2E-07	1.8E-07	4.2E-08	4.2E-06	100%

-- = not applicable

Table 8B. Source-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI

Maximum Exposed Individual Resident (Receptor 1046; 392500, 3751000)						
Source ID	**Exposure Pathway**				**Total**	**Percent Contribution to Cancer Risk**
	Inhalation	**Dermal**	**Soil Ingestion**	**Home-Grown Vegetables**		
101	6.0E-12	--	--	--	6.0E-12	0.0003%
163	2.5E-08	7.0E-09	3.6E-09	7.6E-10	3.6E-08	1.5%
231	9.8E-07	5.1E-08	2.8E-08	6.4E-09	1.1E-06	45.3%
232	3.5E-07	6.2E-08	3.4E-08	7.7E-09	4.5E-07	19.2%
233	5.4E-07	5.6E-08	3.4E-08	8.4E-09	6.4E-07	26.9%
300	1.3E-08	--	--	--	1.3E-08	0.6%
301	7.3E-09	--	--	--	7.3E-09	0.3%
302	5.8E-09	--	--	--	5.8E-09	0.2%
303	8.0E-09	--	--	--	8.0E-09	0.3%
304	5.0E-09	--	--	--	5.0E-09	0.2%
305	7.2E-09	--	--	--	7.2E-09	0.3%
306	7.1E-09	--	--	--	7.1E-09	0.3%
307	6.0E-09	--	--	--	6.0E-09	0.3%
308	3.1E-09	--	--	--	3.1E-09	0.1%
309	4.2E-09	--	--	--	4.2E-09	0.2%
801	5.1E-08	--	--	--	5.1E-08	2.2%
802	3.7E-08	--	--	--	3.7E-08	1.6%
803	1.6E-08	--	--	--	1.6E-08	0.7%
901	--	--	--	--	--	--
Total	2.1E-06	1.8E-07	9.9E-08	2.3E-08	2.4E-06	100%

-- = not applicable

Table 8B. Source-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI (cont.)

Maximum Exposed Indvidual Worker (Receptor 1006; 392300, 3750950)					
Source ID	**Exposure Pathway**			**Total**	**Percent Contribution to Cancer Risk**
	Inhalation	**Dermal**	**Soil Ingestion**		
101	9.7E-13	--	--	9.7E-13	0.0001%
163	5.7E-09	2.3E-09	1.0E-09	8.9E-09	1.1%
231	3.6E-07	2.6E-08	1.2E-08	4.0E-07	48.5%
232	1.3E-07	3.2E-08	1.5E-08	1.8E-07	21.4%
233	1.8E-07	2.7E-08	1.3E-08	2.2E-07	26.4%
300	3.1E-09	--	--	3.1E-09	0.4%
301	1.6E-09	--	--	1.6E-09	0.2%
302	1.4E-09	--	--	1.4E-09	0.2%
303	1.9E-09	--	--	1.9E-09	0.2%
304	1.2E-09	--	--	1.2E-09	0.1%
305	1.6E-09	--	--	1.6E-09	0.2%
306	1.5E-09	--	--	1.5E-09	0.2%
307	1.2E-09	--	--	1.2E-09	0.1%
308	6.1E-10	--	--	6.1E-10	0.07%
309	7.3E-10	--	--	7.3E-10	0.09%
801	3.4E-09	--	--	3.4E-09	0.4%
802	2.9E-09	--	--	2.9E-09	0.4%
803	1.5E-09	--	--	1.5E-09	0.2%
901	--	--	--	--	--
Total	6.9E-07	8.7E-08	4.1E-08	8.2E-07	100%

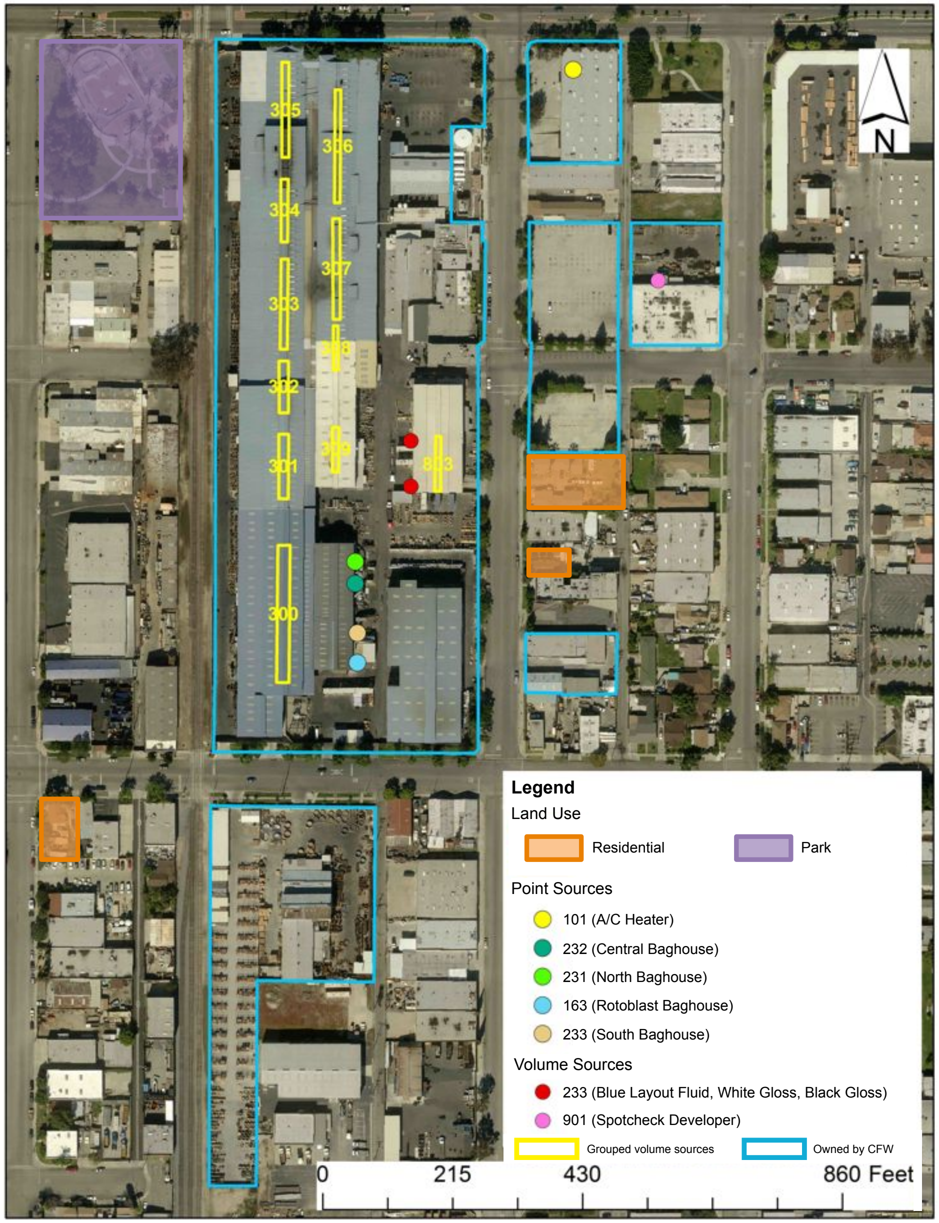
-- = not applicable

Table 8B. Source-Specific Contribution to Cancer Risk for MEIR, MEIW, and PMI (continued)

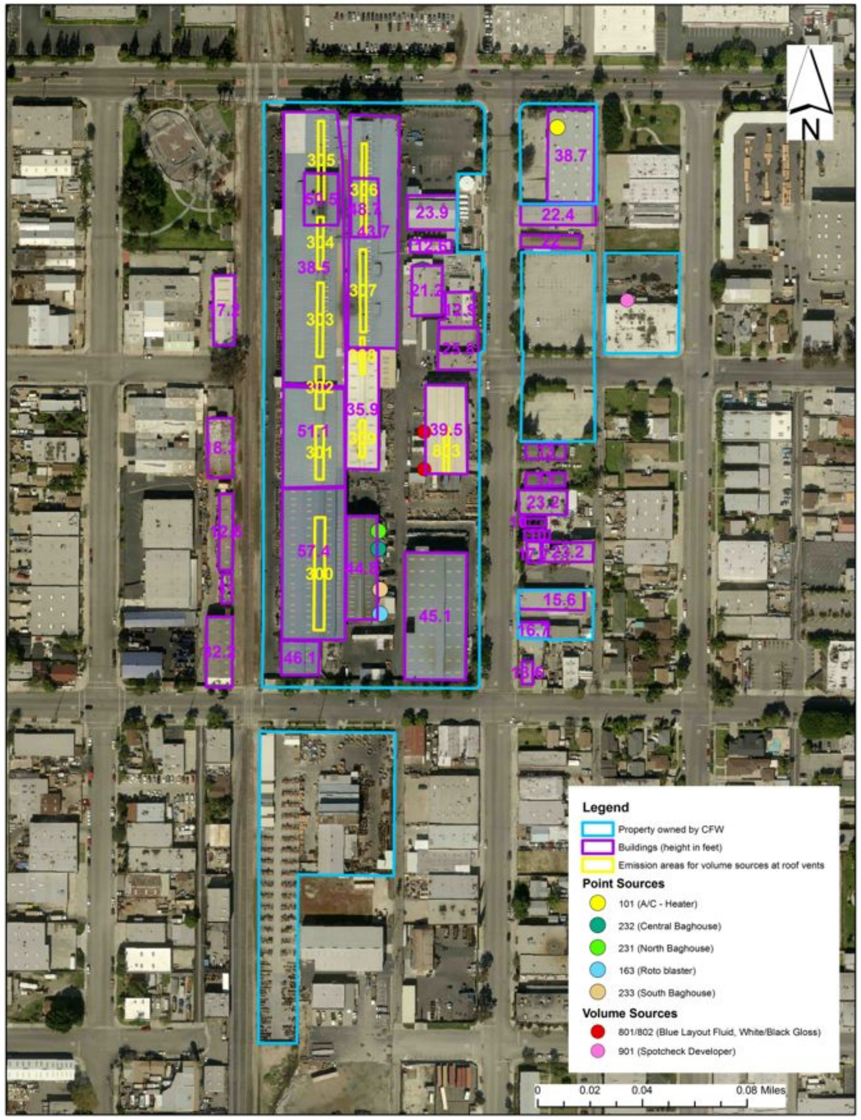
Point of Maximum Impact (Receptor 32; 392336.9, 3751006)						
Source ID	**Exposure pathway**				**Total**	**Percent Contribution to Cancer Risk**
	Inhalation	**Dermal**	**Soil Ingestion**	**Home-Grown Vegetables**		
101	4.8E-12	--	--	--	4.8E-12	0.0001%
163	2.0E-08	5.8E-09	3.0E-09	6.3E-10	3.0E-08	0.7%
231	1.9E-06	9.8E-08	5.4E-08	1.2E-08	2.1E-06	49.8%
232	6.9E-07	1.2E-07	6.6E-08	1.5E-08	8.9E-07	21.4%
233	8.7E-07	9.1E-08	5.6E-08	1.4E-08	1.0E-06	24.6%
300	1.8E-08	--	--	--	1.8E-08	0.4%
301	1.2E-08	--	--	--	1.2E-08	0.3%
302	8.9E-09	--	--	--	8.9E-09	0.2%
303	1.1E-08	--	--	--	1.1E-08	0.3%
304	6.3E-09	--	--	--	6.3E-09	0.2%
305	8.3E-09	--	--	--	8.3E-09	0.2%
306	7.6E-09	--	--	--	7.6E-09	0.2%
307	6.7E-09	--	--	--	6.7E-09	0.2%
308	3.7E-09	--	--	--	3.7E-09	0.09%
309	4.9E-09	--	--	--	4.9E-09	0.1%
801	2.6E-08	--	--	--	2.6E-08	0.6%
802	2.3E-08	--	--	--	2.3E-08	0.5%
803	8.5E-09	--	--	--	8.5E-09	0.2%
901	--	--	--	--	--	--
Total	3.6E-06	3.2E-07	1.8E-07	4.2E-08	4.2E-06	100%

-- = not applicable

FIGURES

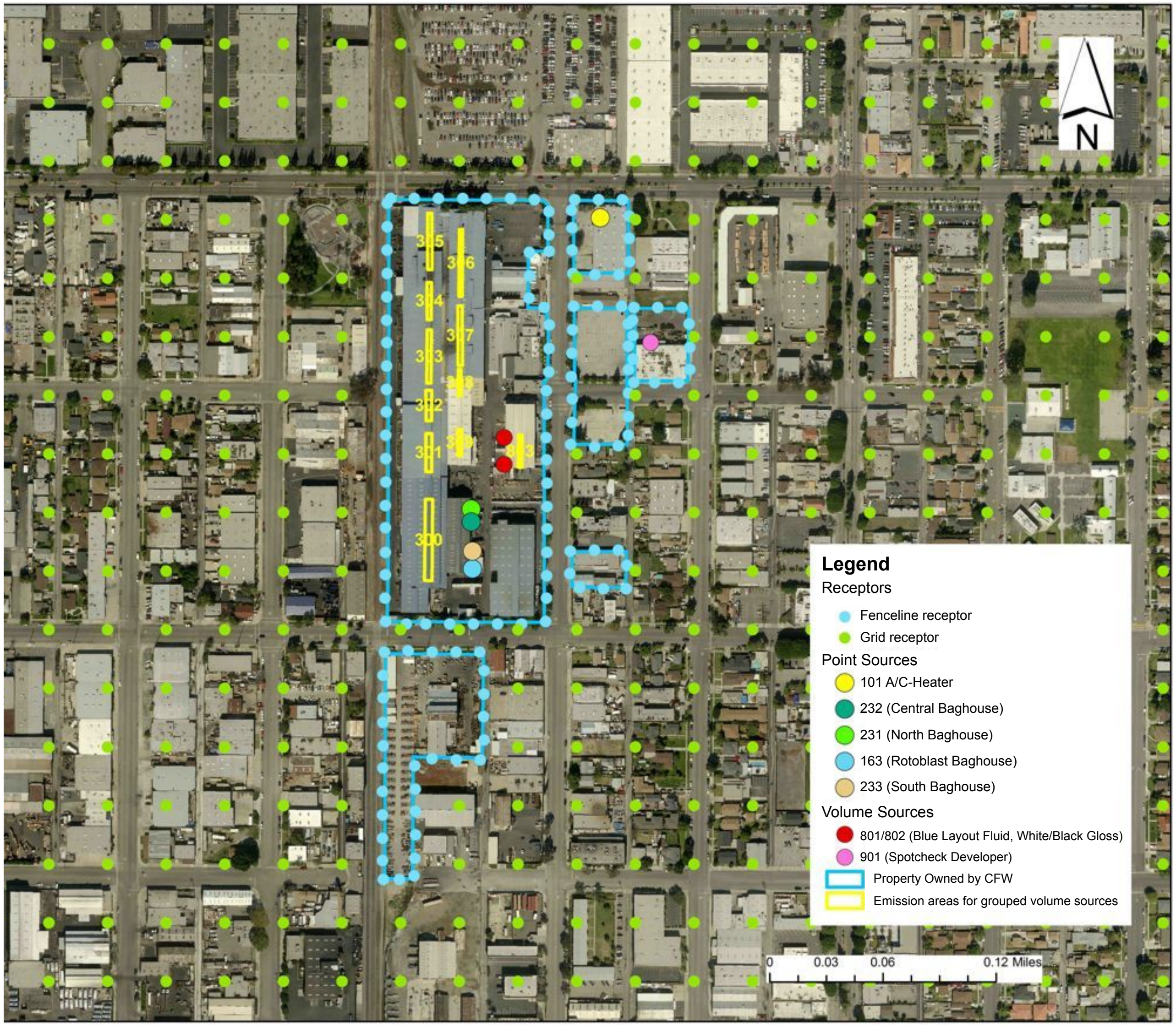


Figure'1A.''Carlton'Forge'Works'Facility,'Air'Emissions'Sources,'and'Nearby'Land'Use'

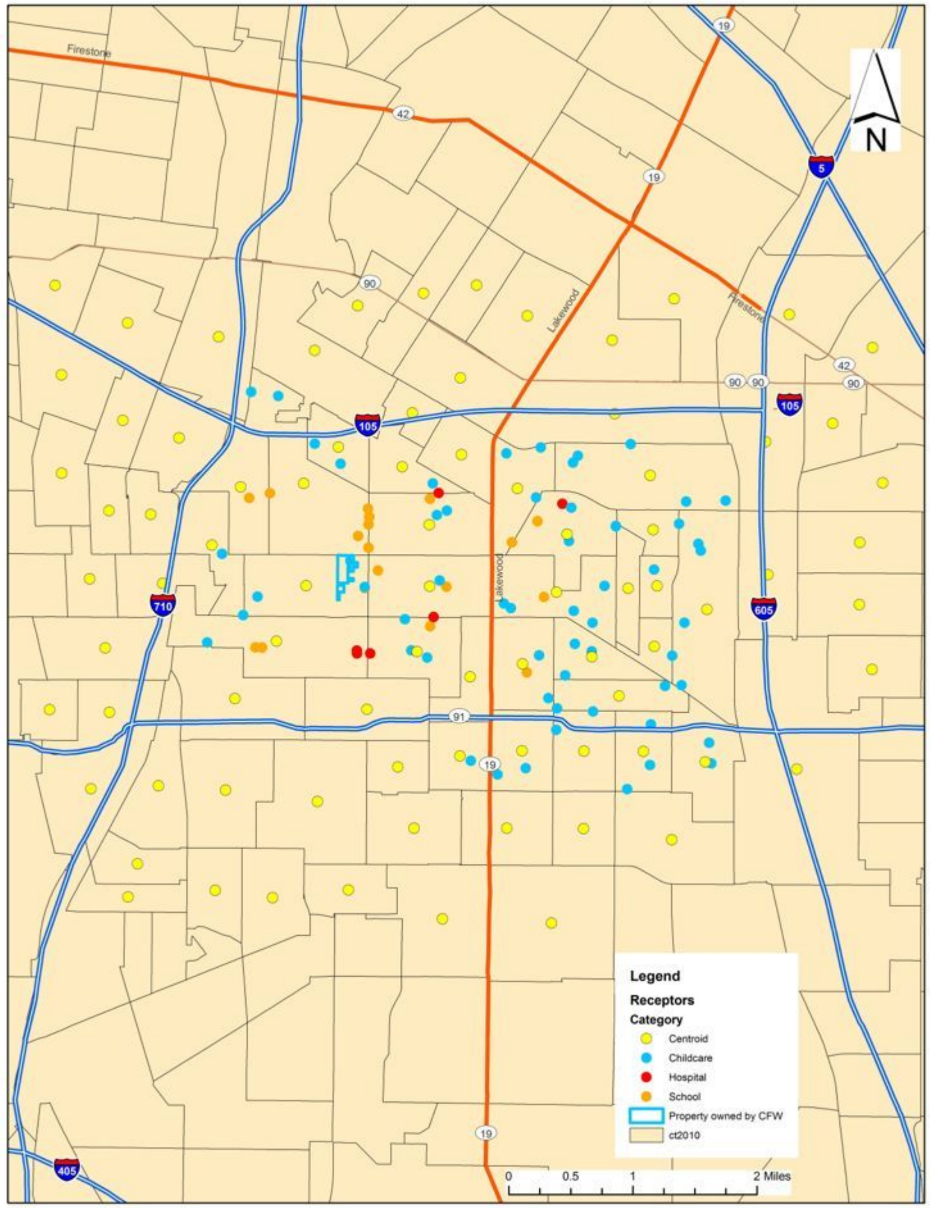


Figure'1B.'Carlton'Forge'Works'Facility,'Air'Emission'Sources,'and''
Buildings'Included'in'the'Air'Dispersion'Model'

Figure'2A.'Grid'Receptors'Included'in'the'Air'Dispersion'Model'



Figure'2B.'Nearby'Grid'Receptors'and'Fence'Line'Receptors''



Figure'2C.'SensiNve'Receptors'and'Census'Tract'Centroid'Receptors' Included'in'the'Air'Dispersion'Model'

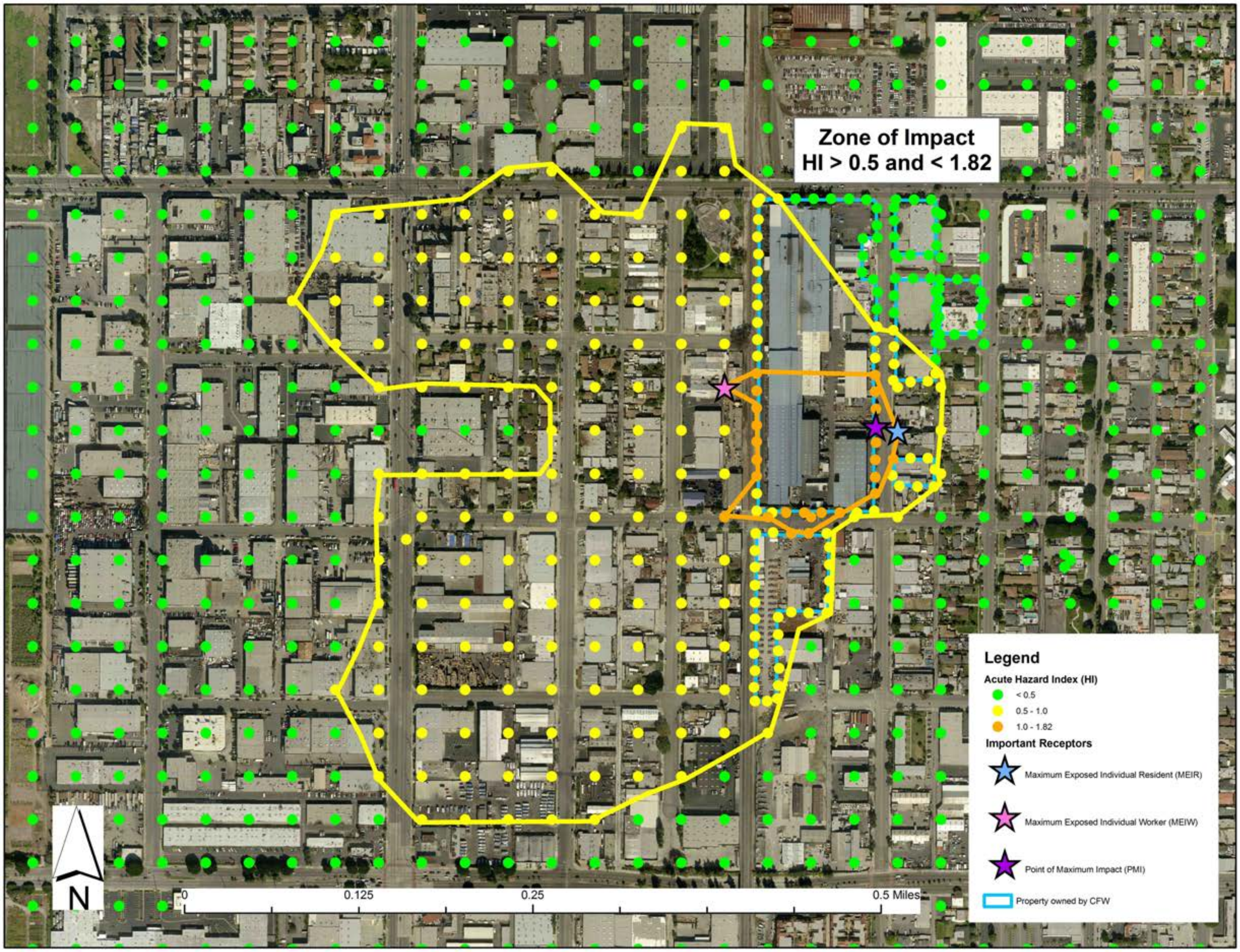


Figure 3. Predicted Acute Hazard Index Isopleths

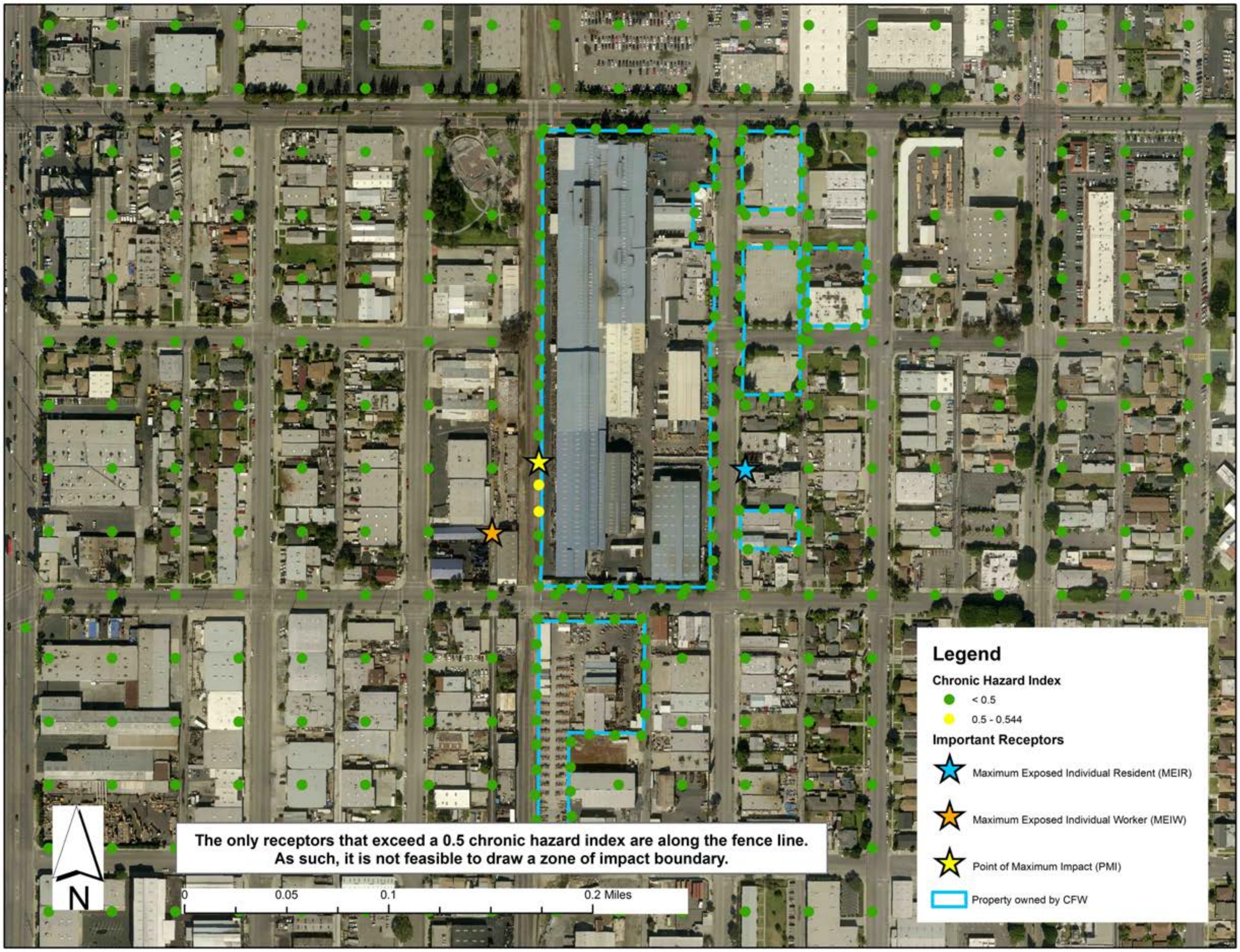


Figure 4. Predicted Chronic Hazard Index

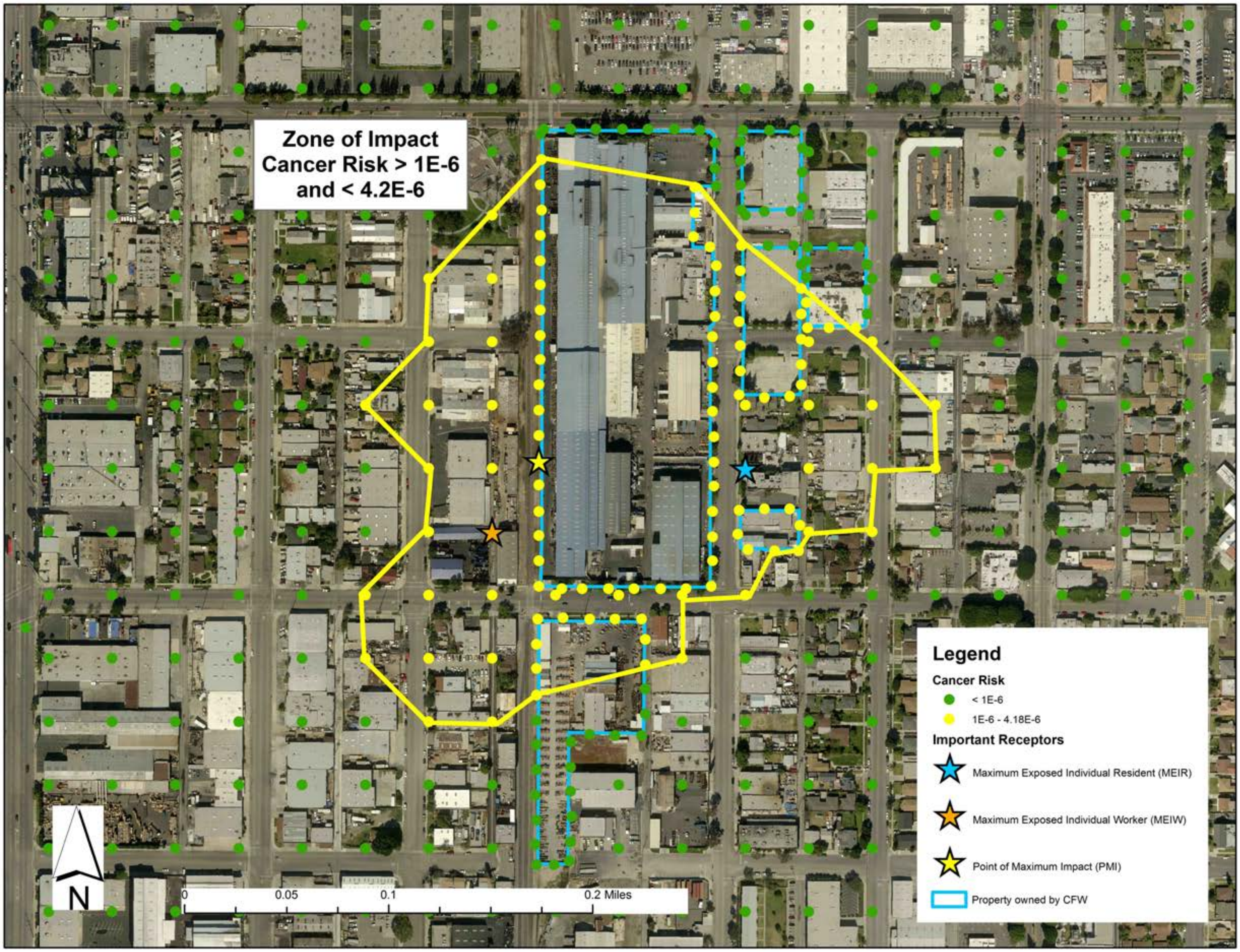


Figure 5A. Predicted Lifetime Excess Cancer Risk and Zone of Impact

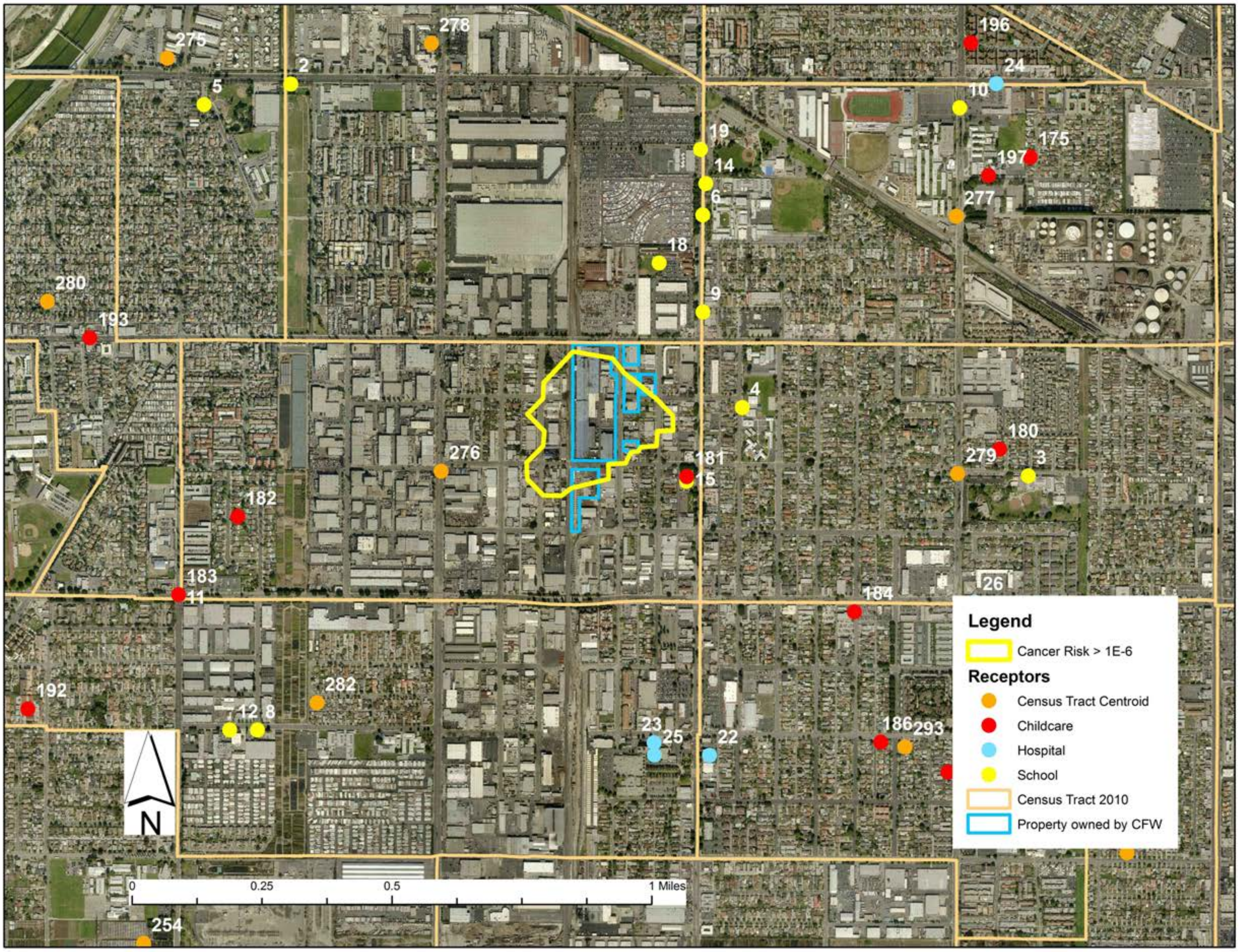


Figure 5B. Predicted Zone of Impact (Lifetime excess Cancer Risk > 1e-6) and Sensitive Receptors Included in the Air Dispersion Model. *(None of the sensitive receptors are within the zone of impact.)*

Appendix A
Air Toxics Inventory Report
(Provided Electronically)

Appendix B
Predicted Ambient Air Concentrations
(Provided Electronically)

Appendix C
Predicted Cancer Risks and Acute Hazard Indexes
for Receptors within the Zones of Impact

Appendix C-1. Predicted Cancer Risks
for Receptors within the Zone of Impact

Receptor ID	UTM E	UTM N	Cancer Risk
32	392337	3751006	4.2E-06
31	392337	3750987	4.2E-06
30	392337	3750966	4.1E-06
29	392337	3750947	3.8E-06
33	392337	3751026	3.7E-06
34	392337	3751046	3.5E-06
35	392337	3751066	3.4E-06
28	392337	3750927	3.3E-06
127	392371	3750905	3.0E-06
128	392355	3750905	2.9E-06
27	392337	3750907	2.9E-06
1006	392300	3750950	2.9E-06
964	392350	3750900	2.9E-06
1045	392300	3751000	2.9E-06
109	392475	3751005	2.8E-06
36	392338	3751086	2.7E-06
108	392475	3751025	2.7E-06
1085	392300	3751050	2.7E-06
110	392475	3750986	2.7E-06
126	392392	3750905	2.7E-06
107	392474	3751045	2.5E-06
37	392338	3751105	2.4E-06
965	392400	3750900	2.4E-06
125	392412	3750905	2.4E-06
111	392474	3750966	2.4E-06
1046	392500	3751000	2.4E-06
106	392474	3751064	2.2E-06
130	392356	3750882	2.2E-06
129	392336	3750881	2.2E-06
38	392338	3751125	2.2E-06
963	392300	3750900	2.2E-06
112	392474	3750946	2.1E-06
115	392495	3750967	2.1E-06
132	392377	3750881	2.1E-06
1086	392500	3751050	2.1E-06
124	392433	3750905	2.0E-06
102	392495	3751058	2.0E-06

Appendix C-1. Predicted Cancer Risks for Receptors within the Zone of Impact

Receptor ID	UTM E	UTM N	Cancer Risk
1125	392300	3751100	2.0E-06
134	392397	3750881	1.9E-06
96	392474	3751084	1.9E-06
103	392515	3751056	1.9E-06
116	392515	3750968	1.8E-06
39	392338	3751145	1.8E-06
118	392494	3750948	1.8E-06
101	392496	3751077	1.8E-06
113	392474	3750927	1.7E-06
1047	392550	3751000	1.7E-06
135	392418	3750881	1.7E-06
104	392535	3751057	1.7E-06
123	392453	3750905	1.7E-06
131	392335	3750861	1.7E-06
95	392474	3751104	1.7E-06
966	392450	3750900	1.7E-06
1087	392550	3751050	1.7E-06
40	392338	3751164	1.6E-06
117	392535	3750968	1.6E-06
105	392544	3751066	1.6E-06
119	392502	3750936	1.6E-06
100	392496	3751097	1.6E-06
962	392250	3750900	1.5E-06
922	392300	3750850	1.5E-06
94	392476	3751120	1.5E-06
114	392473	3750907	1.5E-06
1164	392300	3751150	1.5E-06
1005	392250	3750950	1.5E-06
1084	392250	3751050	1.5E-06
41	392338	3751184	1.5E-06
1044	392250	3751000	1.4E-06
136	392421	3750865	1.4E-06
122	392543	3750955	1.4E-06
99	392495	3751116	1.4E-06
92	392544	3751082	1.4E-06
133	392335	3750842	1.4E-06
93	392476	3751140	1.4E-06

Appendix C-1. Predicted Cancer Risks for Receptors within the Zone of Impact

Receptor ID	UTM E	UTM N	Cancer Risk
120	392523	3750935	1.4E-06
1088	392600	3751050	1.4E-06
1124	392250	3751100	1.4E-06
1048	392600	3751000	1.3E-06
921	392250	3750850	1.3E-06
42	392339	3751204	1.3E-06
1007	392550	3750950	1.3E-06
98	392496	3751136	1.3E-06
967	392500	3750900	1.3E-06
91	392544	3751102	1.3E-06
72	392477	3751160	1.3E-06
1126	392550	3751100	1.2E-06
121	392542	3750935	1.2E-06
43	392338	3751224	1.2E-06
70	392459	3751183	1.2E-06
1202	392300	3751200	1.2E-06
71	392472	3751175	1.2E-06
137	392421	3750845	1.2E-06
1163	392250	3751150	1.2E-06
82	392549	3751111	1.2E-06
97	392496	3751156	1.2E-06
141	392335	3750821	1.2E-06
90	392544	3751122	1.1E-06
1089	392650	3751050	1.1E-06
69	392460	3751202	1.1E-06
81	392566	3751111	1.1E-06
923	392450	3750850	1.1E-06
44	392339	3751244	1.1E-06
961	392200	3750900	1.1E-06
83	392548	3751131	1.1E-06
73	392497	3751176	1.1E-06
1127	392600	3751100	1.1E-06
920	392200	3750850	1.1E-06
1049	392650	3751000	1.1E-06
1008	392600	3750950	1.0E-06
80	392587	3751111	1.0E-06
881	392300	3750800	1.0E-06

Appendix C-1. Predicted Cancer Risks
for Receptors within the Zone of Impact

Receptor ID	UTM E	UTM N	Cancer Risk
89	392544	3751142	1.0E-06
1083	392200	3751050	1.0E-06
880	392250	3750800	1.0E-06
68	392460	3751222	1.0E-06
138	392421	3750826	1.0E-06

Appendix C-2. Predicted Acute Hazard Indices for Receptors within the Zone of Impact

Receptor ID	UTM E	UTM N	Acute HI
109	392475	3751005	1.8
110	392475	3750986	1.8
108	392475	3751025	1.6
111	392474	3750966	1.6
32	392337	3751006	1.5
31	392337	3750987	1.5
33	392337	3751026	1.4
30	392337	3750966	1.4
107	392474	3751045	1.4
126	392392	3750905	1.3
112	392474	3750946	1.3
965	392400	3750900	1.2
34	392337	3751046	1.2
29	392337	3750947	1.2
125	392412	3750905	1.2
115	392495	3750967	1.1
1046	392500	3751000	1.1
106	392474	3751064	1.1
132	392377	3750881	1.1
124	392433	3750905	1.1
127	392371	3750905	1.1
964	392350	3750900	1.0
113	392474	3750927	1.0
35	392337	3751066	1.0
963	392300	3750900	1.0
134	392397	3750881	1.0
1085	392300	3751050	1.0
118	392494	3750948	1.0
27	392337	3750907	1.0
128	392355	3750905	1.0

Appendix D
Electronic Submittals

Appendix E
Comparisons of Measured and Model-Estimated Levels of Nickel in the Area Surrounding Carlton Forge Works

Appendix E

Comparisons of Measured and Model-Estimated Levels of Nickel in the Area Surrounding Carlton Forge Works

The SCAQMD has been analyzing metals in total suspended particulate (TSP) samples collected at three ambient air monitors east of CFW since August 2013. Data provided by SCAQMD were collected through May 2014. The southern monitor is located in close proximity to the MEIR; the northern and eastern monitors are further from CFW. These ambient air samples include both emissions from CFW and from non-CFW sources (i.e., local background). SCAQMD has not monitored upwind of CFW to evaluate local background.

CFW has analyzed metals in samples of ambient air collected at locations upwind and downwind of CFW in November 2013, December 2013, and February/March 2014 (ToxStrategies, 2014). CFW location AC (Aerocraft) is situated the farthest away from the CFW facility (more than 1000 feet) and meteorological data suggest a low frequency of wind out of the northeast, this monitor can be considered as a background monitor relative to the monitors in the vicinity of the CFW facility. Notably, CFW collected samples of particulate matter < 10 microns (μm) in diameter (PM10), which is a subset of TSP and the biologically relevant size fraction of respirable particles that can be deposited in the respiratory system. The locations of monitors sampled by CFW, and the northern and southern SCAQMD monitor locations are depicted in **Figure 1.**

The eastern SCAQMD monitor and CFW location 6 and AC are located outside the ZOI while all the other CFW monitoring locations and the northern and southern SCAQMD monitors are located within the CFW ZOI (Figure ES-1). Levels of nickel measured at CFW locations AC and 6 were compared to levels measured in the SCAQMD southern monitor, CFW monitors 1 and 2, as well as the estimated concentrations predicted by the air dispersion model at receptor 1047 in this HRA. Receptor 1047 is the closest receptor to Location 2 and the SCAQMD southern monitor.

At Receptor 1047, AERMOD dispersion modeling of CFW emissions predicted a 3-year average, ground level concentration of nickel of 3.4 nanograms per cubic meter (ng/m^3), and a 1-hour maximum concentration of 113 ng/m^3. The average monitored concentration of nickel in TSP at SCAQMD's southern monitor for January though May 2014 was 18.4 ng/m^3 and the average concentration of nickel in PM10 at CFW location 2 was 6.0 ng/m^3 for samples collected in February and March 2014.[1]

[1] Airborne concentrations for January – May 2014 from the SCAQMD data and February-March 2014 for the CFW data were selected for this comparison because improvements to the grinding building were implemented in December 2013 and thus the sampling data collected after December is most reflective of current operating conditions.

Figure 1. Carlton Forge Works (blue outline) ambient air sample locations (Location 1-6 and AC, yellow dots) monitored during November and December 2013 and February/March 2014, and SCAQMD sample locations in the vicinity (blue diamonds). Baghouse source locations are shown in red.

The SCAQMD and CFW results at these locations near CFW are likely different because PM10 is a fraction of TSP. To understand the relationship between nickel in TSP and PM10, monitoring results were compared for sampling days in November and December 2013 when both SCAQMD and CFW were monitoring at the southern monitor and location 2. The fraction of nickel in TSP (SCAQMD sample) that was PM10 (CFW sample) ranged from 12% to 49%, with an average of 32% (ToxStrategies 2014), which is consistent with the fraction of the nickel concentrations in TSP compared to PM10 observed in the long-term averages for 2014 (33%).

GraphPad Prism was used to conduct the nonparametric analysis of variance (ANOVA) along with a Dunn's test for multiple comparisons (ToxStrategies 2014). Dunn's test was used to test for differences between Location AC and the other locations. The results indicated that the nickel concentrations were statistically different and lower for all six sample locations compared to location AC (Figure 2).

It is important to note that AERMOD-predicted concentrations are solely related to CFW emissions, and the monitoring data capture nickel from other sources. The background level of nickel in TSP measured in Compton during MATESIII was 6.1 ng/m^3, with monthly average concentrations ranging between 3.5 and 10.5 ng/m^3.[2] However, the average concentration of Ni measured in February-March 2014 at the upwind CFW AC monitoring location was 20.4 ng/m^3 (as PM10), which was statistically significantly higher than that measured at CFW locations closer to the facility during the same time period (**Figure 2**). Similarly, the average concentrations of nickel in PM10 at the other upwind CFW location (location 6) were 18.2 ng/m^3, 6.8 ng/m^3, and 7.2 ng/m^3, in sampling conducted in November 2013, December 2013 and February-March 2014, respectively. The average concentrations in samples at CFW location 2, which were collected on the same days in November, December and February-March (7.1, 4.5 and 6.0 ng/m^3, respectively), were all lower than that measured at locations AC and 6 (ToxStrategies 2014).

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[2] Source: p. 24, http://www.aqmd.gov/docs/default-source/air-quality/air-toxic-studies/mates-iii/mates-iii-final-report-%28september-2008%29/appendix-vi-summaries-for-the-mates-iii-fixed-monitoring-sites.pdf?sfvrsn=4 . SCAQMD also monitored for PM2.5 and the average concentration of nickel was 4.5 ng/m^3.

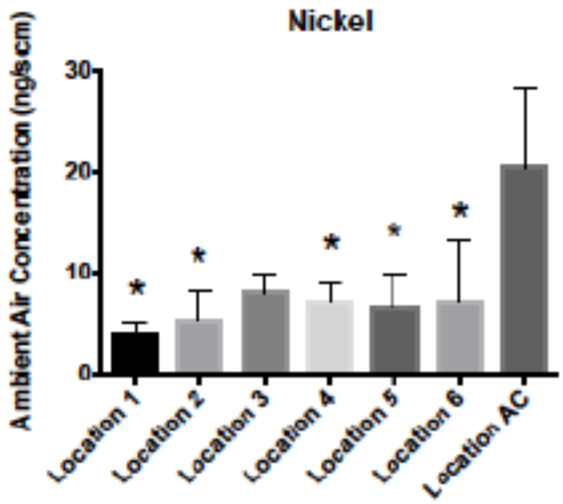

Figure 2. Comparison of Ambient Air data Collected for December 2013 and February/March 2014 at CFW monitoring sites.

Finally, it is noteworthy that AERMOD was used to estimate levels of nickel and other metals measured in December 2013 at the CFW monitoring locations on days when stack testing of the three main grinding building baghouses was being conducted. AERMOD predicted concentrations of nickel were within 10% of measured values at CFW locations 4 and 5, and were 49% to 61% of measured levels at Locations 1, 2, and 3 (ToxStrategies 2014). This exercise demonstrates that the model accurately predicted concentrations of nickel at locations immediately around the facility suggesting that the facility may be a primary source of nickel at these nearby locations, at least on the days when these samples were collected. However, model predicted concentrations of nickel at Locations 6 and AC, which are distant from CFW, were only 16% and 4% of measured levels, demonstrating that other significant nickel sources exist in the local area (ToxStrategies 2014).

Overall, these comparisons demonstrate that the levels of nickel monitored in ambient air near CFW include a significant contribution from upwind sources, and that the AERMOD-estimated concentrations of nickel downwind of CFW are reasonably consistent with measured levels of nickel at SCAQMD and CFW monitoring locations given that a portion of measured nickel appears to come from upwind sources.