APPENDIX H

Example Application: Waste Incinerator

DRAFT

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Prepared By:
John A. Cooper and Aaron Siemers
Cooper Environmental Services, LLC
Portland, OR

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Summary

This hypothetical example details how the Guide for Developing a Multi-Metals, Fence-Line Monitoring Plan for Fugitive Emissions Using X-Ray Based Monitors (Guide) can be applied to a highly industrialized area of a large metropolitan airshed in which the driver is a measured transient spike in ambient arsenic concentration. In this example, the source of the arsenic emission is unknown, but it is hypothesized to be intermittent fumigations by stack emissions from a hazardous waste incinerator. The Guide therefore is used to develop an air monitoring plan to monitor and characterize local air quality issues in a highly active, industrial airshed. The primary objectives of this example are to: 1) illustrate how to develop a monitoring plan in an urban area with unknown air quality risks that is designed to qualify risks and identify emission sources, and 2) provide a guideline for a local ambient metals air monitoring plan that includes discussion of location criteria, action concentrations, airshed compliance concentrations, and a corrective action pathway.

The hazardous waste incineration facility (The Facility) is located in an industrialized area near East St. Louis, Illinois, in a town incorporated as Sauget, Illinois. The Facility has three incinerator units which combust halogenated solvents, acids, propellants, and other highly volatile and toxic chemicals. Emissions from The Facility are part of an airshed which passes over an industrial area, the Mississippi River, residential areas, and schools of Sauget, Illinois, Cahokia, Illinois, St. Louis, Missouri, and East St. Louis, Illinois. In this hypothetical example, regulators have developed a continuous multi-metals ambient air monitoring plan to monitor and characterize local air quality issues, protect human health and the environment, identify potential sources of emissions, and to alleviate the local community's concern. Continuous ambient metals air monitoring, when combined with meteorological records and facility processing records, is a tool for regulators to assess public health risks, locate polluters, and enforce compliance with applicable standards.

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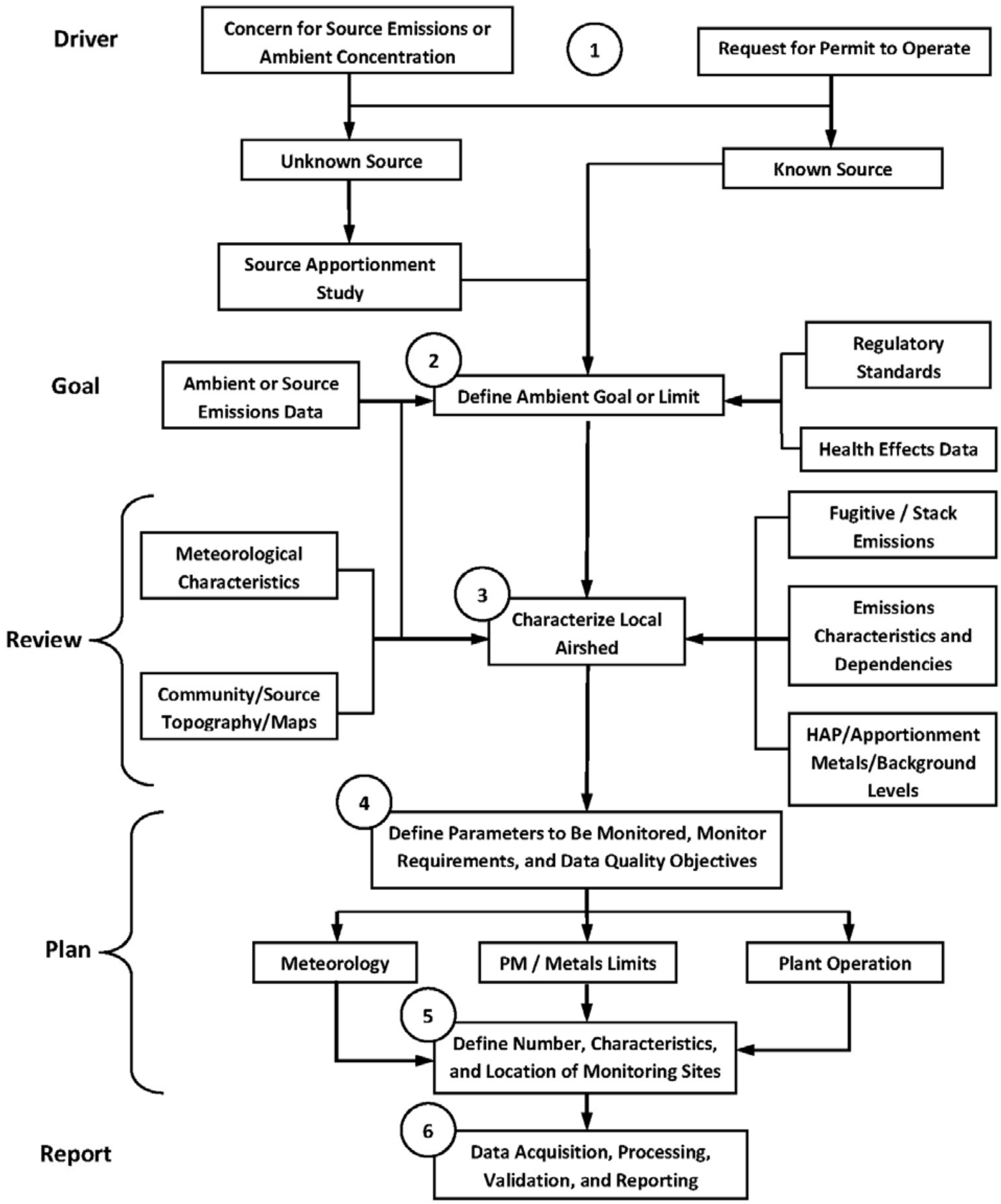

Figure 1. Procedure Flow Diagram

1.0 Driver – Arsenic (As) Episode

1.1 Arsenic Event

On April 13th, 2009, an ambient metals air quality sampler located less than two miles northeast of a hazardous waste incinerator (The Facility) in an East St. Louis, Illinois, residential area recorded an arsenic concentration of 2.34 µg/m³; a level potentially dangerous to human health and the environment. Examination of public records and meteorological data from April 13th strongly suggests that the hazardous waste incinerator is the probable source of the arsenic, however there are numerous other industrial operations in the area and The Facility does not claim responsibility for the release. Because the arsenic release appears to be an isolated occurrence, a comprehensive source apportionment study has not been conducted. However expansion of ambient air hazardous metal sampling is necessary to monitor for future releases and characterize the local airshed.

A description of the arsenic event outlines some of the issues surrounding ambient air sampling and source identification in the Sauget, Illinois, area. During the April 13th, 2009, arsenic event, early morning wind direction was from the northeast at about 7 mph. Around 10:00 am, with wind direction shifting clockwise from out of the east and south, arsenic levels were recorded at 0.76 ng/m³. However, by 12:00 pm, winds had continued to shift clockwise to where the wind was primarily from the southwest, creating a wind vector directly from The Facility to the ambient metals air sampling device, and arsenic readings quickly spiked to 2345 ng/m³. As winds continued to shift clockwise, by around 2:00 pm direction was from the west, and arsenic concentrations declined rapidly. Arsenic concentrations at the monitor decreased from 173 ng/m³ around 2:00 pm, to 11 ng/m³ around 4:00 pm, and 2.4 ng/m³ around 6:00 pm (2009, Missouri DNR). It is probable that arsenic levels remained elevated throughout the course of the day, but declined because the ambient metals air monitor was no longer directly in the air contaminant pathway. **(Figure 2 & 3)**

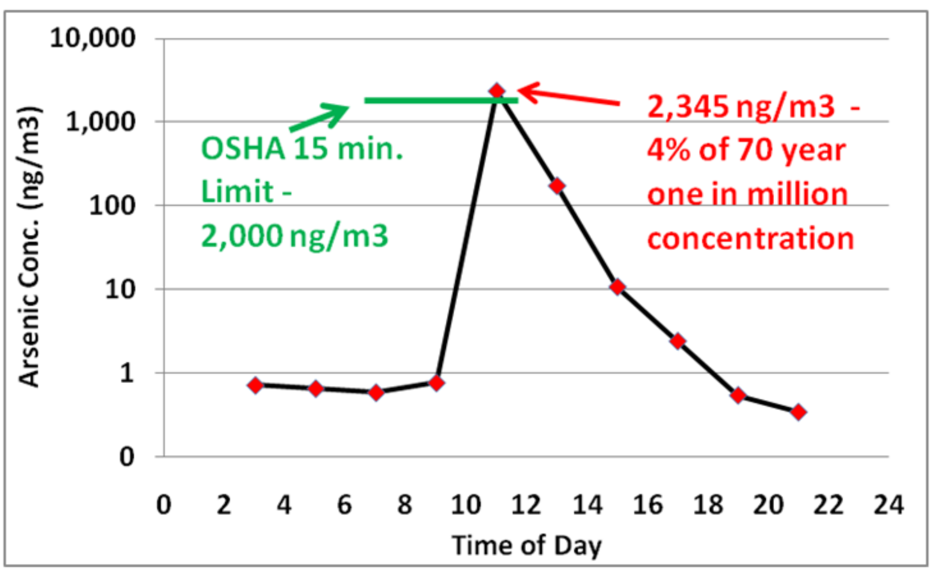

Figure 2. As conc. at metals monitor, April 13, 2009, (sample times shown as mid-points)

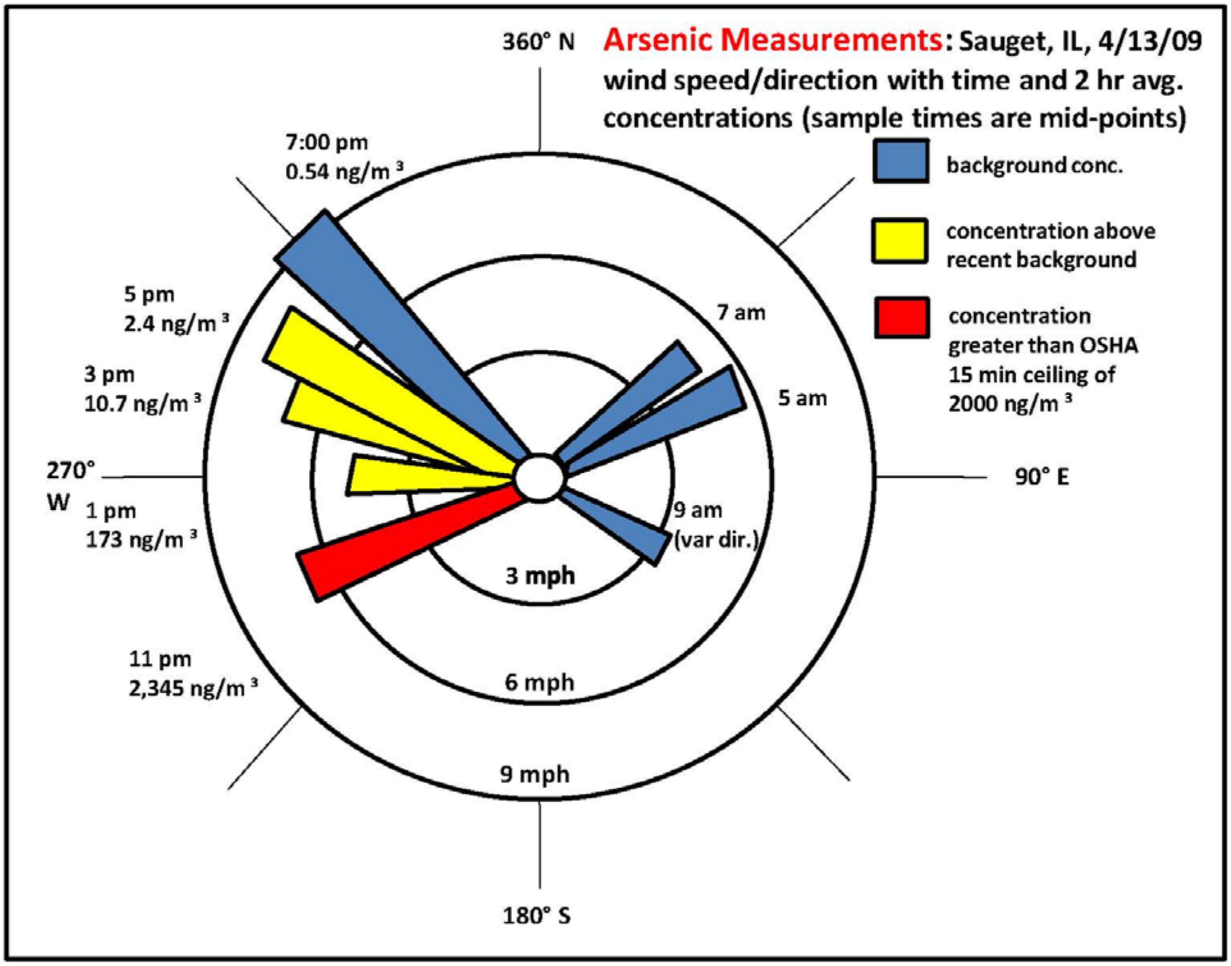

Figure 3. Arsenic Measurements with Cahokia, IL, airport wind data, 5:00 am – 7:00 pm, April 13, 2009, Sauget, Illinois

1.2 Cause/Source

The hazardous waste incineration facility is located on a 35 acre site in Sauget, Illinois, adjacent to the Mississippi River near East St. Louis, Illinois. The Facility processes hazardous waste through combustion in two fixed-hearth, dual chamber, multi-type feed incinerators with 100 feet stacks, and one rotary kiln incinerator with a 100 feet stack. The site also includes ten container storage units, three material processing areas, a waste drum decant area, and a full analytical laboratory. The Facility is permitted by the federal Environmental Protection Agency (EPA) and the Illinois Environmental Protection Agency (IEPA) under the Resource Conservation and Recovery Act (RCRA) and Title V of the Clean Air Act (CAA). The site must renew its permit every five years. The last permit was issued in 2008 and will be reviewed for renewal in 2013.

Services at The Facility include the processing and incineration of hazardous waste such as lab packs, water reactive chemicals, oxidizers/organic peroxides, halogenated solvents, organic acids, propellants, and explosives. Hazardous waste re-packaging is also conducted on-site.

The wastes are transported to The Facility by tank trucks, rail cars, or ship containers, and may be in solid, liquid, or sludge form. Due to the nature of The Facility's processes, there are numerous and diverse chemicals of concern (COCs) at the site, including organic air emissions from containers, dioxins and furans. Metals COCs include mercury, cadmium, lead, arsenic, beryllium, chromium, and antimony. Trace amounts of these metals are emitted through the stacks as part of the waste incineration process. However, faulty incineration has the potential to result in relatively large metals release to air. Fugitive release of contaminants is also of concern. Toxic Release Inventory (TRI) data from The Facility states that 37,277 pounds of arsenic compounds were shipped for off-site release or disposal in 2008. It is likely that this off-site disposal material is arsenic-contaminated incinerator ash from the waste incineration process, indicating a relatively large arsenic waste stream processed at The Facility.

The Facility is located in a highly industrialized airshed. Air emissions are from industrial activity, heavy traffic, and railway operations. Besides The Facility's hazardous waste incinerator, other industries in the Sauget, Illinois, area include a mainly inactive primary zinc smelter, a marine shipping terminal, a number of large chemical corporations, mid-sized manufacturers, and an oil company supply terminal. **(Figure 4)** The area is also the home of the Dead Creek federal Superfund site; a waterway running through the Sauget area which is in the process of dredging and remediation for elevated metals, volatile organic compounds and PCBs.

The zinc smelter, the marine terminal, and a chemical company are also located directly southwest of the multi-metals ambient air monitor site, and therefore were within the arsenic vector pathway April 13, 2009. However US EPA's 2008 Toxic Release Inventory records show that the hazardous waste incinerator handles significantly more arsenic compounds than any other nearby facility. Specifically, the zinc smelter's records state a total of 4 pounds of arsenic compounds listed as off-site disposal or release, the chemical company lists zero, and the marine terminal, though It can store over 10 million gallons of industrial chemicals including herbicides and chlorobenzenes, as a storage facility isn't required to report TRI data.

While the hazardous waste incinerator is the most likely source of the April 13th, 2009, arsenic event, there are other viable source candidates. The multi-metals ambient air monitoring plan is designed to assess the ongoing threats to the airshed, and, if a release occurs, identify the source of emissions and pursue corrective action.

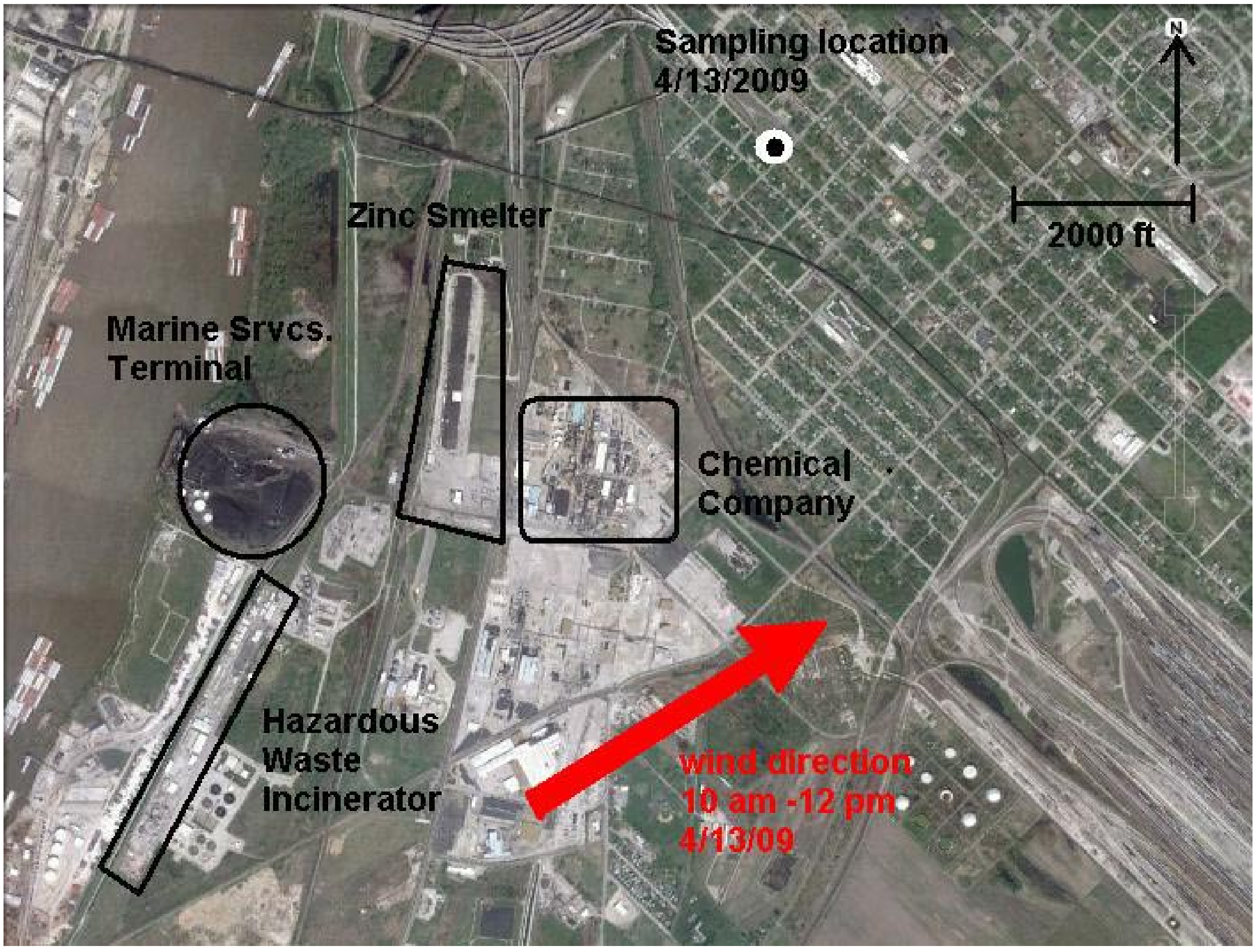

Figure 4. Map of local airshed detailing locations of potential arsenic sources, sampling location and wind direction, 4/13/2009.

2.0 Goals: Defining Ambient Goals and Compliance

In this hypothetical example, it is hypothesized that after the recent high arsenic episode, regulators decide to develop a Continuous Multi-Metals Ambient Air Monitoring Plan (Plan) to monitor local ambient air near The Facility and throughout the airshed using the Procedure Flow Diagram illustrated in **Figure 1.** The goals of the Continuous Multi-Metals Ambient Air Monitoring Plan are to provide comprehensive ambient metals air quality data within the local airshed to assess the public health threat, as well as to identify emission sources and enforce compliance with applicable standards and goals established.

Local airshed ambient air monitoring was chosen as a viable air quality monitoring and regulatory approach due to a number of issues and concerns:

1) Due to the number of potential hazardous air pollutant sources in the area, no fully confirmed source, and intermittent toxic emissions, ambient air monitoring will provide the broadest data of the overall health of the airshed and will adequately assess risks to human health and the environment.

2) The primary receptors for air-born particulate metals contamination are the residents of Sauget, Illinois, East St. Louis, Illinois, and St. Louis, Missouri.

3) The Facility has three (3) 100 feet stacks, making fence-line monitoring ineffective in characterizing a possible facility release.

4) Additional ambient data could be utilized to identify a source and proceed with corrective action including stack monitoring or a fugitive emissions study at the offending facility.

2.1 Ambient Emissions/Primary Elements of health/regulatory concern

Of the potential metals emissions in the region, arsenic concentrations in the industrial airshed are of primary concern. Numerous scientific studies indicate that short-term exposure to elevated arsenic concentrations poses significant risk to human health. During the April 13, 2009, arsenic event, concentrations exceeded acute one hour exposure limits set by the state of California at 0.2 $\mu g/m^3$ by over a factor of ten, and exceeded the National Institute for Occupational Safety and Health (NIOSH) standard for acute 15 minute exposure to workers set at 2 $\mu g/m^3$.

2.1.2 Secondary Elements of potential health concern

TRI Metals data from 2008 state that The Facility processed, disposed of, and/or incinerated well over 100,000 pounds of copper, zinc, silver, and manganese. Selenium is also of concern. At elevated concentrations these metals pose a significant risk to human health and the environment.

2.1.3 Source Apportionment Elements

A comprehensive source apportionment has not been conducted for The Facility or the local airshed. The Facility processes a wide range of hazardous materials and has a dynamic waste stream. Stack and fugitive emissions at The Facility generally depend upon the nature of the waste and the efficiency of the incineration process. Major source apportionment contaminants of concern at hazardous waste facilities generally include arsenic, mercury, cadmium, lead, chromium, beryllium, and antimony.

2.2 Regulatory Standards – Emission standards and Ambient Standards

United States EPA regulations 40 CFR Part 63 Subpart EEE, the National Emission Standards for Hazardous Waste Combustors, regulate emissions of hazardous air pollutants at incinerators, cement kilns, and lightweight aggregate kilns operating in the United States. The Federal Hazardous Air Pollutants (HAP) standards are based on the Maximum Achievable Control Technology (MACT) approach directed by the federal Clean Air Act which states that emission control technologies should be evaluated by their effectiveness, availability, current use, cost, and non-air environmental impacts.

The regulations limit emissions of mercury, semi-volatile metals (cadmium and lead), low-volatile metals (arsenic, beryllium, chromium, and antimony), particulate matter, acid gas emissions (hydrochloric acid and chlorine), hydrocarbons, and carbon monoxide, as well as dioxins and furans. **(Table 1)** The USEPA has also developed feed rates for metals, hydrogen chloride and chlorine gas which are intended to curb toxic emissions and are a part of The Facility's permitted operation specifications and performance tests.

Table 1. HAP/MACT Metals Emission Limits for Hazardous Waste Incinerators for new and existing facilities

HAP MACT STNDRDS	Mercury (Hg)	Cadmium (Cd) and Lead (Pb)	Arsenic (As), Beryllium (Be), Chromium (Cr)
existing facilities	130 µg/m³	230 µg/m³	92 µg/m³ combined emissions
new facilities	8.1 µg/m³	10 µg/m³	23 µg/m³

Hazardous Waste Incinerators perform CAA-mandated Comprehensive Performance Testing every five years to gauge effectiveness of the waste incineration process and develop incineration protocol. However, successful completion of the performance test does not fully ensure that the incinerator remains in compliance between testing events. There are a number of factors that can affect incineration efficiency and stack emissions, including inadequate waste characterization, negligent monitoring of the incineration process, or issues with the incinerator's instrumentation. The relatively long period of time between performance tests also means that incremental changes in the performance of the incinerator may not be understood or characterized.

Air Quality Standards for the protection of human health and the environment that pertain to ambient air include federal Clean Air Act National Ambient Air Quality Standards (NAAQS), California Reference Exposure Limits (REL), and Regional Screening Levels (RSL). The NAAQS were developed to address nation-wide ambient air quality concerns for public health. California RELs and U.S. EPA's RSLs provide risk-based levels which, if exceeded, indicate a general increase in the health risks to a population. At levels below RELs and RSLs however no health risks are known. Occupational Safety and Health Administration standards (OSHA) and NIOSH standards were developed for worker safety and work-place industrial scenarios and give limits for 8 hour exposures, 10 hour exposures, and acute exposures to toxins and carcinogens.

Considering the metals contaminants of concern related to The Facility, lead (Pb) is regulated by the NAAQS, and mercury (Hg), arsenic (As), chromium (Cr), and cadmium (Cd) have associated air quality standards from California, Region IX of the EPA, and NIOSH that can be utilized to assess risk and compliance. **(Table 2)**

Table 2. Relevant Air Quality Standards, Reference Exposure and Screening Levels (µg/m3)

Element	Parameter	NIOSH/OSHA[a]	NAAQS[b]	Reg. IX RSL[c]	CA REL[d]
As	**Indicator**	**TSP As**	**n/a**	**TSP As**	**TSP As**
	Avg. Time	15 min.		chronic	1 hour
	Conc. Level	2		0.016	0.2
	Form	NTBE		risk based	NTBE
Cd	**Indicator**	**TSP Cd**	**n/a**	**TSP Cd**	**n/a**
	Avg. Time	8 hr.		chronic	
	Conc. Level	0.005		0.01	
	Form	NTBE		risk based	
Cr	**Indicator**	**TSP Cr**	**n/a**	**TSP Cr**	**TSP Cr**
	Avg. Time	8 hr.		chronic	chronic
	Conc. Level	1		0.01	0.2
	Form	NTBE		risk based	risk based
Pb	**Indicator**	**TSP Pb**	**TSP Pb**	**n/a**	**n/a**
	Avg. Time	8 hr.	3 mo. RA		
	Conc. Level	50	0.15		
	Form	NTBE	NTBE		
Hg	**Indicator**	**Vapor Hg**	**n/a**	**Vapor Hg**	**Vapor Hg**
	Avg. Time	8 hr.		chronic	1 hour
	Conc. Level	100		0.31	0.6
	Form	NTBE		risk based	NTBE

a. National Institute for Occupational Safety and Health or Occupational Safety and Health Administration

b. National Ambient Air Quality Standard

c. US EPA Region IX Regional Screening Level

d. California Reference Exposure Limit

Not To Be Exceeded

2.3.1 Health Effects Data: Risks from Hazardous Ambient Metals Exposure and Air Monitoring Sampling Frequency

Evaluation of monitoring data and meteorological conditions from the arsenic event, along with basic mathematical modeling, suggests metals concentrations averaged over 12 to 24 hours may be significantly lower than 4 hour averages, 2 hour averages or discreet 15 minute averages. Due to the nature of fugitive or erratic emissions, which are tied to specific plant processes, the majority of a metals release might occur over a relatively brief period of time. Dynamic wind conditions also result in varying concentrations recorded in an ambient metals air sampler. During the April 13, 2009, arsenic detection near the facility, arsenic levels were recorded over a 12-hour period in a range from 0.65 ng/m^3/2hr to 2345 ng/m^3/2hr. The range of concentrations is hypothesized to be related to the highly dynamic wind conditions in the area. Considering the range of values, the 12-hour averaged concentration is around 362 ng/m³, which is an order of magnitude below the maximum arsenic value **(see Table 3).** The data shows that continuous, near real-time ambient metals monitoring produces high-resolution data that more accurately characterizes health risks within the local airshed.

Table 3. Recorded As concentration averages in East St. Louis, IL, 4/13/2009, demonstrating time averages and metals concentration

	As 12 hr Avg.	Time/Conc. Factor	As 2 hr Avg.
East St. Louis, IL, 4/13/2009	0.362 µg/m³	6/6.5	2.34 µg/m³

2.4 Action Levels

With a limited number of COCs with National Ambient Air Quality Standards, monitoring goals of a continuous multi-metals ambient air monitoring plan are based on NAAQS, Region IX EPA Regional Screening Levels, California Reference Exposure Levels (REL), Agency for Toxic Substances and Disease Registry (ATSDR) standards, as well as NIOSH/OSHA standards for worker safety and health.

Compliance Goals for ambient toxic metals are set at levels below the NAAQS for lead and at the RSL for mercury, arsenic, chromium and cadmium **(Table 4).**

Since, high-risk receptors like children and pregnant woman should not be exposed to ambient toxic metals concentrations at or near workplace limits, Action Levels for the local airshed can be set at 10 % of OSHA workplace standards for chromium; the California REL for arsenic and mercury; the NAAQS value for lead; and the ATSDR acute value for cadmium. Action Level exceedences can be utilized to trigger corrective action, source apportionment studies, and source mitigation. (**Table 5)**

Table 4. East St. Louis/Sauget, Illinois, Ambient Air Quality *Compliance Levels* proposed for example

	Lead (Pb)	Mercury (Hg)	Arsenic (As)	Chromium (Cr)	Cadmium (Cd)
NAAQS/ Region IX RSL	150 ng/m³ Rolling 3 month avg	310 ng/m³	16 ng/m³	10 ng/m³	10 ng/m³

Table 5. East St. Louis/Sauget, Illinois, Ambient Air Quality *Action Levels* proposed for example

Lead (Pb)	Mercury (Hg)	Arsenic (As)	Chromium (Cr)	Cadmium (Cd)
150 ng/m^3/3 month rolling	600 ng/m^3/1hr	200 ng/m^3/1hr	100 ng/m^3 Per 8 hr TWA	30 ng/m^3 Per 8 hr TWA

Continuous multi-metals ambient air monitoring devices will be located at critical meteorological points or at a sensitive nearby locations within the airshed such as a school or hospital. Considering the general distances of the monitoring device(s) from The Facility or other industrial fugitive emission sources, monitoring data at these residential locations near 10% the levels reflected in the OSHA work-place standards would suggest an air release of high volume and concentration. Without comprehensive federal or state ambient air regulations, ATSDR levels, EPA's RSLs, California RELs, and NAAQS Air Quality Standards provide a health and safety, as well as risk-based frame of reference by which regulators can base Compliance Goals and Action Levels.

2.5 Demonstrating Compliance

The continuous multi-metals ambient air monitoring program for the East St. Louis/Sauget, Illinois airshed is un-mandated environmental program developed by regulators to address local air quality concerns, identify potential polluters, and protect human health and the environment. Compliance will be demonstrated by comparing data emerging from the multi-metals ambient air monitors to the stated Compliance Levels and Action Levels stated in the plan. The continuous multi-metals ambient air monitoring devices can remotely communicate, which allows for ongoing monitoring of the air quality within the airshed. If Action Levels are triggered, the emissions source would be identified and corrective action would commence. **(Tables 4 & 5)**

Compliance Levels are risk based standards which delineate potential risk to human populations within the airshed. They are based on EPA Region IX Residential Screening Levels. At concentrations below Compliance Levels, no quantifiable risk due to ambient hazardous metals pollution is expected in the local airshed. At concentrations above Compliance Levels, health risks, while not imminent, begin to increase within the airshed. If a Compliance Level is surpassed by a monitored parameter, the parameter would go into an assessment monitoring period. Levels would continue to be closely monitored and a preliminary source investigation would proceed.

Action Levels are comprised of various ambient standards and are intended to provide a not-to-be-exceeded baseline for analyzing ambient metals data. If an Action Level is exceeded, a series of regulatory actions would ensue. **(Figure 5)** Utilizing real-time meteorological and air quality data, as well as general chemical fingerprint knowledge of potential sources, regulators should be able to identify or disqualify potential sources of the emissions. Upon identification of the source, regulators would notify the probable polluter. In the event it is The Facility, regulators would seek to initiate a temporary shut-down of the facility, and re-evaluate the waste stream and incinerator processes including a subsequent additional performance test for the incinerator and installation of a stack emissions monitoring device. If an alternate local industry is identified as the source of emissions, an alternate corrective action plan would be developed. Regulators would report the full incident to federal, state, and local authorities.

General assumptions on source identification can be drawn from the historic scientific literature. Real-time meteorological data will also play a significant role in identifying local sources. In the event identifying a potential source(s) proves difficult and data readings surpassing action levels remain persistent, a comprehensive regional chemical mass balance source apportionment study would be initiated to fingerprint the local sources of air emissions, and to help evaluate the data emerging from the air monitoring devices. Regulators would sponsor the source apportionment study and develop a chemical fingerprint library for regional air pollution sources.

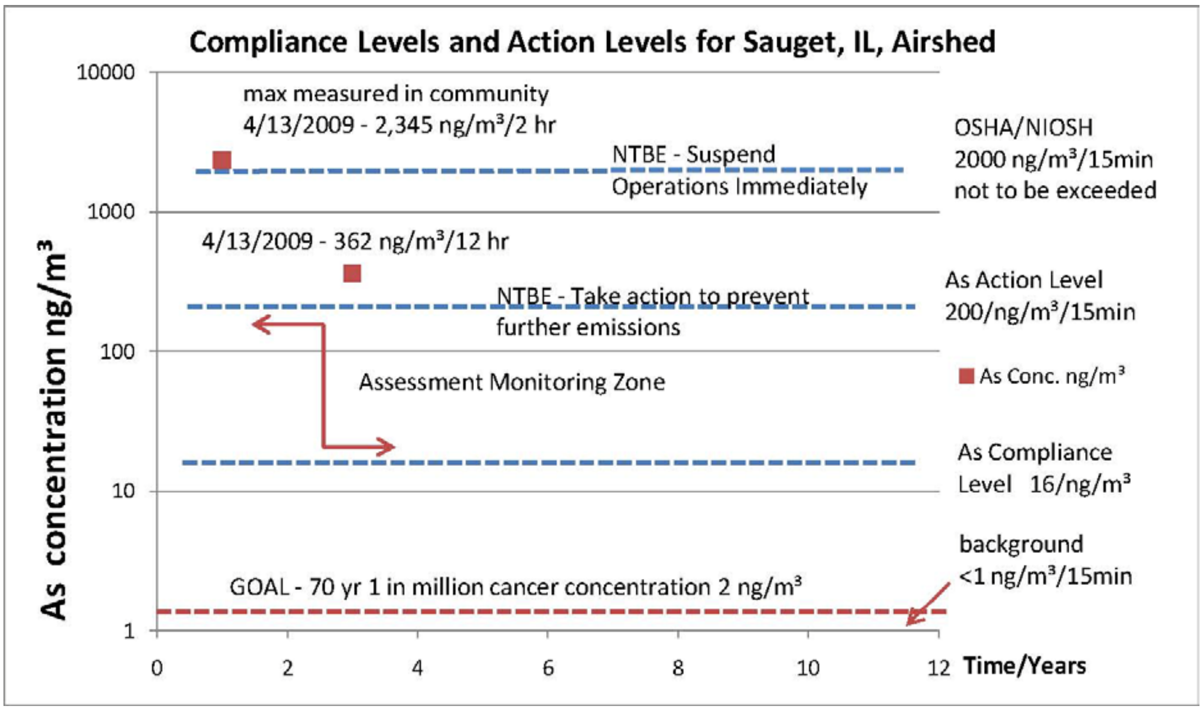

Figure 5. Compliance Plan for Arsenic in Sauget, IL, Airshed

3.0 Local Airshed Characteristics

3.1 Physical Features

The population of Sauget during the census in the year 2000 was 249 people. Nearby larger communities of Cahokia, Illinois, East St. Louis, Illinois, and St. Louis, Missouri, are located within three miles of The Facility and within the local airshed. Martin Van Lucas School, Dunbar Elementary School, and Maplewood Elementary School are all within The Facility's airshed and are potential receptors of elevated emissions from Sauget industries and the hazardous waste incinerator.

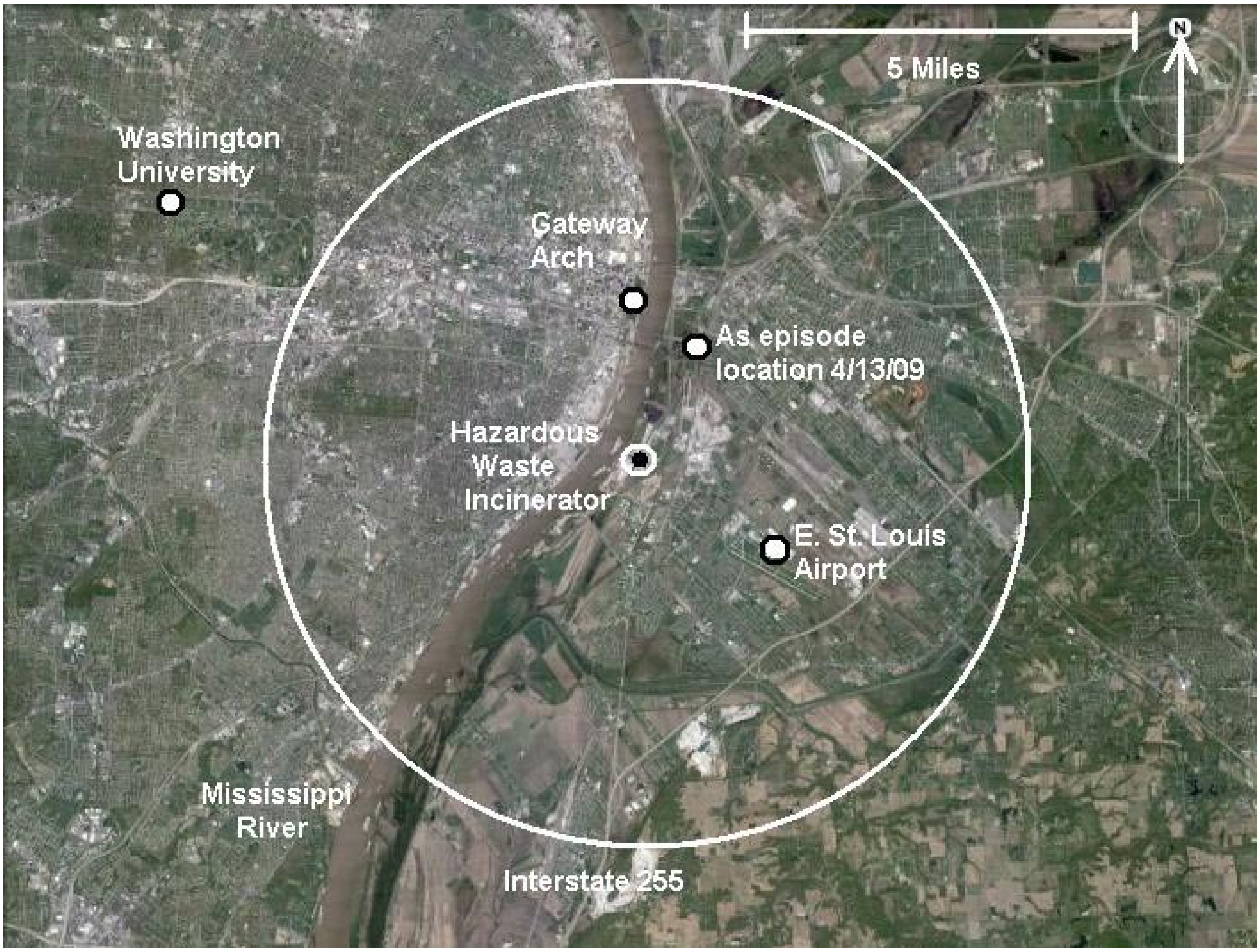

Figure 6. Hazardous Waste Incinerator Facility Map

3.2 Meteorological Characteristics

The Facility is situated on the Mississippi River flood plain, in an area known as the American Bottom, just adjacent to the channel of the river. The area is generally flat, with substantial flood plain soils and limited topographic expression. Wind speed and direction in the East St. Louis region is variable, but is generally from northwest and south/southeast, with an average speed of approximately 10 mph. **(Figure 7)**

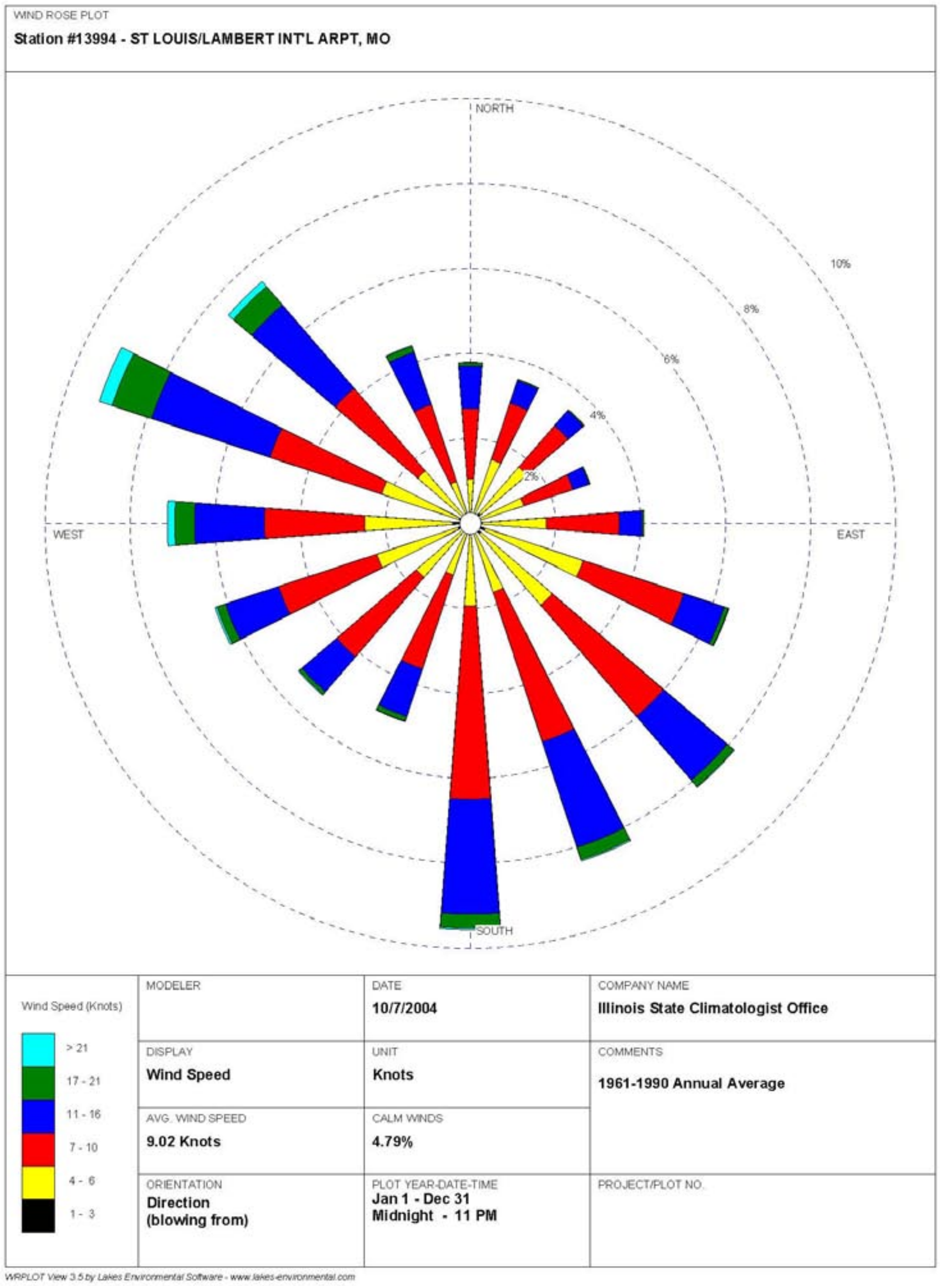

Figure 7. Average wind speed/direction, St. Louis, Missouri 1961-1990. 1 knot = 1.15 miles

The average annual temperature in the Sauget, Illinois, region is 56.3 °F, with average highs in July of 88.4 °F, and average lows in January of 22.6 °F. The area is located in the transition zone between humid subtropical and humid continental climates types, and receives on average a total precipitation of 38.75 inches per year. A small but not insignificant majority of rainfall occurs during the spring months.

3.3 Source Characteristics –Hazardous Waste Incinerator Map

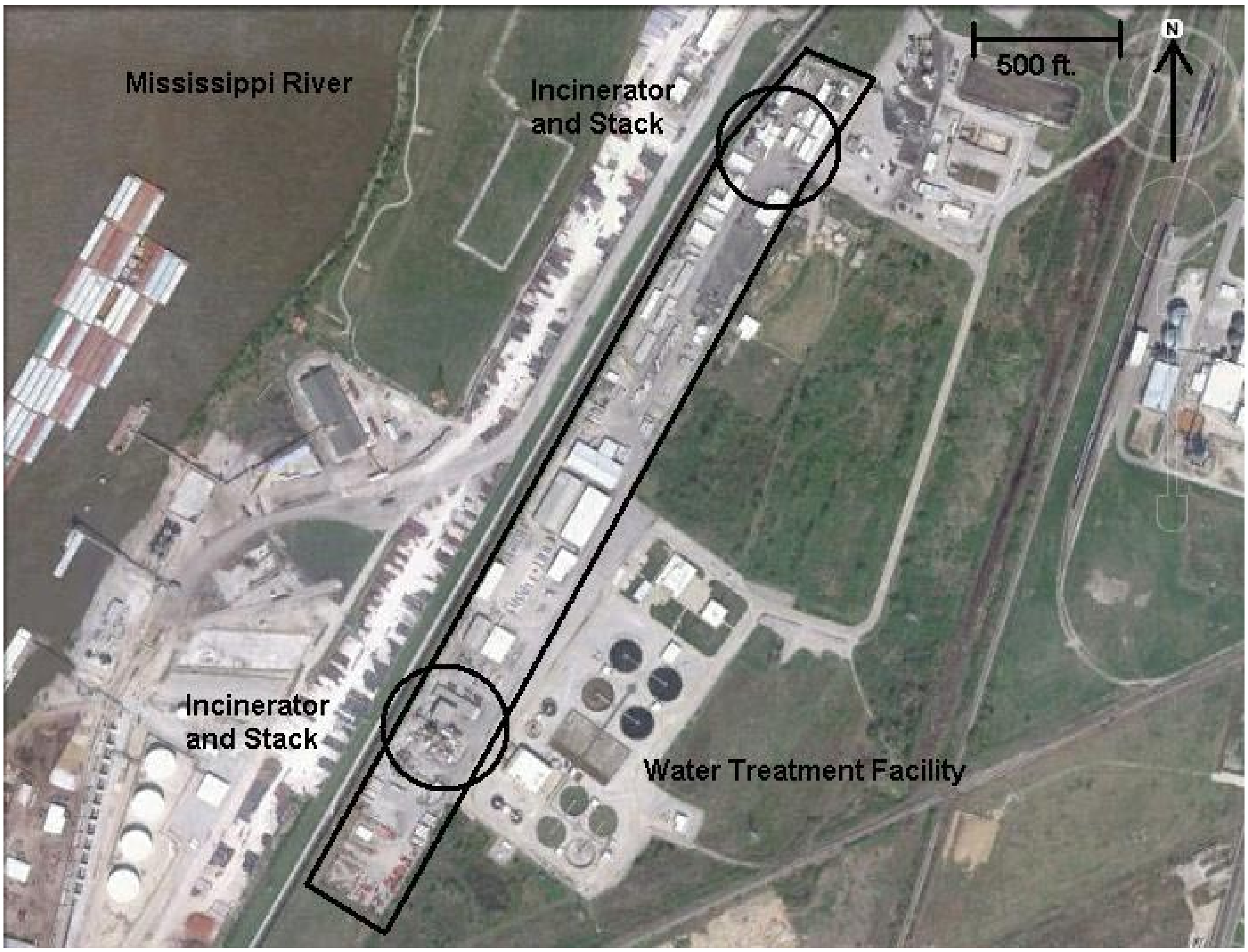

Figure 8. Hazardous waste incinerator and Mississippi River

3.3.1 Source Characteristics

Probable source locations for primary and secondary elements of concern at The Facility include the two currently operating incinerators and associated 100 feet stacks, as well as fugitive emissions from plant operations. While two incinerators are in use, there are a total of three incinerators located on site with a combined energy of 86 million BTU/hr. The incinerators process organic acids, non-halogenated and halogenated solvents, inorganic wastes, propellants and explosives, pyrophoric compounds, organic peroxides, and water reactive compounds.

Waste characterization samples are taken on average of one sample per bulk load of waste and on 10% of the drums of waste accepted. An on-site laboratory conducts analysis of the waste samples to ensure that it conforms to the associated waste characterization documents such as

Material Safety Data Sheets. Wastes are examined for characteristics such as physical state, color, layers, odor, water mix, pH, specific gravity, ignitability screen, cyanide screen, PCBs, heat value, radiation screen, and other physical and chemical attributes. Upon characterization, the waste proceeds to a storage area or a staging area to prepare for incineration. Waste feed rates into the incinerator are based on laboratory characterization and MSDS documentation. Inadequate waste characterization has a significant potential to result in toxic metals emissions.

At the rotary kiln incinerator, temperatures are maintained above 1800° F using waste feed and supplemental fuel oil. Liquid waste is injected as fine particulates. Solid waste is fed into the kiln using a conveyer or gravity feed system. Combustion parameters such as temperature, feed rate, and combustion gas velocity are closely observed to ensure efficient incineration of the waste. Incomplete or inefficient incineration during this portion of the plant process has the greatest potential to induce emissions that exceed performance standards. After incineration of the waste, residue ash is analyzed for organic constituents to ensure that it complies with land disposal standards. Non-organic constituents such as metals are chemically stabilized to reduce leaching of the material to acceptable levels. The treated waste is then disposed of in a hazardous waste landfill.

Due to the diverse hazardous waste stream, process variability is generally high at The Facility. Performance testing is designed to develop efficient incineration protocol, and involves periodic trial burns (5 years) with specific waste types which are analyzed to study the effectiveness of the incineration, and establish waste and metals feed rates. During optimal performance, a hazardous waste incinerator should remove 99.99% of the organic hazardous constituents in the waste stream. Emissions include particulate matter (PM) including metals, Hydrogen Chloride (HCl), Carbon Monoxide (CO), and remaining organic constituents. In the event that an additional elevated metals detection is potentially linked to the hazardous waste incinerator, incinerator processes and associated documentation would be requested to determine the nature of the possible emission.

3.3.2 Relevant Hazardous Air Pollutants and Apportionment Metals

Upon arriving at The Facility, waste samples are characterized to determine specific feed rates for incineration. Trace metals are present during the incineration of certain waste streams. However, metal feed rates are designed and written into the operations permit to limit metals emissions. An increase in hazardous metals emissions can potentially occur through The Facility's stacks if the incineration is operating inefficiently or a waste stream is inadequately characterized.

Metals air emissions of primary concern at The Facility include arsenic (As), cadmium, (Cd), mercury (Hg), lead (Pb), chromium (Cr), and Beryllium (Be). Secondary metals of concern are selenium (Se), copper (Cu), zinc (Zn), silver (Ag), and manganese (Mn). Typical PM size for metals is less than or equal to 10 µg.

As stated previously, the hazardous waste incineration facility is located in a highly industrialized area. The EPAs Toxic Release Inventory lists over 1,099,641 lbs of total hazardous, on or off-site disposal or other releases in the area near the hazardous waste incinerator.

4.0 Monitoring Plan

4.1 Parameters to Monitor

4.1.1 Meteorology

Real-time, comprehensive meteorological data will be gathered in conjunction with the metals data in order to fully characterize potential sources and receptors. Variable wind speeds and direction make consistent, comprehensive air monitoring more complex. Local, real-time meteorological wind and precipitation data is necessary to characterize any potential contaminant transport in the area and will be used in close conjunction with the continuous ambient metals data to analyze potential emissions sources.

4.1.2 Elements, PM and Sampling Frequency

The NRT ambient metals monitors (AMM) devices will monitor for the primary and secondary elements of health and regulatory concern, as well as accompanying metals.

Primary Elements of Health and Regulatory Concern: mercury (Hg), arsenic (As), chromium (Cr), lead (Pb), and cadmium (Cd)

Secondary Elements of Health and Regulatory Concern: copper (Cu), zinc (Zn), silver (Ag), manganese (Mn), and selenium (Se).

Accompanying metals: calcium (Ca), scandium (Sc), titanium (Ti), vanadium (V), iron (Fe), cobalt (Co), nickel (Ni), bromine (Br), tin (Sn), and antimony (Sb)

The ambient air metals AMM devices will be outfit with a PM_{10} inlet to limit particle size of the sample matter and to monitor for a broad range of fine to coarse particulate sizes.

4.1.3 Plant Processes and Events

The general processes at The Facility include the incineration of hazardous waste such as lab packs, water reactive chemicals, oxidizers/organic peroxides, halogenated solvents, organic acids, propellants, and explosives. Hazardous waste re-packaging is also conducted on-site. The wastes are transported to The Facility by tank trucks, rail cars, or ship containers, and are in solid, liquid, or sludge form. Facility records such as Material Safety Data Sheets, laboratory waste characterization records, incinerator operations records and stack emissions data for carbon monoxide or hydrocarbons will be available for review.

If Action Levels are exceeded and the emission is traced to The Facility, operations would be temporarily suspended using established shut-down protocol. Waste, laboratory and incineration records would be examined to identify operational issues resulting in persistent pollution of the airshed.

4.2 Monitoring Sites

Multi-metals ambient air monitoring devices will be located utilizing established site guidelines for air sampling promulgated by the U.S. EPA (U.S.EPA, 1987). For this example, four sampling sites have been established and two unique monitoring plans will be developed and discussed.

The primary factors influencing multi-metals ambient air monitor locations within The Facility's airshed are the variable wind regime in Sauget, Illinois **(Figure 6),** sensitive receptors within the community like schools and hospitals, source identification, the project's financial limitations, and ease of access.

4.2.1 Ambient Metals Monitor Locations

In this example, the probable source of arsenic emissions in the local Sauget, Illinois, airshed is the incinerator stacks of The Facility and neighboring industrial operations. The 100 feet elevation of the hazardous waste incinerator stacks promotes emissions transport to the surrounding residential and industrial areas. Ambient metals sampling locations should be placed to account for possible stack fumigation and to characterize the general airshed.

The location of the April 13, 2009, detection is in an East St. Louis neighborhood less than 2 miles to the northeast of the facility. The monitoring device that recorded the original detection is no longer present in the area. While wind patterns do not generally trend northeast, the strong data signal from the April 13, 2009, arsenic episode make the site appropriate for continued monitoring. Ambient metals monitor (AMM) location **AMM #1** is near the April 13th arsenic detection site, 1.7 miles from the hazardous waste incinerator on the roof of Martin Van Lucas Public School, 1620 Russell Avenue, East St. Louis, Illinois.

The remaining monitoring locations are at strategic locations that correlate to established wind patterns in the area. The wind rose diagram **(Figure 6)** clearly indicates that the primary wind direction in the St. Louis area is from the south. The **AMM #2** location is at the Gateway Arch Park, 2.25 miles directly north of The Facility.

Wind directions also trend strongly from the northwest. The Cahokia East St. Louis Airport is located 1.7 miles to the southeast of The Facility. There are concerns with ambient lead concentrations associated with small engine planes that still utilize leaded gasoline and may skew ambient metals data that is intended to characterize the greater airshed. However, lead concentrations associated with airport activity should be relatively low and can be accounted for in the data analysis. The airport is also currently equipped with advanced meteorological sensors that can aid in data analysis and source characterization. The **AMM #3** location is at the Cahokia East St. Louis Airport.

Schools and hospitals are areas that have dense, sensitive receptors and usually accommodate with requests for access. The third largest wind vector in the Sauget area trends from the southeast. Humboldt Middle School, located at 2516 S 9th St., St Louis, Missouri, is located 1.4

miles directly northeast of the hazardous waste incinerator. The **AMM #4** sampling location is on the rooftop of Humboldt Middle School.

See **Figure 9** for Ambient Metals Monitoring sampling locations.

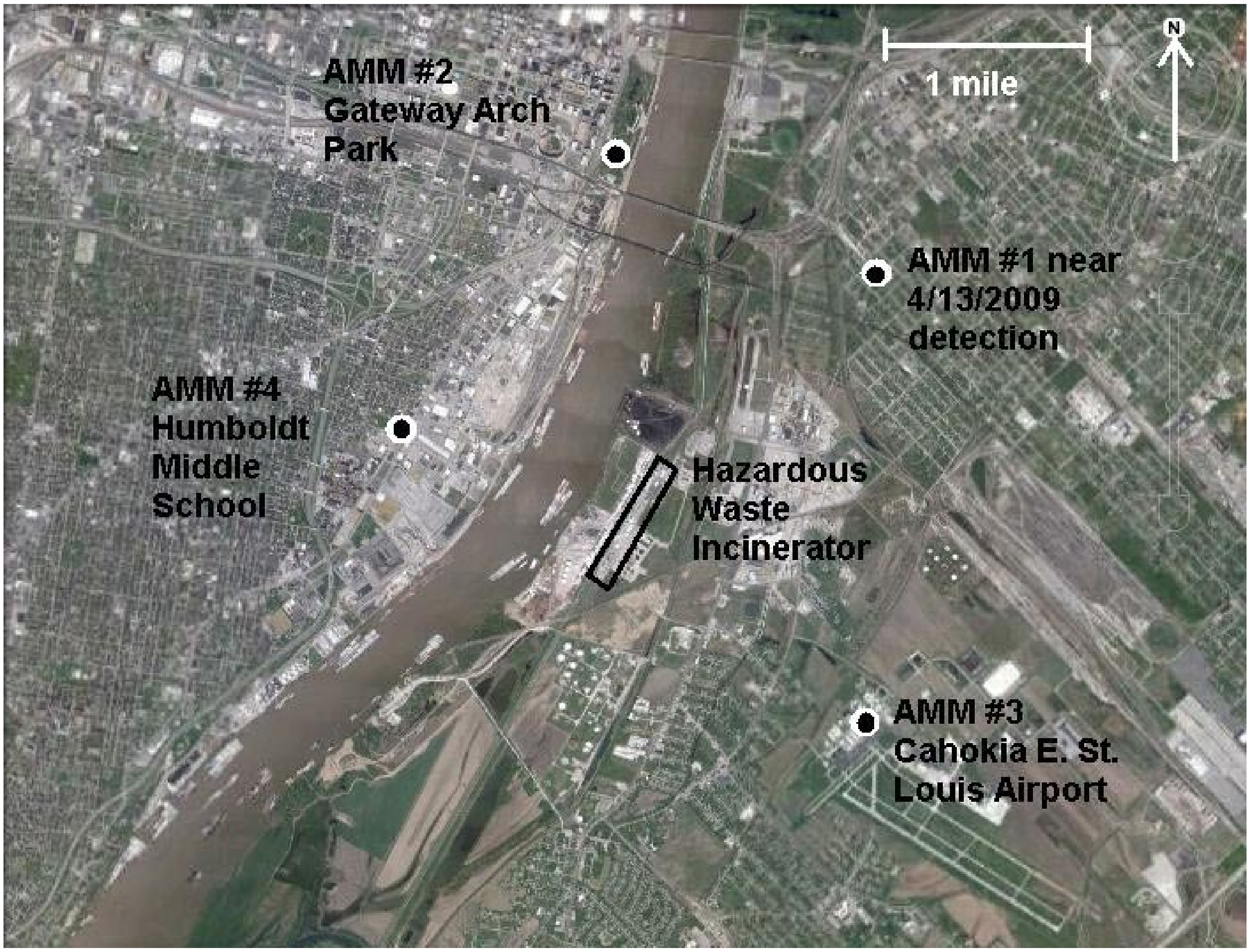

Figure 9. Continuous Multi-Metals Ambient Air Sampling Device Locations near Sauget, Illinois

4.3 Monitoring Plans

Depending upon the project's financial constraints, one to four continuous multi-metals ambient air sampling devices may be deployed. For this example, two different monitoring plans have been developed that represent relatively conservative plans. However, a hybrid of the two plans, full deployment to all sampling locations, or additional sampling locations could be added to characterize the local airshed or enlarge the study area.

4.3.1 Monitoring Plan 1

Monitoring Plan 1 (Plan 1) is designed on the assumption that the elevated arsenic concentrations recently detected in the airshed are not indicative of a chronic emissions problem at The Facility or other local industry, but that the arsenic episode still warrants additional study and monitoring to determine the nature and extent of air quality risks. Plan 1 involves a two-year study of the Sauget area airshed to gather ambient metals data and assess risks to the local population. One continuous multi-metals ambient metals monitor (AMM) will circulate from monitoring locations AMM #1 through AMM #4 for a period of six months at each locale. Data will be gathered and analyzed in accordance with plan goals to characterize the public health risks associated with ambient metals and identify potential sources. If concentrations of metals are detected above Plan Action Levels, the number of air monitors would be increased and the corrective action outlined in Section 2, Goals: Defining Ambient Goals and Compliance would proceed.

Plan 1 provides essential monitoring capability with a smaller monitoring footprint and lower associated costs to assess if consistent air quality risks are present near the hazardous waste incinerator.

4.3.2 Monitoring Plan 2

Monitoring Plan 2 (Plan 2) is strictly designed around established wind data and the goal of developing and maintaining a thorough, comprehensive data set that characterizes ambient metals in the local airshed. For Plan 2, two multi-metals ambient air monitoring devices will be deployed at Gateway Arch Park AMM #2 and Cahokia East St. Louis Airport AMM #3. These two locations represent the most probable vector pathways for Facility emissions, as determined by area wind data. Continuous ambient metals data will be gathered at the locations for two years. If concentrations of metals are detected above Plan Action Levels but a source is not identified, the number of air monitors and sampling locations may be increased, or a source apportionment study for the area may proceed. If an emissions source is identified, the corrective actions outlined in Section 2, Goals: Defining Ambient Goals and Compliance, would commence.

Plan 2 provides a stationary, consistent approach utilizing basic contaminant transport concepts to achieve Plan goals.

4.4 Monitoring Protocol

Multi-metals ambient air continuous sampling devices can be programmed to sample at a range of intervals from high resolution data such as sampling every fifteen minutes, to lower resolution data like sampling once every four hours. Higher data resolution provides more information to regulators to assess and protect worker and public health, and to fully characterize incineration and other industrial operations on ambient air quality. Air samples are collected on a tape medium that is relatively expensive. In this case, due to the duration of the study (2 years), the number of monitors (1 - 2), and the need for short-term arsenic and metals concentrations, the multi-metals ambient air sampling device will initially be programmed to sample every hour. After a full year of ambient air sampling, data will be analyzed to determine if a decrease in sampling frequency would adversely impact the goals of the project.

Data will be available within two hours of sampling event, streamed via wireless or cabled connection to regulators, and stored on the on-board computer system. Sampling tape will be changed out periodically as necessary by trained technicians. Samples will be collected, labeled with location, time interval and sampler identification information, and stored and preserved by regulators.

The multi-metals continuous ambient air monitors will be protected from weather conditions with a shelter and rain guard. A PM_{10} inlet will funnel particulate to the sampler, and electrical lines and data acquisition cables will run from the shelter to the nearest phone/internet connection.

If emerging data indicates that a more comprehensive ambient air monitoring approach is necessary to achieve project goals, additional multi-metals ambient air monitoring devices would be located taking into account the general wind regime in the region (see figure 3) and potential public receptors.

4.4 Data Processing and Reporting

4.4.1 Quality Assurance

Multi-metals ambient air sampling devices are initially calibrated by the manufacturer using thin film standards which are inserted into the monitor to provide a control metals concentration from which calibrations can be based. Subsequent periodic audits of the monitors are conducted using a Quantitative Reference Aerosol Generator (QAG) to test the machines X-ray Fluorescence and sample analysis components. The QAG is an effective quality assurance tool and can be utilized to ensure accurate data is provided by the device. The QAG disperses a control metals aerosol sample to the device, which is then compared against the recorded value analyzed by the monitor. The QAG individually tests a wide range of metal concentrations against the monitoring unit, and the accuracy is determined by testing the relative bias of the monitor. The multi-metals ambient air sampling devices will be audited and serviced by trained technicians consistent with the device manufacturer's recommendations (See Appendix B).

4.4.2 Regulators

The ambient air sampling program associated with the hazardous waste processor is an un-mandated environmental sampling program to characterize threats to the local airshed and to further regulator's, engineer's and scientist's understanding of hazardous metals emissions, pollutant dispersion, and industrial processes. While open to comment from local authorities and industry, regulators at the state and federal level will have full control and responsibility for the continuous multi-metals ambient air monitoring plan.

Regulators will maintain contacts with representatives from the city governments of East St. Louis, Illinois, and St. Louis, Missouri, local radio and television stations, representatives from relevant local industry, and potential sensitive local receptors such as hospitals and schools. Regulators will compile quarterly multi-metals ambient air sampling data and provide a report summarizing the data to the public, as well as appropriate state, federal, and local authorities.

4.4.3 Plant

Near real-time data emerging from the ambient metals-air monitoring system will be provided to The Facility and other potential sources of metals emissions. Upon exceedence of an Action Level, regulators would analyze the meteorological and metals data emerging from the monitors to attempt to determine a source. If a source is identified, the probable polluter would be notified and corrective actions would ensue. In the event that multi-metals ambient air sampling data indicates that The Facility's operations are resulting in emissions dangerous to human health and the environment, regulators would request that the incinerator's operations be suspended until the cause of the exceedence is determined and the issue is addressed. The Facility would suspend incineration and hazardous waste processing using established safety and shut-down protocol.

4.4.4 Internet and Public

Regulators will maintain a public internet location that details the ambient air multi-metals monitoring program goals, shows the data emerging from the monitoring location(s), and provides a venue for regulators to answer any questions that the public or industry may have over the monitoring program and local industrial operations. Data on the site will be updated daily to ensure quality assurance of the reported values.

In the event a multi-metals ambient air monitoring Action Level is exceeded, regulators would notify local television and radio, as well as sensitive receptors such as schools and hospitals. Recommendations would be given for those at elevated risk like children, asthmatics and pregnant women to remain indoors until the issue is addressed or the concentrations dissipate. A full report of the incident would be written and forwarded to the state, local and federal authorities.

5.0 References

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4) Yanca, et al. *Validation of Three New Methods for Determination of Metal Emissions Using a Modified Environmental Protection Agency Method 301,* Air and Waste Management Association, Vol. 56. December 2006.

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