

REPORT

***Air Contaminant Exposure
to Residents of the Town of Camillus
from
Honeywell's Sediment Treatment
and Containment Facility***

SUBMITTED TO

**THE TOWN OF CAMILLUS
AND
CAMILLUS CLEAN AIR COALITION**

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SUBMITTED BY

MINNICH AND SCOTTO, INC.

Timothy R. Minnich

Robert L. Scotto

71 West Main Street, Suite 103

Freehold, NJ 07728

(732) 409-9900

(732) 409-9901 (fax)

trminnich@msiair.net

rlscotto@msiair.net

CONTENTS

<u>Section</u>		<u>Page</u>
Tables		iii
Figures		iv
Selected Acronyms and Abbreviations		v
Executive Summary		E-1
1 Introduction and Objectives		1-1
2 Background		2-1
2.1 Facility Process Description		2-1
2.2 Current Situation		2-3
2.3 Principal Community Concerns		2-5
2.3.1 Adverse Airborne Exposure		2-5
2.3.2 Air Monitoring Program Deficiencies		2-5
3 Information Reviewed		3-1
3.1 Publicly Available Project Documents		3-1
3.2 Additional Data		3-3
4 Programmatic Deficiencies		4-1
4.1 Employment of Flawed Methods in the HHRA		4-1
4.2 Employment of an Inadequate Air Monitoring Program		4-4
5 Assessment of Community Exposure		5-1
5.1 Method		5-1
5.2 Model Input Data		5-3
5.2.1 Emissions Inventory		5-3
5.2.1.1 Chronic Exposure		5-3
5.2.1.2 Acute Exposure		5-6
5.2.2 Source Location and Dimensions		5-7
5.3 Results		5-8
5.3.1 Year 1		5-8
5.3.2 Total Project		5-12
6 Recommendations		6-1
6.1 Facility Emissions Reduction		6-1
6.2 Implementation of an Independent Community Air Monitoring Program		6-2

TABLES

<u>Table</u>	<u>Page</u>
3-1 Requested Additional Information	3-3
5-1 Assessment Scenarios Considered	5-1
5-2 Total Mass of Each COC to be Dredged	5-3
5-3 Total Mass of Each COC for Release via Volatilization	5-4
5-4 Emission Factors for Annual Modeling	5-4
5-5 Facility HAP Compliance Assessment	5-5
5-6 Maximum Emission Rates for Hourly Modeling	5-6
5-7 Emission Factors for Hourly Modeling	5-6
5-8 Source Location and Dimensions for All Dispersion Modeling	5-7
5-9 Year 1 Maximum Predicted Residential Acute Exposure	5-8
5-10 Total Project Maximum Predicted Residential Chronic and Acute Exposure	5-12

FIGURES

<u>Figure</u>		<u>Page</u>
5-1	Year 1 Maximum Predicted Acute Exposure Exceedance Factors: Naphthalene	5-9
5-2	Year 1 Maximum Predicted Acute Exposure Exceedance Factors: 1,4-Dichlorobenzene	5-10
5-3	Year 1 Maximum Predicted Acute Exposure Exceedance Factors: Benzene	5-11
5-4	Total Project Predicted Chronic Exposure Exceedance Factors: Naphthalene	5-13
5-5	Total Project Predicted Chronic Exposure Exceedance Factors: 1,4-Dichlorobenzene	5-14
5-6	Total Project Maximum Predicted Acute Exposure Exceedance Factors: Naphthalene	5-15
5-7	Total Project Maximum Predicted Acute Exposure Exceedance Factors: 1,4-Dichlorobenzene	5-16
5-8	Total Project Maximum Predicted Acute Exposure Exceedance Factors: Benzene	5-17

SELECTED ACRONYMS AND ABBREVIATIONS

<u>Term</u>	<u>Meaning</u>
AERMOD	<u>A</u> merican Meteorological Society / <u>EPA</u> <u>R</u> egulatory <u>M</u> odel
AGC	Annual Guideline Concentration
BTEX	benzene, toluene, ethyl benzene, and xylenes
CAS	Chemical Abstracts Service
CCAC	Camillus Clean Air Coalition
CEM	continuous emissions monitoring
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLS	classical least squares
COC	compound of concern
DAR	Division of Air Resources
DEC	New York State Department of Environmental Conservation
EPA	U.S. Environmental Protection Agency
FTIR	Fourier-transform infrared
HAP	Hazardous Air Pollutants
HHRA	Human Health Risk Assessment
ICAM	independent community air monitoring
IR	infrared
kg	kilogram
MDL	minimum detection level
Method TO-15	EPA Toxic Organic Compendium Method 15
Method TO-16	EPA Toxic Organic Compendium Method 16
mg	milligram
MSDS	material safety data sheet
NWS	National Weather Service
NYCRR	New York Code of Rules and Regulations
PAH	polycyclic aromatic hydrocarbon
PER	permissible emission rate
PID	photoionization detector
ROD	Record of Decision
SCA	sediment consolidation area
SGC	Short-Term Guideline Concentration
SMU	sediment management unit
TSDF	Treatment, Storage and Disposal Facility
TVOC	total volatile organic compounds
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VGAC	vapor-phase granular activated carbon
VOC	volatile organic compound
WTP	wastewater treatment plant

EXECUTIVE SUMMARY

Honeywell is currently remediating Onondaga Lake under the federal Superfund program in accordance with a 2007 Consent Decree entered into with DEC. The remediation includes the offsite treatment and containment of highly contaminated lake bottom sediments at the Wastebed 13 Facility near the town of Camillus. Minnich and Scotto has been retained to evaluate residential exposure to air contaminants arising from Facility operations.

Principal findings and recommendations include:

- ***Employment of Flawed Methods in the Supplemental HHRA***

EPA, in their June 2010 Supplemental Human Health Risk Assessment, concluded that risk to the Camillus residents from exposure to Facility air emissions would be well within acceptable levels. We have determined, however, that EPA employed flawed methods to assess this exposure, thus rendering invalid their conclusion of acceptable risk.

- ***Employment of an Inadequate Air Monitoring Program***

We have determined that the air monitoring program currently in place at the Facility provides little value to the Camillus residents.

- ***Exceedance of Facility Major Source Threshold for HAP***

Based on a compliance assessment for Hazardous Air Pollutants (HAP), the Facility exceeds the HAP “major source” threshold under Section 112 of the 1990 Amendments to the Clean Air Act.

- ***Unacceptable Safe Levels Throughout the Community***

Based on air dispersion modeling results, exceedances of safe-level thresholds are predicted to occur across much of the Camillus community over the duration of the remediation for: (a) naphthalene, for long-term (annual) exposure; and (b) naphthalene and benzene, for short-term (1-hour) exposure.

- ***Reduction of Facility Emissions***

Results demonstrate an immediate need to reduce Facility emissions in order to comply with residential safe levels and to avoid a Title V designation for HAP.

- ***Replacement of the Existing Air Monitoring Program***

Results demonstrate an immediate need to replace the existing air monitoring program with a state-of-the-art, real-time independent community air monitoring (ICAM) program, control of which should rest with the Camillus community. The ICAM program should be based on EPA Method TO-16 – the only practical way to demonstrate, in real time, the causative relationship between Facility emissions and residential exposure.

SECTION 1 - INTRODUCTION AND OBJECTIVES

In January 2007, Honeywell International Incorporated (Honeywell) and the New York State Department of Environmental Conservation (DEC) entered into a Consent Decree requiring Honeywell to remediate Onondaga Lake under the federal Superfund program. Comprising 4.6 square miles, Onondaga Lake is located immediately northwest of Syracuse, New York.

After many years of dumping by numerous upland industries, the lake sediments are characterized by extensive contamination, including chlorinated benzenes, BTEX (benzene, toluene, ethyl benzene, and xylenes), light and heavy PAHs (polycyclic aromatic hydrocarbons), and chlorinated dioxins/furans.

Many residents in the town of Camillus, New York have reported severe odors and symptoms of acute exposure to air contaminants in connection with Honeywell's remediation – specifically, the operation of the nearby sediment treatment and containment facility (the Facility), also known as the sediment consolidation area (SCA). The affected residents live generally within a mile of the Facility.

On March 18, 2013, the Camillus Clean Air Coalition (CCAC), a local community group, filed a complaint against Honeywell in Onondaga County State Supreme Court seeking injunctive relief. This filing was preceded by an understanding between the attorneys representing the Town and CCAC that they would jointly retain the air quality consulting firm Minnich and Scotto to perform an independent, technical evaluation (Evaluation) of the extent of exposure to the Camillus residents.

The objectives of the Evaluation would be to: (a) identify relevant programmatic deficiencies in the remediation; (b) quantify past and future air contaminant exposure to the residents; and (c) provide specific recommendations to remedy this situation. The scope of work comprising the Evaluation was set forth in our March 8, 2013 proposal agreed to by all parties (Proposal).

Section 2 of this report presents relevant background information. **Section 3** identifies the information reviewed. **Section 4** discusses programmatic deficiencies in the remediation of Onondaga Lake as they relate to the Evaluation. **Section 5** presents the assessment of past and future community exposure. **Section 6** presents our recommendations.

SECTION 2 - BACKGROUND

The Onondaga Lake remediation commenced on July 30, 2012. From the start, there were numerous odor complaints and reports of adverse health effects from the community. Honeywell implemented several emission-reduction measures from August until mid-September, but DEC finally ordered the temporary shutdown of the operation on September 20 while Honeywell and DEC attempted to come up with a more effective remedy. Remediation operations resumed 3 weeks later (October 11) and continued until the (planned) winter shutdown on November 19. Remedial operations are scheduled to resume this month.

The remediation is expected to last three or four more years. The remedy involves the hydraulic dredging of approximately 2.7 million cubic yards of lake sediments, and the capping of about 400 acres of lake bottom. The dredged sediment slurry (i.e., the water/sediment mixture) is piped a distance of 3.9 miles to a secure facility in the town of Camillus, designed specifically for the treatment and long-term containment of the contaminated sediment. Essentially a hazardous waste Treatment, Storage and Disposal Facility (TSDF), the Facility is located primarily on a parcel of land designated as Honeywell's Wastebed 13.

Section 2.1 presents a description of the Facility process. **Section 2.2** discusses the current situation. **Section 2.3** identifies the principal community concerns.

2.1 Facility Process Description

The treatment and containment of the sediment slurry involves a two-step process:

- Step 1 - The slurry enters one of three enclosed screening buildings where oversized materials (large rocks and pieces of debris) are removed and temporarily stockpiled for eventual placement within the SCA. The air inside each screening building is sent through a dedicated vapor-phase granular activated carbon (VGAC) adsorption system for removal of volatile organic compounds (VOCs) before being discharged to the atmosphere.

- Step 2 - The screened slurry is pumped through a pair of pipes into high-strength containers (geotextile tubes) for treatment (dewatering) and long-term containment. A preconditioning polymer and a coagulant agent are injected into the pipes to optimize the quality of the sediment slurry before it enters the geotextile tubes.

The contaminated water (filtrate) drains from the geotextile tubes to an onsite liquid management system (a filtrate storage basin) where it is held and treated to applicable water quality standards. The filtrate is then pumped to an onsite wastewater treatment plant (WTP) for primary treatment, and finally to the Onondaga County Metropolitan Sewage Treatment Plant for secondary treatment and ammonia removal before discharge back to Onondaga Lake. We assume that the vented air from the onsite WTP is not being treated before being released to the atmosphere.

As each geotextile tube undergoes dewatering, additional slurry is added until it is filled with dewatered sediments. After a filled tube has dewatered for several weeks, it has sufficient integrity to support another tube placed on top of it. Up to five layers of tubes comprising an area of about 65 acres will be required in order to accommodate all of the dredged lake sediment.

2.2 Current Situation

The U.S. Environmental Protection Agency (EPA), in their June 2010 Supplemental Human Health Risk Assessment (HHRA), concluded that there was no potential for adverse offsite exposure to airborne contaminants emitted from the treatment and containment facility. Nonetheless, following much public comment at that time, Honeywell agreed to install a water misting system around the geotextile tubes to reduce air emissions and to implement a community air monitoring program to assure the residents that there would, in fact, be no harmful offsite impacts.

However, upon startup of the remediation (July 30, 2012), numerous residents began experiencing severe odors and a host of deleterious effects; complaints were filed promptly via DEC's project hotline. In at least one instance, the air quality was so bad that an individual was forced to seek emergency treatment at the local hospital. Other acute symptoms included the occurrence of repeated nosebleeds, severe asthma attacks, burning sinuses, nausea, and headaches lasting more than three days. The air monitoring system currently in place at the Facility confirmed the presence of elevated levels of numerous gaseous compounds, including benzene and naphthalene.

In August through mid-September (prior to the DEC-ordered temporary shutdown), Honeywell implemented various emission-reduction measures, including the installation of a floating cover atop the filtrate storage basin, and the covering, via large tarps, of those geotextile tubes which had finished dewatering. These mitigative measures also included the installation of VGAC adsorption systems in the screening buildings (which, according to planning documents, were supposed to have already been in place when the remediation began).

The remedy put in place during the 3-week shutdown involved the installation of a second tier of misters around the geotextile tubes, and the addition of a proprietary detergent to the water to cause a chemical interaction with the emitted gases, thus masking or neutralizing the odors. From operation resumption (October 11) until shutdown for the winter (November 19), the residents reported that the misters had little or no beneficial effect, and instead felt they now had yet another airborne compound about which to be concerned.

We were unable to find information in the available project documents concerning the additive composition. We have since reviewed manufacturer literature which indicates the additive is not toxic, but suggests it can be an irritant when aerosolized. However, *we have determined that the misters do not reduce contaminant emissions nor does the manufacturer make any claim that they do.*

Project planning documents from Honeywell dated as recently as May 2012 (e.g., the Onondaga Lake Remediation Operations Community Health and Safety Plan) insisted that all sediment

management processes would be performed in a closed system, and that the slurry would never be exposed to the open atmosphere. Attempts to reduce emissions to acceptable levels notwithstanding, the latest design drawings and the project history to date continue to show otherwise – namely that some processes are uncontrolled.

Community trust eroded further during a January 31, 2013 public meeting when DEC, in tacit acknowledgment that airborne exposure had indeed been occurring, identified a total of 22 potential emission-reduction measures Honeywell would be considering prior to the resumption of lake dredging later this month; these actions spanned all facets of the facility sludge handling and treatment activities. This acknowledgment contradicts existing project documents and the understanding given the community by DEC, in earlier public meetings held prior to the remediation start-up, that not only would there be no air emissions or odors during Facility operations, but they “would not even know that Honeywell was there.”

After review of all available information, we believe the geotextile tubes are the main source of emissions within the Facility. Two emission mechanisms from this source are: (a) volatilization of filtrate during tube draining (mostly lighter molecular weight VOCs, such as benzene); and (b) sediment off-gassing (mostly heavier VOCs, such as naphthalene) prior to final covering. Other VOC sources, believed to be less significant, are the filtrate storage basin, the screening building (should VGAC system breakthrough occur), and the onsite wastewater treatment plant.

2.3 Principal Community Concerns

The affected community has two principal concerns: past and future adverse airborne exposure, and deficiencies in the air monitoring program currently in place.

2.3.1 Adverse Airborne Exposure

As discussed earlier and evidenced by the reported acute effects, many residents contend they were exposed to high levels of toxic air contaminants during the first year of remediation.

Of particular concern are the laboratory analysis results from lake sediment samples collected in 1992 and 2000, which show very high concentrations of naphthalene. For example, the Record of Decision (ROD), which includes a summary of this data, showed a depth-weighted mean naphthalene concentration in the top 2 meters of the lake-bottom surface of 79.2 milligrams per kilogram (mg/kg), or 0.0079 percent by mass; the greatest concentrations in each strata were typically above 500 mg/kg, or 0.05 percent by mass, with the greatest concentrations in the top layer of the lake-bottom surface (0-to-2-centimeter depth) as high as 26,000 mg/kg, or *2.6 percent by mass*.

A volume of 236,000 cubic yards of contaminated sediment was dredged from the lake during Year 1. This represents about 8.9 percent of the 2.7 million cubic yards of contaminated sediment to be removed and treated during the 5-year dredging program.

2.3.2 Air Monitoring Program Deficiencies

The existing air monitoring program relies on a network of eight fixed stations sparsely positioned along the Facility perimeter. Hourly total VOC (TVOC) concentrations are automatically monitored at each station, 24 hours per day, 7 days per week, using photoionization detector (PID) instruments.

Evacuated Summa canisters, equipped with 24-hour-averaged flow control devices, collect air samples at four of these stations, once every 6 days. Speciated VOCs are measured at an offsite laboratory using U.S. EPA Toxic Organic Compendium Method 15 (Method TO-15).

Community concerns include:

Use of PID Instruments

PID instruments do not have sufficient minimum detection limits (MDLs) and are not compound-specific. This latter deficiency is especially important, as there is large variability in the contaminant composition of the sediment slurry, and *slurry characterization monitoring is not being performed*.

Naphthalene Monitoring

Given the fact that naphthalene is well-documented as an important driver from an air emissions perspective (see Section 5.1), the affected community finds it unacceptable that this contaminant is not being monitored in real time – especially as there is a robust, EPA-approved method (Method TO-16) which does just that. This issue was raised at the January 31 public meeting and, while DEC initially dismissed the TO-16 technology as having insufficient sensitivity, they did promise to research it further.*

Use of Method TO-15

The long turnaround time by the laboratory (on the order of weeks) makes this method unsuitable for protecting the affected community from adverse airborne exposure. Further, this method is not intended for monitoring naphthalene, as there is a systematic low bias due to adherence to the sampling handling system; other states discourage its use for this compound.

Spatial Data Representativeness

The fixed-station network does not provide data which are spatially representative. This means that air emissions can, and do, pass between monitoring stations undetected.

* On March 7, DEC requested a conference call to learn how Method TO-16 could be applied at the SCA. On March 11, in an 80-minute call, we answered an extensive list of questions from a total of five DEC project personnel.

SECTION 3 - INFORMATION REVIEWED

To support the Evaluation, we reviewed the following information: publicly available project documents, and additional data supplied by the Town Engineer pursuant to a March 6 request.

3.1 Publicly Available Project Documents

All publicly available project documents reviewed for the Evaluation can be downloaded from one or both of the following websites:

- <http://www.lakecleanup.com/publicdocs/> (Honeywell's site)
- <http://www.townofcamillus.com/default.aspx?PageID=968> (the Town's site)

Documents utilized and numbered for reference in subsequent discussion are:

1. EPA's June 2010 Supplemental Human Health Risk Assessment
2. A March 24, 2010 letter from Senator Charles E. Schumer and Congressman Daniel B. Maffei to EPA Administrator Lisa P. Jackson, requesting a supplemental health assessment to address potential air exposure to Camillus residents
3. O'Brien & Gere's community air monitoring results, available online at <http://www.lakecleanup.com/health-and-safety/air-monitoring/>
4. Honeywell's May 2008 Air Dispersion Modeling Protocol for Onondaga Lake
5. Honeywell's September 2005 Onondaga Lake Pre-Design Investigation: Phase I Work Plan – Appendix D, Onondaga Lake Pre-Design Investigation: Air Emission and Odor Work Plan, November 2005 (prepared by Parsons)
6. Service Engineering Group's June 2008 (revised) Wind Tunnel Testing Report
7. Honeywell's March 2008 Onondaga Lake Pre-Design Investigation: Phase III Addendum 7 Work Plan, Air Emissions and Odors (prepared by O'Brien & Gere)
8. Honeywell's January 2008 Onondaga Lake Pre-Design Investigation: Meteorological Monitoring Program Manual

9. Honeywell's November 2004 Onondaga Lake Final Draft Feasibility Study Report
10. EPA's and DEC's July 2005 Record of Decision, Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site
11. Drawing No. 444853-201-C-003 (Rev. 0), Berm and Subgrade Grading Plan, September 2011 (prepared by Parsons)
12. DEC's October 18, 2012 Division of Air Resources DAR-1, AGC/SGC Tables
13. Honeywell's May 2012 Onondaga Lake Remediation Operations Community Health and Safety Plan

Documents reviewed but not directly referenced include:

- An August 5, 2010 letter from DEC Commissioner Alexander B. Grannis to Senator Charles E. Schumer, Senator Kirsten E. Gillibrand, and Congressman Daniel B. Maffei, concerning Wastebed 13 disposal and EPA's conclusions concerning the HHRA
- Atlantic States Legal Foundation's February 28, 2005 comments to DEC on the Proposed Remedial Action Plan
- The October 11, 2006 Consent Decree Between the State of New York and Honeywell International Inc., United States District Court, Northern District of New York
- Honeywell's December 2002 Onondaga Lake Remedial Investigation Report
- Honeywell's June 2012 Quality Assurance Project Plan, Air Quality Monitoring Program: Onondaga Lake Dredging, Sediment Management and Water Treatment Project
- Honeywell's "Lake Cleanup Process" video, accessible online at http://www.lakecleanup.com/photo_gallery/
- Honeywell's September 2011 Onondaga Lake Sediment Management Final Design

3.2 Additional Data

The Town Engineer, Mr. Paul Czerwinski, was our point of contact for procuring from DEC additional data to support the Evaluation. We requested this data, via memorandum, on March 6, 2013.

Table 3-1 describes the requested additional information as well as the status of the request (our best understanding).

Table 3-1. Requested Additional Information*

Item No.	Description	Status	Comments
1	Depiction of lake dredging locations by day since remediation start	N	Does not exist
2	Results of all sediment sample analyses to guide dredging locations	N	Does not exist
3	Reports or lab analyses which would evidence dredged "hot spots"	N	Does not exist
4	Logbook copies from all personnel on days when dredging occurred	N	
5	H&S air sampling information from the SCA and dredging area	N	
6	DEC's most recent complaint log, with complainants' house numbers	P	Addresses not provided
7	2012 raw and AERMOD-ready meteorological data from Wastedbed 13	N	Only EXCEL data provided
8	Specifications, records, and breakthrough data for all VGAC systems	P	Records & data do not exist
9	Slurry analysis results: pre-screening building and post-geotextile tubes	N	Does not exist
10	Filtrate analysis results: during holding in filtrate storage basin	N	Does not exist
11	Sediment analysis results: pre-long-term containment in geotextile tubes	N	Does not exist
12	All air dispersion modeling results referenced in 2008 Modeling Protocol	N	Does not exist
13	Specifications, including MSDSs, for the aerosol misters	Y	Masking agent unidentified

* **Note to Table 3-1:**
 Key to "Status" column:
 Y = yes, provided N = not provided P = partially provided

SECTION 4 - PROGRAMMATIC DEFICIENCIES

Programmatic deficiencies in the remediation of Onondaga Lake as they relate to this Evaluation are discussed below. **Section 4.1** and **Section 4.2**, respectively, discuss such deficiencies inherent in the HHRA and in the air monitoring program currently employed.

4.1 Employment of Flawed Methods in the HHRA

Overview

Based on a detailed review of the HHRA (Ref. 1) and supporting project documents, we have determined that flawed methods employed by EPA to assess the risk to the Camillus residents represents the most significant programmatic deficiency.

EPA performed the HHRA in response to a request from the Town, and a letter from Senator Schumer and Congressman Maffei (Ref. 2). Its purpose, stated in the Executive Summary, was:

“[T]o identify any potential risks posed by sediment management and dewatering activities which will take place at the SCA.”

EPA asserted that the residents of Camillus would experience no adverse effects from the SCA operations. From the Executive Summary:

“This assessment incorporated numerous conservative assumptions, and indicates *all potential risks are within levels identified by EPA as acceptable* [emphasis added].”

The air emissions that EPA modeled to demonstrate risk insignificance were simply “backed into,” having been neither measured nor calculated. *These emissions were arbitrarily assigned*, based on the assumption that compliance with safe levels would be achieved everywhere along the Facility perimeter. Results from the current air monitoring program (Ref. 3) have shown this to be a very poor assumption.

Based on review of the HHRA and supporting project documents, we have determined that EPA employed flawed methods to assess air exposure to the community, thus rendering invalid their conclusion of acceptable risk.

Background

Parsons, Honeywell's contractor at the time, was responsible for the design and execution of the air dispersion modeling analysis (Modeling Analysis), which represents an integral component of the Feasibility Study process for any hazardous waste site remediated under CERCLA (or Superfund). For this remediation, the purpose of the Modeling Analysis was to: (a) predict the offsite air impact which could be expected from the Facility without implementation of any emission controls; and (b) support design of needed emission-reduction measures.

As stated in the Executive Summary of Honeywell's May 2008 Onondaga Lake Air Dispersion Modeling Protocol (Modeling Protocol, Ref. 4), prepared by Parsons, these results would be used to address several objectives, one of which included:

“Design of best management practices, control systems and operations strategies to reduce air emissions resulting from remedial activities to levels less than applicable short-term and long-term ambient air standards, and established threshold levels.”

Before discussing the HHRA, it is necessary to review one more issue about the Modeling Analysis. A key component was the derivation of reasonable Facility emission rates for all compounds of concern (COCs). This “emissions inventory” would then be modeled using a full year of onsite data collected from the meteorological tower at Wastebed 13. From Ref. 3, Section 3.1.3 – Source Emission Rates (page 3-2):

“The actual emission rates to be input to the model for each source are being evaluated as a *separate component* [emphasis added] of the overall investigation. In general, emission rates for the specified COIs [chemicals of interest] will be provided for model input in terms of mass per unit time per unit area, such as grams per second per square meter (g/sec/m²) for area sources, and mass per unit time (g/sec) for point sources.”

Results of the Modeling Analysis were never reported in the project documents. In our request for additional data, we asked for the results of the air dispersion modeling analysis and were told the data does not exist (Table 3-1, Item 12).

The *separate component* for developing the actual emission rates, as mentioned in the Modeling Protocol (above), was the wind tunnel work performed by Service Engineering Group (Ref. 5, 6). The Executive Summary of the March 2008 Phase III Work Plan Addendum, Air Emissions and Odors (Ref. 7) states these objectives:

“[V]erification of results from Phase I Wind Tunnel Tests by retesting sediments under similar conditions in a reconfigured wind tunnel.

Evaluation of potential chemical and odor emissions from exposed sediment at the SCA over a long-term period of time (e.g., 20 days).

Evaluation of the potential viability and/or efficiency of mitigation techniques to control air emissions and odors from ponded and exposed sediments.”

HHRA Air Exposure

Sometime between completion of the Modeling Protocol (May 2008) and the HHRA (June 2010), a decision was made to abandon the wind tunnel work as a means of assigning Facility emission rates for use in the air dispersion model; in fact, the decision was made to eliminate the Facility modeling altogether. Page 15 of the HHRA states:

“In order to conservatively estimate the maximum concentration of these chemicals that might migrate into the community, concentrations at the work zone perimeter were used as a starting point. These concentrations, which are health-based air concentrations developed by either EPA or NYSDEC to be protective of commercial exposures over a 5 year duration, are discussed in detail below and in Appendix C. Control measures will be implemented to ensure these criteria are met. An air dispersion model was then used to estimate the chemical concentrations at community receptors assuming the maximum allowable concentrations were present at the site boundary. A significant level of conservatism is built into this approach because it assumes that site boundary conditions are at the maximum level for all chemicals, when in reality the worst case is that one or a select few chemicals may be approaching this level while the vast majority of chemical concentrations would be significantly below the criteria. This dispersion modeling is discussed more thoroughly in Appendix C.”

So instead of modeling the Facility emission rates, EPA simply assumed that the concentration of each COC along the SCA perimeter would be “fixed” at the safe-level criteria. They then applied dispersion modeling relationships to dilute these concentrations before reaching the nearest residents. Appendix C of the HHRA states:

“For purposes of this modeling, a unit emission rate modeling scenario was (sic) been utilized, to calculate the dispersion factor between the maximum work zone perimeter concentration, and the maximum nearest receptor concentration. This dispersion factor was then applied to the maximum *allowable* [emphasis added] site-perimeter concentrations to calculate a maximum receptor concentration. This method is not described in the protocol [Modeling Protocol].”

The faulty premise, of course, was that control measures would have been implemented in the first place such that these health-based thresholds would be complied with along the entire perimeter when, in fact, the Facility has been operating from the start with little or no controls. *An approach which begins by assuming the null hypothesis and is based on such circular, flawed logic cannot fail to demonstrate acceptable risk to the downwind community.*

4.2 Employment of an Inadequate Air Monitoring Program

Given the proximity of the Facility to the Camillus residents, it is imperative that the air monitoring program clearly evidences the status of COC safe-level compliance throughout the community, both short-term (acute) and long-term (chronic).

The need for such capability is underscored by the fact that there is virtually no other “line of defense” for community protection in place at this time.

Based on a detailed review of available project documents and other information, we have determined that the current Facility air monitoring program provides little value to the Camillus residents.

The inadequacies of the current air monitoring program are discussed in some detail in Section 2.3.2 and need not be reiterated here. Please refer to Section 6.2 for our air monitoring program recommendations.

SECTION 5 - ASSESSMENT OF COMMUNITY EXPOSURE

Section 5.1 presents the method employed. **Section 5.2** presents the air dispersion model input data. **Section 5.3** presents the results of the community exposure assessment (Assessment).

5.1 Method

Assessment Scenarios

Table 5-1 depicts scenarios considered for the Assessment. For past exposure (Year 1, prior to the November 19, 2012 shutdown for winter), only acute (1-hour) exposure is considered. For total project exposure (Years 1 through 5), both acute and chronic (annual) exposure are considered. For Years 2 through 5, emissions are assumed only between April 15 and November 15; emissions are conservatively assumed to be zero during the remaining cold season.

Table 5-1. Assessment Scenarios Considered

Duration	Exposure Type	
	Acute	Chronic
Past (Year 1)	✓	
Total Project (Years 1-5)	✓	✓

Contaminants of Concern

During Facility operations, there are several compounds released into the ambient air which could result in unacceptable community exposure. Based on each compound's abundance, inhalation risk, and volatility, however, we have narrowed the COC list to the following "drivers" for the Assessment:

- naphthalene
- 1-4, dichlorobenzene
- benzene

Coal tar, which by all indications represents a sizable fraction of the dredge sediments, is itself a human carcinogen regulated by DEC, and could well be a driver more important than any of these COCs. However, the mass of coal tar to be dredged was not ascertained during the Remedial Investigation, so we are unable to consider this compound in our Assessment.

Meteorological Data

All air dispersion modeling was based on 2012 surface data from Hancock International Airport in Syracuse, with coincident upper-air data from Albany County Airport – the nearest National Weather Service (NWS) station of this type. Onsite (Wastebed 13) surface data was obtained for 2012, but was not of a quality sufficient to meet AERMOD input requirements.*

Air Dispersion Model

EPA's refined Guideline air dispersion model, AERMOD (American Meteorological Society / EPA Regulatory Model), version 12345 (December 10, 2012), was employed to predict the concentrations of each COC across the community for each assessment scenario (Table 5-1).

Emissions Approach

As Facility operations are performed without process monitoring of any type (e.g., sludge, air, sediment), we developed our emissions inventory based on mass balance estimates derived from data generated during the Remedial Investigation and the wind tunnel study. This is essentially the same approach that Parsons intended to employ, as detailed in the Modeling Protocol.

For *chronic exposure*, the emissions inventory was developed for each COC by first calculating the total lake-bottom sediment mass to be dredged from the seven sediment management units (SMUs), and then applying the volatilization loss percentage determined from the wind tunnel data. The resultant volatilized mass (for each COC) was then used to derive a constant unit emission rate (mass per time per area) across the entire geotextile tube placement area (Phases I, II, and III) over the 5-year project duration. This area emission rate was modeled using the most recent full year (2012) of onsite (Wastebed 13) meteorological surface data.

For *acute exposure*, the emissions inventory was developed for each COC by first calculating the maximum weighted 1-meter-interval composite mass loading of each COC, irrespective of SMU, and then applying the same volatilization loss percentage. The resultant volatilized mass was then used to derive a maximum hourly emission rate (mass per time per area) across a single geotextile tube area: Phase I for Year 1, and Phase III (nearest to the residents) for subsequent years. This area emission rate was again modeled using the 2012 onsite surface data.

* Honeywell's meteorological monitoring program specifies creation of AERMOD-ready files generated directly from the raw data (Ref. 8); both were requested on March 6 for the year 2012 (Table 3-3, Item 7). On March 30, we received only an EXCEL spreadsheet which required reprocessing in order to make the data AERMOD-compatible. More importantly, the parameters needed to run AERMOD for the critical nighttime hours were missing altogether, presumably because they were never considered during the monitoring program design.

All things being equal, use of onsite (rather than Syracuse) data would likely result in higher residential concentrations. Although it might be possible to use some combination of these two data sets to refine the modeling results, this endeavor would be difficult and time-consuming.

5.2 Model Input Data

Section 5.2.1 presents the emissions inventory data. **Section 5.2.2** presents the source location and dimensions.

5.2.1 Emissions Inventory

Section 5.2.1.1 and **Section 5.2.1.2**, respectively, present the emissions inventory data for chronic (annually averaged) and acute (1-hour-averaged) exposures.

5.2.1.1 Chronic Exposure

Mass Calculation

Table 5-2 provides, for each SMU, the total mass of each COC to be dredged from the lake bottom and treated at the SCA. Information upon which these mass calculations are based includes:

- Tables B.9 thru B.11 of Appendix B of the Feasibility Study (Ref. 9), which provide the average COC concentrations (in mg/kg) for each SMU to be dredged for depth intervals of 0-1 meters, 1-2 meters, and 2-3 meters, respectively
- Page I.2-10 of Appendix I of the Feasibility Study, in which a dredged-sediment density of 1.4 tons per cubic yard is assumed
- Table 15 of the ROD (Ref. 10), which shows, by SMU, the sediment volume to be dredged

Table 5-2. Total Mass of Each COC to be Dredged

Compound of Concern	CAS No.	Total Mass by Sediment Management Unit (in kilograms)							Total
		1	2	3	4	5	6	7	
naphthalene	00091-20-3	311,866	60,441	16	7	24	881	6,228	379,463
1,4-dichlorobenzene	00106-46-7	54,292	1,121	2	7	4	75	2,332	57,833
benzene	00071-43-2	10,650	1,226	112	1	1	28	113	12,131

Emission-Factor Calculation

Table 5-3 presents the total mass loss of each COC due to volatilization. Information upon which these mass-loss estimates are based includes:

- Total available (in-sediment) mass from Table 5-2
- Tables 9 through 14 of the Wind Tunnel Testing Report (Ref. 6), which present the pre- and post-test sediment sampling results (10% mixed slurry) designed to simulate emissions from active sediment placement operations for SMUs 1, 6, and 7 (other SMUs were not simulated)
- Tables 3 and 5 of the ROD (Ref. 10), which apportion the mass of 1,4-dichlorobenzene as 54% of the total dichlorobenzene

Table 5-3. Total Mass of Each COC for Release via Volatilization

Compound of Concern	CAS No.	Total Available Mass (kg)	Loss Through Sediment Dewatering Step	
			As Percent of Mass	Kilograms
naphthalene	00091-20-3	379,463	82.9	314,575
1,4-dichlorobenzene	00106-46-7	57,833	82.8	47,886
benzene	00071-43-2	12,131	79.7	9,668

Table 5-4 presents the emission factors used in annual modeling. Information upon which these calculations are based includes:

- Specifications provided in Drawing No. 444853-201-C-003 (Rev. 0), Berm and Subgrade Grading Plan, September 2011 (Ref. 11)
- The fact that the Facility operated for 92 days during Year 1 and the assumption that it will operate for 215 days per year for Years 2 through 5

Table 5-4. Emission Factors for Annual Modeling

Compound of Concern	CAS No.	Geotextile Tube Area (Phases I-III) (m ²)	Mass Emitted (kg) (Table 5-3)	Emission Factor (ug/s-m ²)
naphthalene	00091-20-3	263,000	314,575	14.54
1,4-dichlorobenzene	00106-46-7	263,000	47,886	2.21
benzene	00071-43-2	263,000	9,668	0.45

Facility HAP Compliance Assessment

Table 5-5 presents a Facility compliance assessment for Hazardous Air Pollutants (HAP). Bolded, shaded entries indicate HAP exceedances.

Results show that the Facility exceeds the HAP compliance criteria for naphthalene and 1,4-dichlorobenzene.

Table 5-5. Facility HAP Compliance Assessment

Compound of Concern	CAS No.	Mass Emitted			HAP Threshold (Tons/Year)
		Total		Annual (Tons/Year)	
		Kilograms (Table 5-3)	Tons		
naphthalene	00091-20-3	314,575	346.8	69.4	10
1,4-dichlorobenzene	00106-46-7	47,886	52.8	10.6	10
benzene	00071-43-2	9,668	10.7	2.1	10

Based on the above HAP compliance assessment, the Facility is currently operating as a “major source” pursuant to Section 112 of the 1990 Amendments to the Clean Air Act.

5.2.1.2 Acute Exposure

Emission-Factor Calculation

Table 5-6 presents the maximum emission rates used in hourly modeling. Information upon which these calculations are based includes:

- From the ROD (Ref. 10): Table 15, which shows the total sediment volume to be dredged; and maximum weighted 1-meter-interval concentrations from Table 5 (naphthalene and benzene), and Table 3 (1,4-dichlorobenzene)
- Page I.2-10 of Appendix I of the Feasibility Study (Ref. 9), in which a dredged-sediment density of 1.4 tons per cubic yard is assumed
- The fact that the Facility operated for 92 days during Year 1 and the assumption that it will operate for 215 days per year for Years 2 through 5

Table 5-6. Maximum Emission Rates for Hourly Modeling

Compound of Concern	CAS No.	Processing Rate (kg/hr)	Maximum Concentration (ug/kg)	Loss Factor (Table 5-3)	Emission Rate	
					(g/hr)	(g/s)
naphthalene	00091-20-3	147,472	1,300,000	82.9	158,931	44.15
1,4-dichlorobenzene	00106-46-7	147,472	522,500	82.8	63,801	17.72
benzene	00071-43-2	147,472	222,300	79.7	26,128	7.26

Table 5-7 presents the emission factors used in hourly modeling. Information upon which these calculations are based includes:

- Specifications provided in Drawing No. 444853-201-C-003 (Rev. 0), Berm and Subgrade Grading Plan, September 2011 (Ref. 11)
- The fact that the Facility operated for 92 days during Year 1 and the assumption that it will operate for 215 days per year for Years 2 through 5

Table 5-7. Emission Factors for Hourly Modeling

Compound of Concern	CAS No.	Geotextile Tube Area				Emission Rate (g/s) (Table 5-6)	Emission Factor (ug/s-m ²)	
		Year 1		Years 2-5			Year 1	Years 2-5
		Phase	(m ²)	Phase	(m ²)			
naphthalene	00091-20-3	I	101,000	III	65,000	44.15	437.13	679.23
1,4-dichlorobenzene	00106-46-7	I	101,000	III	65,000	17.72	175.45	272.62
benzene	00071-43-2	I	101,000	III	65,000	7.26	71.88	111.69

5.2.2 Source Location and Dimensions

Table 5-8 provides the source location and dimensions for all air dispersion modeling. Information upon which these calculations are based includes:

- On-line USGS Map Locator http://store.usgs.gov/b2c_usgs/usgs/maplocator/
- Specifications provided in Drawing No. 444853-201-C-003 (Rev. 0), Berm and Subgrade Grading Plan, September 2011 (Ref. 11)

Table 5-8. Source Location and Dimensions for All Dispersion Modeling

Location (m)		Dimensions (m)		Area (m ²)	
UTM Coordinates	Elevation	X	Y		
Annual Modeling (Phases I-III Area)					
397310	4749500	130	500	526	263,000
1-Hour Modeling – Year 1 (Phase I Area)					
397260	4769687	130	500	202	101,000
1-Hour Modeling – Years 2-5 (Phase III Area)					
397207	4769883	130	500	130	65,000

5.3 Results

Section 5.3.1 presents Year 1 (past) acute exposure results. **Section 5.3.2** presents total project (five-year) chronic exposure results.

5.3.1 Year 1

Table 5-9 compares the maximum predicted residential acute (1-hour) exposure with DEC-established safe levels for Year 1 for the three COCs. Also shown are the exceedance factors, which are derived by dividing the maximum predicted concentration by the safe level. Bolded, shaded entries indicate predicted safe-level exceedances.

Safe levels for 1-hour exposure are provided in (or, for 1,4-dichlorobenzene, calculated in accordance with) DEC's October 18, 2012 Division of Air Resources DAR-1, AGC/SGC Tables (Ref. 12).

Each predicted 1-hour number is the highest concentration for any hour during Year 1 (a total of 92 days Facility operation), irrespective of residential location.

Table 5-9. Year 1 Maximum Predicted Residential Acute Exposure

Compound of Concern	CAS No.	Concentration (micrograms per cubic meter, ug/m ³)		
		DEC Safe Level (1-Hour)	Maximum Predicted (1-Hour)	Exceedance Factor
naphthalene	00091-20-3	7,900.0	40,066	5.1
1,4-dichlorobenzene	00106-46-7	14,300.0	16,081	1.1
benzene	00071-43-2	1,300.0	6,588	5.1

Figure 5-1 through **Figure 5-3**, respectively, are graphical depictions of Year 1 maximum predicted acute exposure exceedance factors for naphthalene, 1,4-dichlorobenzene, and benzene. Plotted are equal lines (isopleths) of exceedance factors.*

It is important to recognize that these concentration exceedances are the highest for any hour during the 92 days comprising Year 1 Facility operations. In other words, for a given COC, the maximum predicted 1-hour concentrations for any two locations will likely occur during different days and times.

* The maximum 1-hour exposure-exceedance plots for naphthalene and benzene are nearly identical owing to the very similar exceedance factors (5.072 for naphthalene and 5.068 for benzene).

Figure 5-1. Year 1 Maximum Predicted Acute Exposure Exceedance Factors: Naphthalene

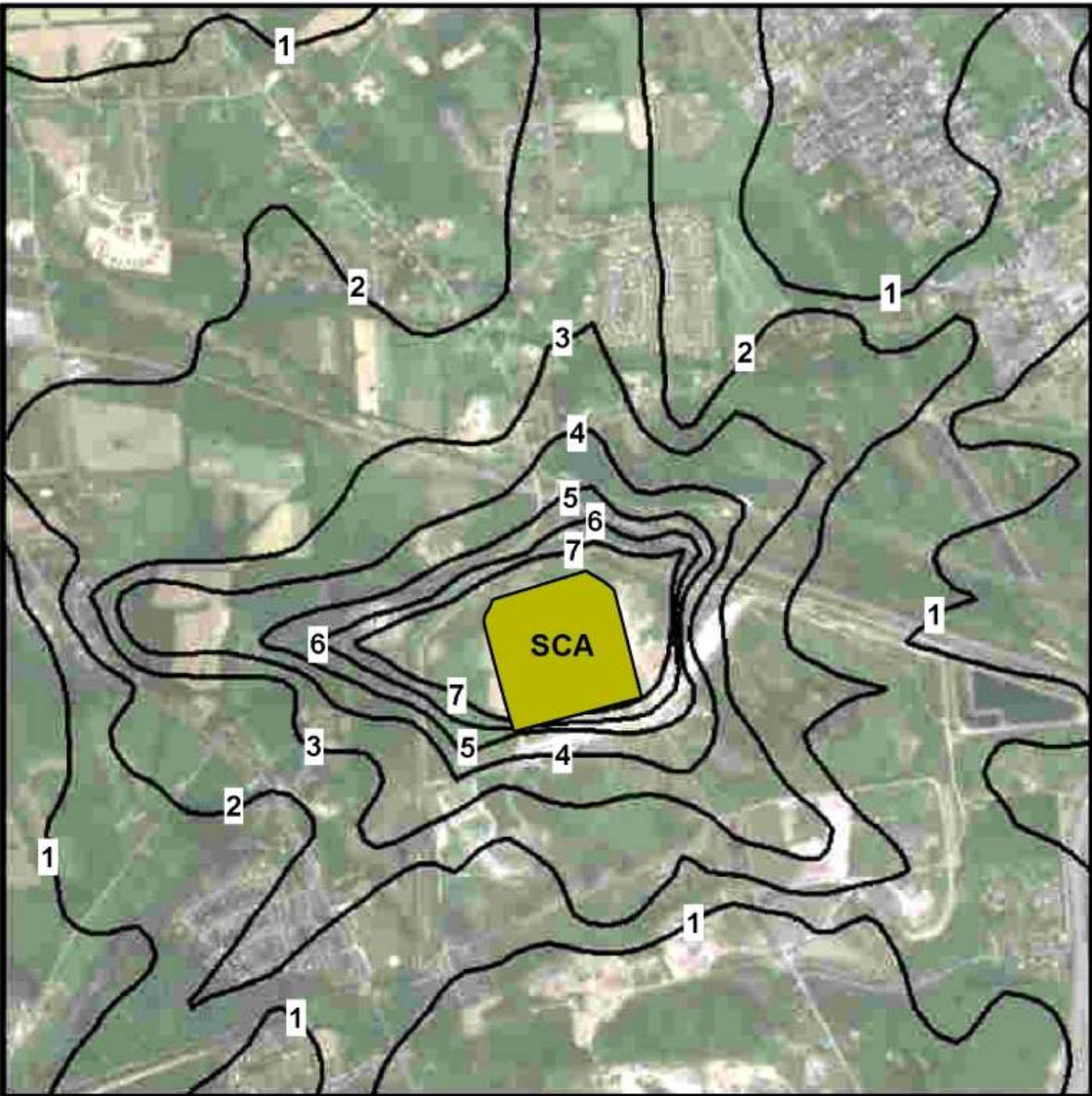


Figure 5-2. Year 1 Maximum Predicted Acute Exposure Exceedance Factors: 1,4-Dichlorobenzene

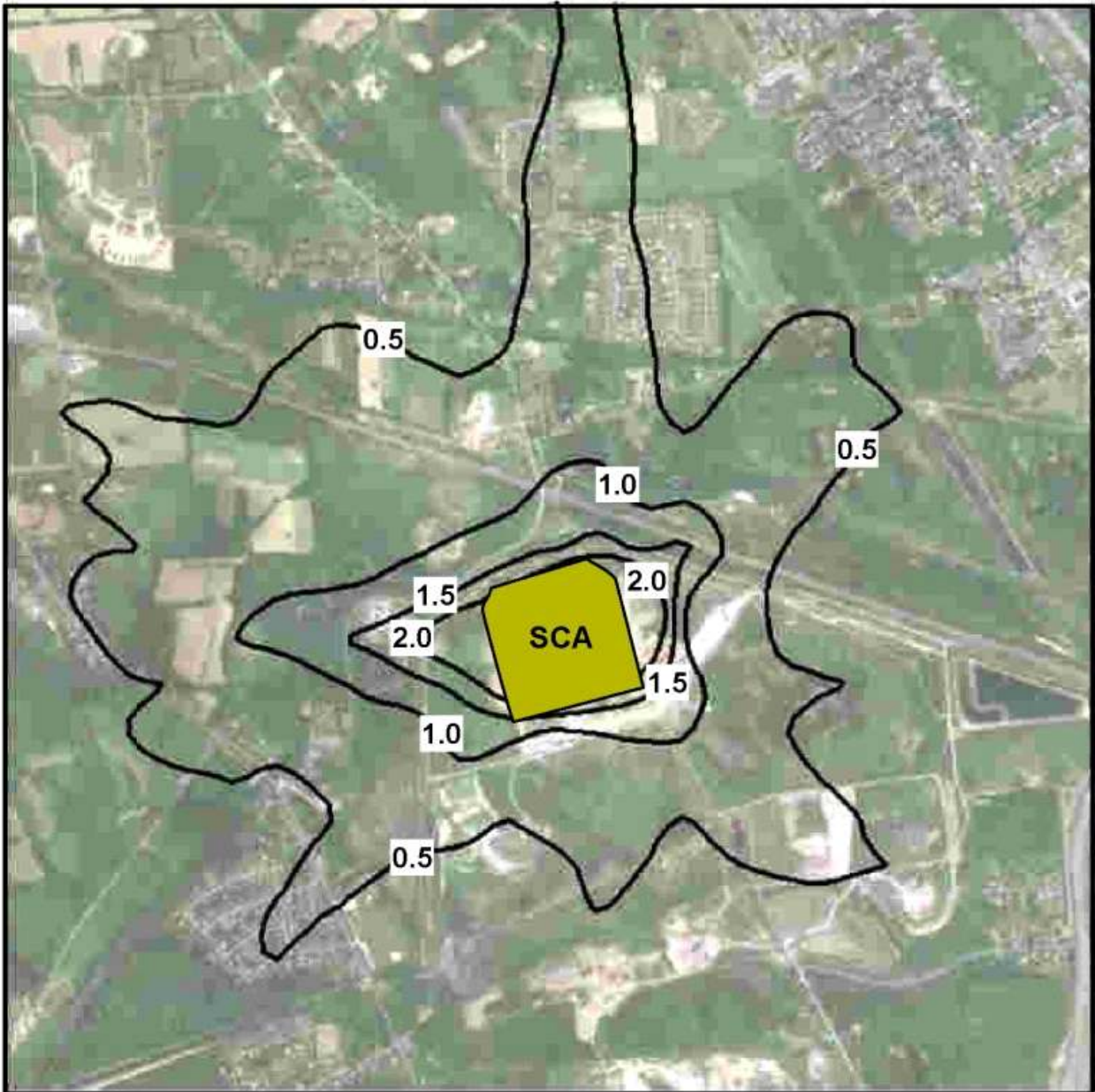
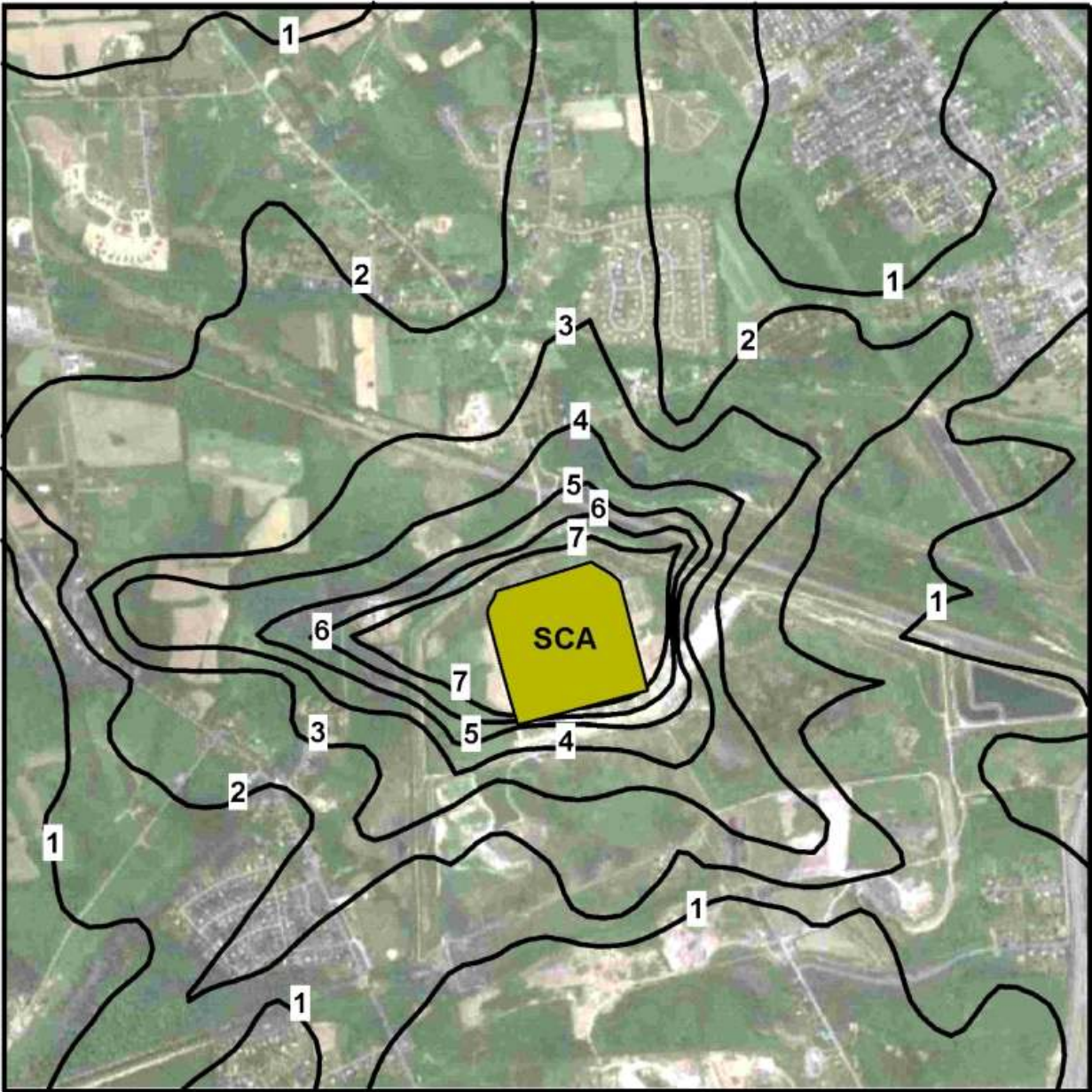


Figure 5-3. Year 1 Maximum Predicted Acute Exposure Exceedance Factors: Benzene



Year 1 maximum predicted 1-hour residential concentrations exceeded the safe level by factors of 5.1 for naphthalene and benzene, and 1.1 for 1,4-dichlorobenzene.

5.3.2 Total Project

Table 5-10 compares the maximum predicted residential chronic (annual) and acute (1-hour) exposure with DEC-established safe levels for the total project (Years 1 through 5) for the three COCs. Also shown are the exceedance factors, which are derived by dividing the maximum predicted concentration by the safe level. Bolded, shaded entries indicate predicted safe level exceedances.

Safe levels for annual exposure are provided in Appendix B of the May 2012 Remediation Operations Community Health and Safety Plan (Ref. 13). Safe levels for 1-hour exposure are provided in applicable DEC guidance as discussed in Section 5.3.1 (Ref. 12).

Each predicted annual (or 1-hour) number is the highest concentration for any year (or hour) during the total project, irrespective of residential location.

Table 5-10. Total Project Maximum Predicted Residential Chronic and Acute Exposure

Compound of Concern	Concentration (micrograms per cubic meter, ug/m ³)					
	Chronic			Acute		
	DEC Safe Level (Annual)	Maximum Predicted (Annual)	Exceedance Factor	DEC Safe Level (1-Hour)	Maximum Predicted (1-Hour)	Exceedance Factor
naphthalene	2.0	14.50	7.3	7,900.0	72,904	9.2
1,4-dichlorobenzene	1.3	2.20	1.7	14,300.0	29,261	2.0
benzene	1.9	0.45	0.2	1,300.0	11,988	9.2

Figure 5-4 and **Figure 5-5**, respectively, are graphical depictions of total project predicted chronic exposure exceedance factors for naphthalene and 1,4-dichlorobenzene. Plotted are exceedance-factor isopleths.

Figure 5-6 through **Figure 5-8**, respectively, are graphical depictions of total project maximum predicted acute exposure exceedance factors for naphthalene, 1,4-dichlorobenzene, and benzene. Plotted are exceedance-factor isopleths.*

For acute concentrations, it is important to recognize that these concentration exceedances are the highest for any hour during the expected 5-year facility operations.

* The maximum 1-hour exposure-exceedance plots for naphthalene and benzene are nearly identical owing to the very similar exceedance factors (9.228 for naphthalene and 9.222 for benzene).

Figure 5-4. Total Project Predicted Chronic Exposure Exceedance Factors: Naphthalene

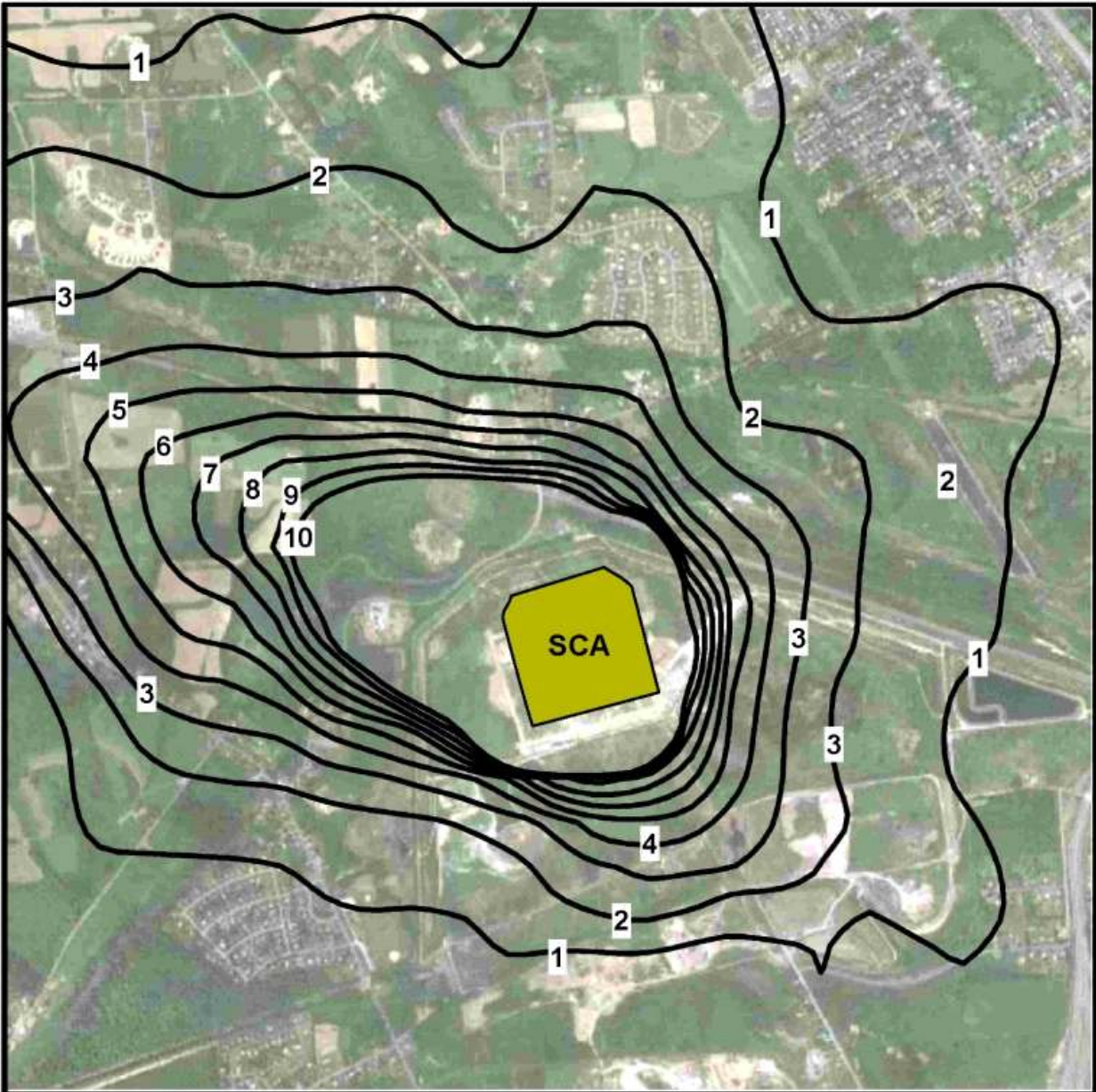
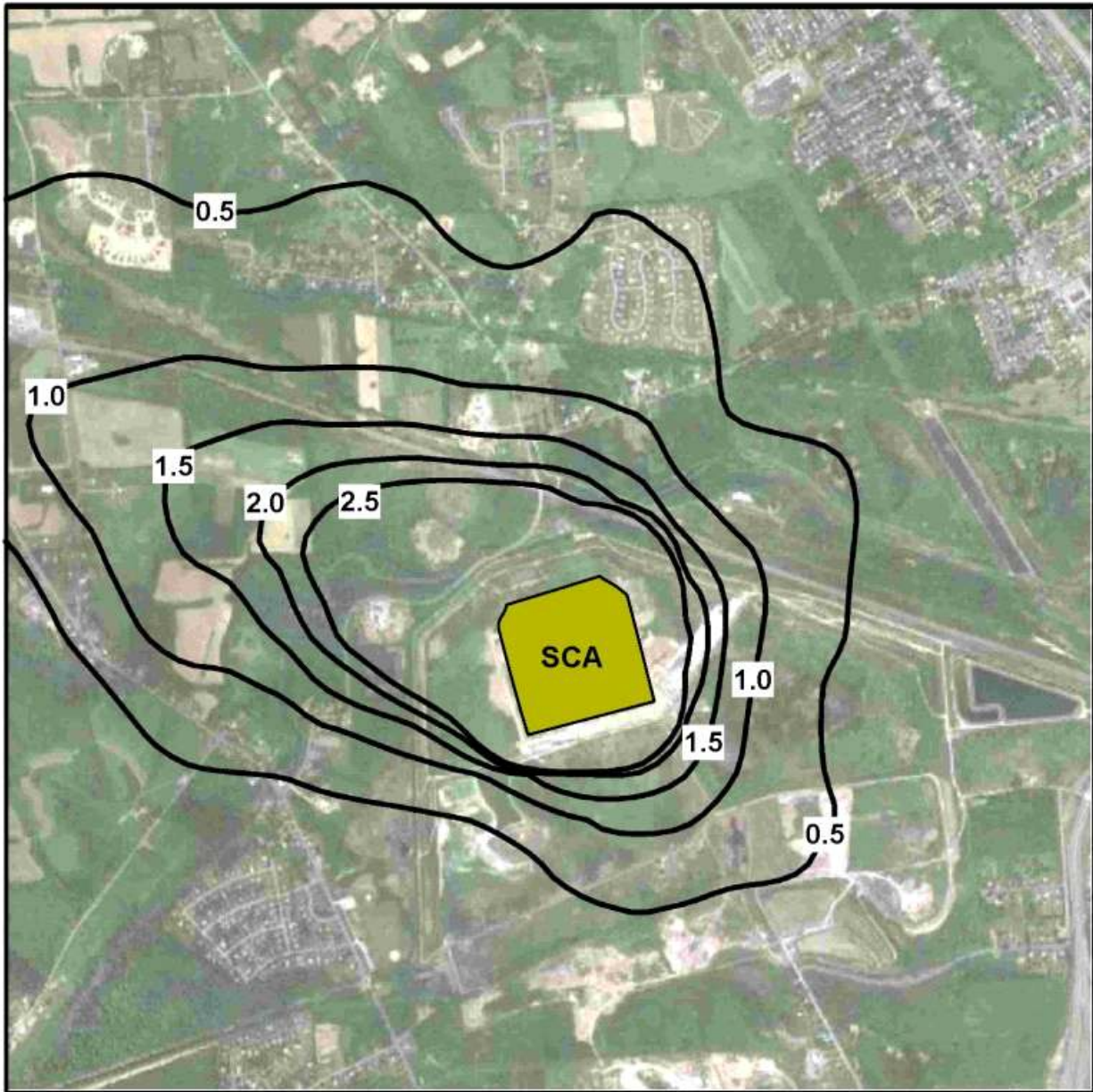


Figure 5-5. Total Project Predicted Chronic Exposure Exceedance Factors: 1,4-Dichlorobenzene



Total project predicted annual residential concentrations exceed the safe level by factors of 7.3 for naphthalene and 1.7 for 1,4-dichlorobenzene.

Figure 5-6. Total Project Maximum Predicted Acute Exposure Exceedance Factors: Naphthalene

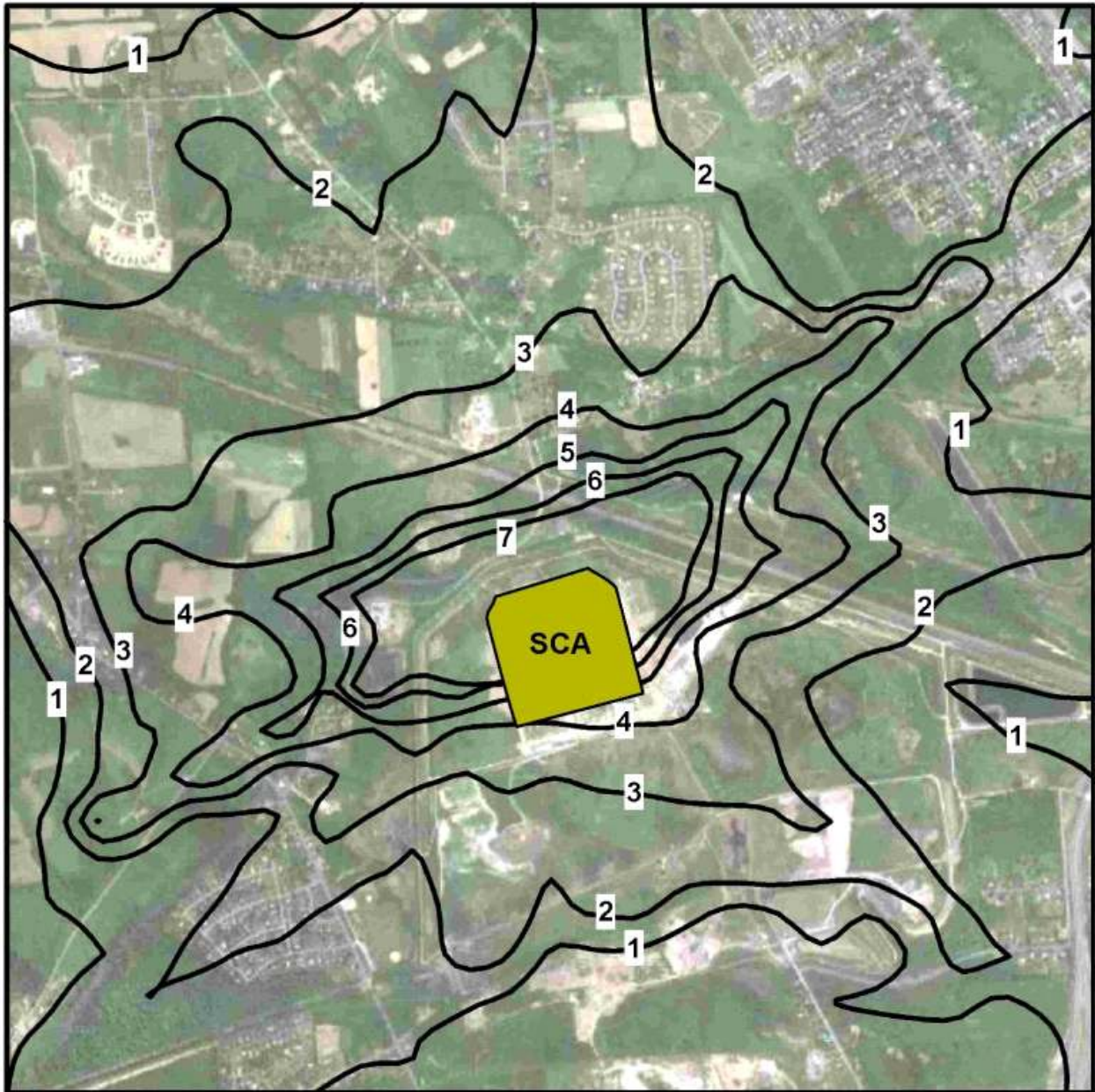


Figure 5-7. Total Project Maximum Predicted Acute Exposure Exceedance Factors: 1,4-Dichlorobenzene

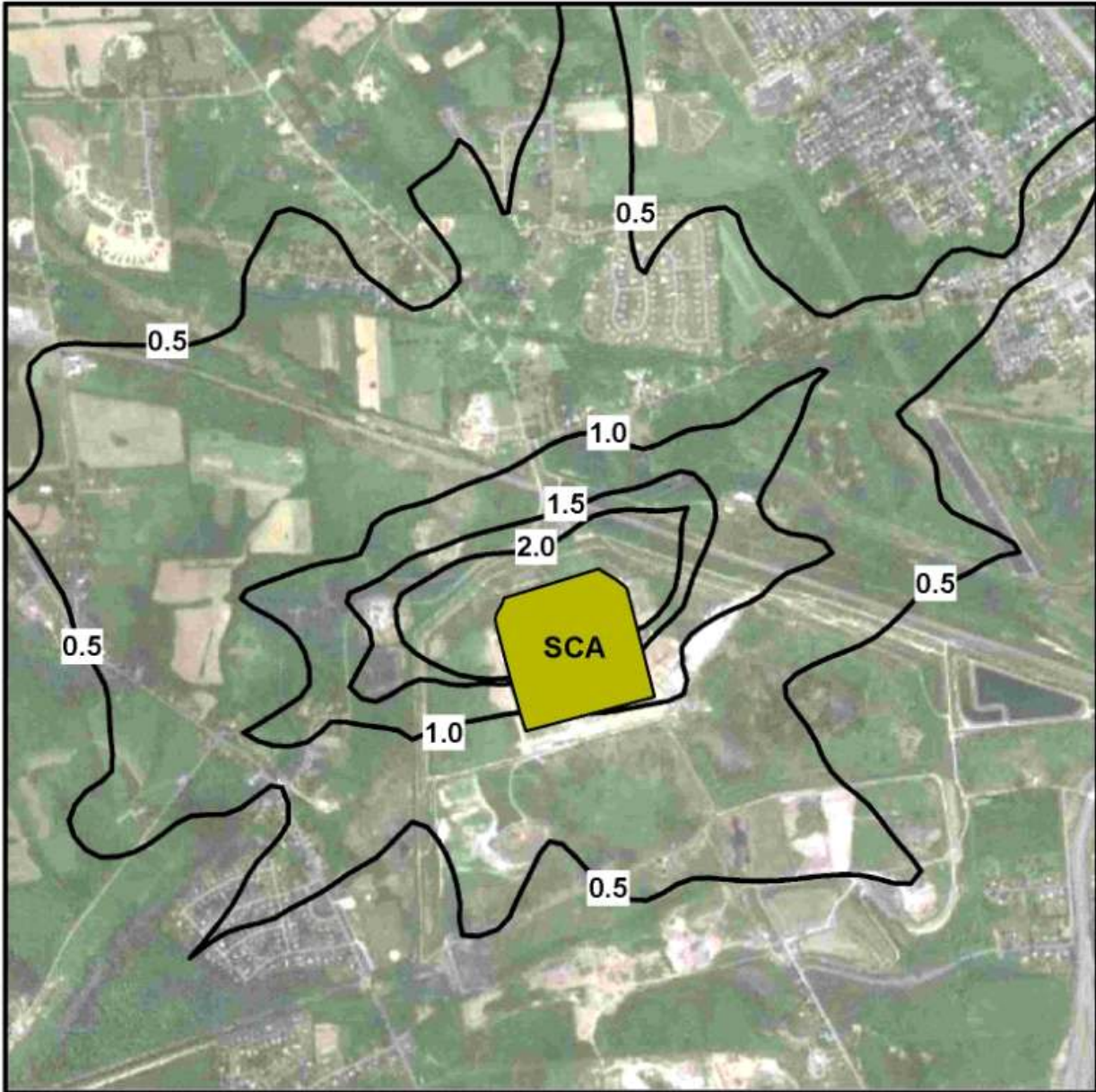
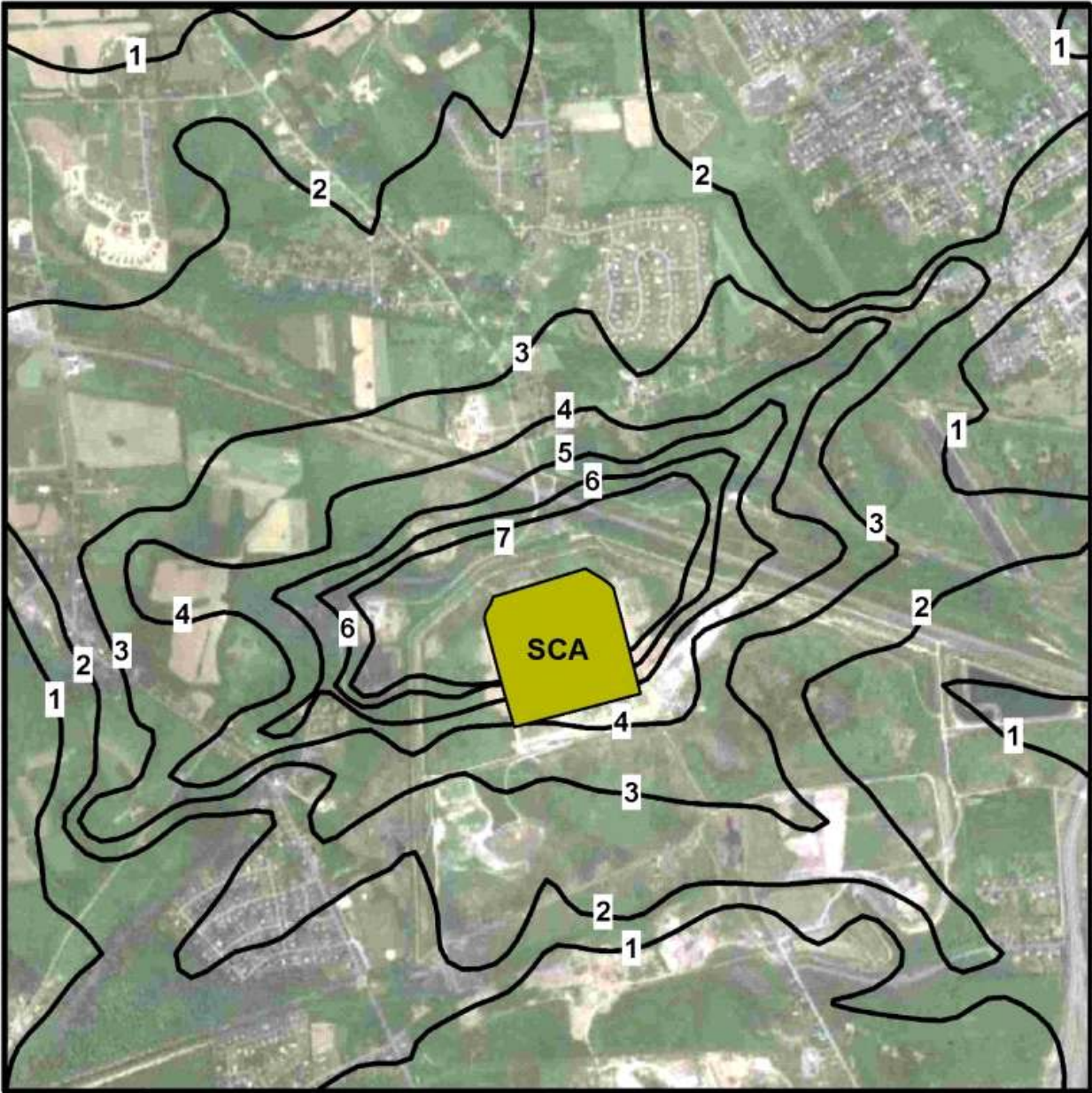


Figure 5-8. Total Project Maximum Predicted Acute Exposure Exceedance Factors: Benzene



Total project maximum predicted 1-hour residential concentrations exceed the safe level by factors of 9.2 for naphthalene and benzene, and 2.0 for 1,4-dichlorobenzene.

SECTION 6 - RECOMMENDATIONS

Based on our findings and results from Sections 4 and 5, we recommend that the following actions be taken prior to resumption of dredging:

- Reduce Facility air emissions
- Design and install a state-of-the-art, independent community air monitoring program to replace the existing system

6.1 Facility Emissions Reduction

Results presented in Section 5 demonstrate an immediate need to reduce Facility emissions in order to comply with residential safe levels and to avoid Title V designation for HAP.

In general, there are two types of emission-reduction methods: in-process controls and post-process controls.

In-Process Controls

A technically viable in-process control for slurry stream VOC removal is the incorporation of a multiple-carbon-bed system, located upstream of the screening buildings, which can be designed to accommodate widely varying contaminant mass loading. Implementation of a real-time slurry monitoring program to periodically determine such loading would be integral to the carbon-bed system's successful employment.

The monitoring program would measure the slurry directly or, as a slurry proxy, the head-space air from some type of containment vessel. In either case, the measurements would need to be made far enough upstream to allow sufficient time for determining the number of carbon beds to be utilized.

Post-Process Controls

A technically viable post-process control for VOC removal is the installation of one or more sprung structures over the geotextile tubes and, possibly, the filtrate storage basins. Each sprung structure would be operated under negative pressure, and would include an effective contaminant removal system (e.g., thermal destruction or carbon filtration).

6.2 Implementation of an Independent Community Air Monitoring Program

Programmatic deficiencies discussed in Section 4 demonstrate an immediate need to implement a state-of-the-art, real-time independent community air monitoring (ICAM) program, control of which should rest with the community.

We recommend an ICAM program, based on EPA Method TO-16, which: (a) facilitates optimization of emission control processes via continual, direct COC emission-rate measurement; (b) presents, every 15 minutes, the compliance status with respect to safe residential concentrations for each COC; and (c) is accessible online by each resident.

General Approach

Together with onsite meteorological data, Method TO-16 can be used to continuously monitor Facility emission rates in much the same manner that CEM (continuous emission monitoring) systems are routinely employed at industrial plants permitted by DEC under 6 NYCRR Part 201.

A unique, permissible emission rate (PER) can be identified for the Facility, based on results of air dispersion modeling (AERMOD), for each of several meteorological “regimes” which can occur.

PER compliance would ensure that offsite, residential exposure remains within safe levels established by DEC for this project. As discussed earlier, these safe levels address two types of potential exposure to the general public: (a) acute exposure, for which Short-Term Guideline Concentrations (SGCs) are established and expressed as hourly averaged values (Ref. 12); and (b) chronic exposure, for which project-specific, long-term air monitoring criteria are established and expressed as annually averaged values (Ref. 11, Appendix B).

Method TO-16

Method TO-16 employs open-path Fourier-transform infrared (FTIR) spectroscopy to identify and quantify gaseous airborne contaminants in real time. The technology is identical in principle to classical laboratory FTIR spectroscopy, in which a sample is injected into a cell for spectral analysis; in this case, the cell is extended to the open atmosphere. A beam of light spanning a range of wavelengths in the near-IR portion of the electromagnetic spectrum (approximately 2 to 14 microns) is propagated from the transmitter portion of the instrument.

In its most common configuration, Method TO-16 employs a retroreflector, comprised of an array of corner-cubed mirrors, positioned to intercept this beam and redirect it back upon itself to the receiver portion of the instrument. One-way path lengths can be several hundreds of meters or more.

A path-integrated concentration yields contaminant information along the entire measurement path, not just at a single point in space (or collection of points) as with point-monitoring methods. This resolves the spatial data representativeness deficiency inherent in programs employing point-monitoring approaches, as *a non-buoyant, ground-level plume cannot pass through the beam path undetected*. Path-integrated concentrations are typically reported in units of parts-per-million-meters (ppm-m).

Individual target contaminants are identified and quantified via a computer-based spectral search involving sequential, compound-specific analysis and comparison to the system's internal reference spectral library. Analysis of the spectral absorption data is typically carried out using a multi-component classical least squares (CLS) fitting routine. Any gaseous compound which absorbs in the IR region is a potential candidate for monitoring using this technology; spectral libraries exist for hundreds of compounds.

Method TO-16 offers several other significant benefits. First, it enables each compound to be monitored individually. Second, it is the only legally admissible and technically defensible means of monitoring naphthalene in real time. Third, all measurement spectra are electronically generated and permanently retained, thus enabling one to re-visit the data at any time; this capability would be invaluable in developing an indicator compound for coal tar vapors (in addition to naphthalene).

Most importantly, U.S. EPA Method TO-16 is the only practical way to demonstrate, in real time, the causative relationship between Facility emissions and residential exposure.

Emission-Rate Calculation

Facility emission rates for all COCs can be continually generated using the area-source technique, which relates the *measured* path-integrated concentration along the entire downwind measurement path to the *modeled* path-integrated concentration along this same path based on a “unity” source emission factor (e.g., 1 mg/m²-s) and actual meteorology.

A simple ratio is established which says, for any 15-minute-averaged monitoring event, the measured (path-integrated) concentration (C_M), exists in the same proportion to its actual emission rate (Q_A), as the modeled concentration (using a unity emission rate) (C_U) does to its unity emission rate (Q_U):

$$C_M / Q_A = C_U / Q_U$$

By solving this equation for Q_A , the only unknown term, *a continual, accurate assessment of source emission rates is provided in real time.*