

**AMBIENT AIR QUALITY AND ODOR ASSESSMENT
AT THE
CITY OF ALBANY RAPP ROAD SOLID WASTE
MANAGEMENT FACILITY**

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AMBIENT AIR QUALITY AND ODOR ASSESSMENT AT THE CITY OF ALBANY RAPP ROAD SOLID WASTE MANAGEMENT FACILITY

1.0 INTRODUCTION

RTP Environmental Associates, Inc. (RTP), along with several other consultants, have been tasked with the investigation of current and future operations and impacts associated with the City of Albany Rapp Road Solid Waste Management Facility (RRSWMF). RTP's role included the investigation of potential odor and air quality impacts associated with the daily operations of the RRSWMF, through a series of ambient odor and air quality tests. There are several technical differences in the methodologies and time frames for monitoring odors versus air pollutant compounds. As such, although there are concepts that are common to both, it is best to separate the discussions as part of this report.

Odors, in general, are typical short-term occurrences that have no specific standards. The standards the facilities must meet are commonly treated under nuisance criteria that are based on judgments and relate to quality-of-life issues. Air quality aspects, such as individual air pollutants are, in some cases, closely regulated with fixed numerical standards over various time frames. Landfills are not a significant source of criteria pollutants, which are highly regulated by the United States Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC). However, landfills have the potential to emit toxic air pollutants due to several factors including landfill gas (LFG) generation and leachate collection and storage. The NYSDEC provides ambient guidelines for toxic air pollutants. NYSDEC has established short- (1-hour) and long-term (annual) guideline concentration (SGC/AGC) values for several air toxic compounds. Most of the compounds are considered volatile organic compounds (VOCs). In addition to VOCs, landfills have the potential to emit other toxic air pollutants such as aldehydes, ketones, volatile organic acids (VOAs), methane and sulfur containing compounds (such as hydrogen sulfide) and the NYSDEC has guidelines and/or standards for some of these compounds.

Odor potential and air pollutant emissions from landfills are dependent on several landfill operational factors such as the type of waste in place, waste acceptance rates, landfill

management practices, age of the landfill, LFG generation rates, LFG collection rates, LFG control methods, etc. In order to quantify odor and air emissions from the RRSWFMF, a series of ambient odor and air quality tests were conducted. Four (4) odor and air quality sampling events were performed on a calendar quarterly basis over the course of a year. The first test was conducted on May 3, 2007 and the fourth and final test was conducted on January 31, 2008. The purpose of testing on a quarterly schedule was to identify and evaluate the existence of any seasonal variations. In addition, staggering tests over an annual period allowed for testing during different stages of typical landfill operations. Such operations include, routine maintenance of LFG capture and control equipment, installation of LFG collection wells, management of leachate collection and storage, waste placement and movement, capping and closure of landfill sections, etc. Further, testing was performed during different times of the day including during normal business hours and when the landfill complex was closed. This allowed monitoring of odor and air quality levels during the day and at night and provided diurnal meteorological conditions and their impact on local odor and air quality levels.

In addition to odor and air quality sample collection, supporting information was gathered to assist with the ambient odor and air quality assessment. This included the collection of landfill gas samples and the collection of onsite meteorological parameters, the assessment of odor complaints and tracking landfill operations.

This report provides information on the methodology applied, an analysis of the sample results and conclusions. This report is divided into six (6) sections. Section 2.0 provides a site description and overview of operations. Section 3.0 provides the methodology and analytical protocols used for odor, air quality and landfill gas sample collection. Meteorology data collection is also provided in this section. Section 4.0 provides detailed sampling event information and sample site location selection criteria. Section 5.0 contains a summary and analysis of the results and Section 6.0 provides conclusions.

2.0 SITE OVERVIEW

2.1 Site Description

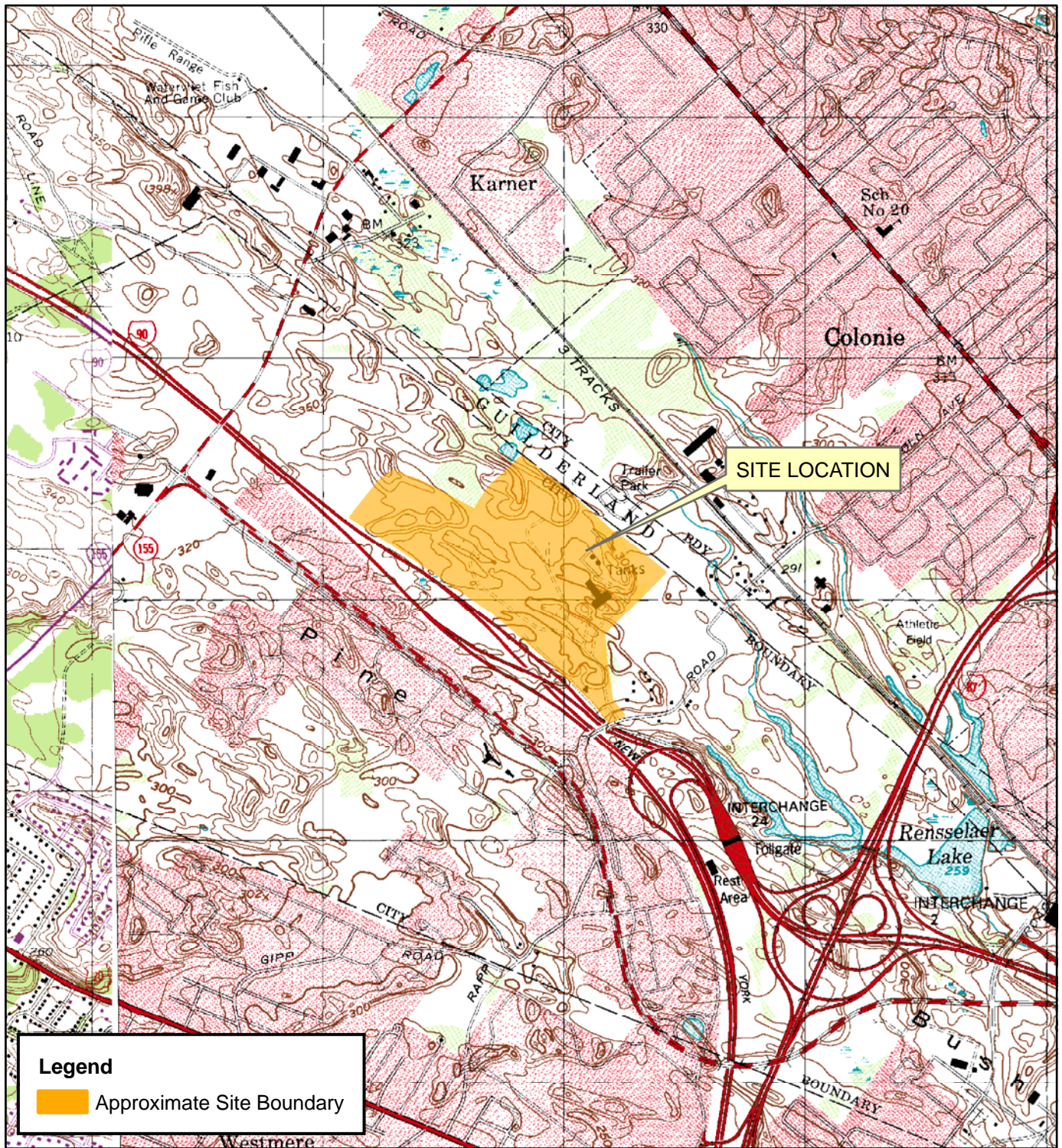
Since 1969, the City of Albany Department of General Services has been operating the municipal solid waste (MSW) landfilling facility at 525 Rapp Road North, Albany County, New York, approximately 0.25 miles north of the Washington Avenue Extension. The facility is approximately 255 acres in size, with approximately 155 acres dedicated to the landfill footprint. The site is bounded by the New York State Thruway (I-90) to the south, a residential area to the north (City property) and the Albany Pine Bush Preserve to the east and west. A site location map is provided as Figure 2.1.

2.2 Site Operations

The City currently accepts approximately 1,050 tons of solid waste per day. The waste is brought to the landfill by City owned and operated garbage trucks, other municipally owned trucks, as well as trucks owned and operated by private sector waste haulers. All truck traffic must access the site via Washington Avenue Extension to Rapp Road. No truck traffic related to the landfill is permitted on Rapp Road north of the landfill entrance. Equipment used at the site includes two (2) excavators, two (2) dozers, two (2) track loaders and a trash shredder.

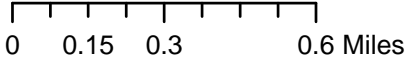
Other activities conducted at the facility include: waste shredding, LFG management for odor control, LFG management for power generation and leachate collection and storage. Following daily landfilling activities on the active portion of the landfill, Posi-Shell[®], a spray-applied cement-mortar coating, is applied for erosion prevention and odor control.

In addition, an interim cover system was installed over 17 acres of the west, north and east slopes of the active landfill area. The cover system consisted of a series of shallow gas collection trenches and an 8 mil geomembrane liner ballasted with tires. Installation of the interim cover began in early March and was completed on May 20, 2007. In July 2007, 19

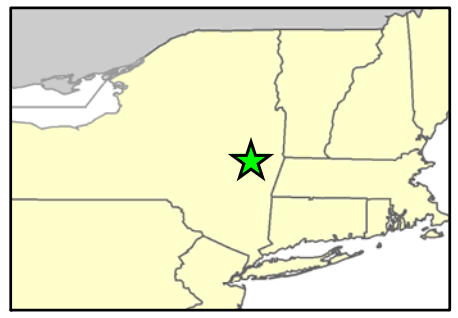


SOURCE: USGS 7.5 Minute Topographic Quadrangle - Albany, NY

FIGURE 2.1
 SITE LOCATION MAP
 CITY OF ALBANY RAPP ROAD SOLID
 WASTE MANAGEMENT FACILITY
 ALBANY, NEW YORK



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vertical gas collection wells were installed to improve the LFG collection system and in September 2007, about five (5) acres of the interim cover system was removed from the west slope and the final cap was constructed over this area. Also, a snow storm in early January caused damage to a significant portion of the geomembrane that was not repaired prior to the fourth and final odor and air quality test.

2.3 Odor Complaint Log

The City of Albany via Clough Harbour & Associates LLP (CHA) established an odor hotline to allow local residents to register nuisance odors that might be attributed to the facility. Beginning in April 2007, complaint calls received by the hotline, were logged and investigations were performed to determine the probable causes of the odors. Complaint investigations included, but was not limited to, determination of weather conditions, visiting the location of the complaint, recording landfill operations and the status of gas collection system, and a discussion with the caller. Prior to April of 2007, odor complaints were made to the NYSDEC Region 4 office or the Landfill office's general phone number. The hotline was established because these calls had not been investigated in a timely manner.

The complaint log indicates that odor complaints were received during the first (May 3, 2007) and second (August 1 & 2, 2007) ambient odor and air quality test events. The one complaint received on the day of first test was not confirmed as odors associated with the landfill. Several odor complaints were received during the second test. These complaints were confirmed as odors associated with the landfill, specifically the construction of a horizontal LFG collection trench along the active landfilling face. No complaints were logged during the last two tests.

3.0 SAMPLING METHODOLOGY AND ANALYTICAL PROTOCOLS

The ambient air monitoring program was designed to evaluate odor and air quality impacts of RRSWMF operations on surrounding areas. The primary odor and air pollutant emission sources include: dumping, handling and the decomposition of MSW; operation and maintenance of the

LFG collection system; operation and maintenance of the leachate collection system; exhausts from LFG control equipment, including flares and internal combustion engines; and vehicle exhausts. The monitoring program contained three main components: (1) odor sampling; (2) air quality sampling; and (3) landfill gas sampling. The sample collection methodology and a summary of analytical protocols are described below for each sampling activity. In addition, the meteorological data collection methodology is provided in this section. Detailed information from each sampling event can be found on field data sheets located in Appendix A.

3.1 Odor Sampling

A specific protocol for collecting odor samples was designed to account for the variability of the odors released by the landfill and associated activities and the meteorological conditions occurring on the test day. The protocol required the forecasting of persistent meteorological conditions with falling barometric pressure, and then isolating sample locations at which odor samples could be collected. Whole air samples were collected in preconditioned 12-liter Tedlar bags. Clean Tedlar bags were purchased through Odor Science and Engineering (OS&E), the firm tasked with analyzing the samples.

Odor samples were collected on the landfill surface, as well as downwind of the landfill, both on and off landfill property. In addition, one upwind odor sample was collected during each sampling event to establish a “background” odor concentration. In terms of air quality, an upwind sample is traditionally used to determine background levels, meaning the level of air quality not associated with sources of concern. However, since odors are normally very localized and diffuse rapidly, an upwind odor sample is used more of a “field blank” sample, meaning any odor level detected at the upwind sampling site may be associated with the Tedlar sampling media or general background odors, which may possess odor characteristics not normally associated with landfill activities.

For samples collected on and near the landfill, the sampling team would wait until an odor was detected at the sampling site. Once the presence of an odor was detected, the sample collection process began. The first step was to precondition, three (3) times, the clean, new Tedlar bags

with odorous air from the sampling location. Conditioning a bag involves putting the target odor into the bag and emptying the bag. This allows absorption sites in the Tedlar bag to be filled prior to the collection of the actual sample. In order to condition the Tedlar bags, they were placed inside a sampling drum (connected via Teflon/Tygon sampling line) and placed under a slight negative pressure (vacuum) by using a battery-powered low-flow sampling pump. For sampling locations further downwind of the landfill, both on and off site, as well as the upwind site, where odors were not detected by the sampling team, bag conditioning and sampling would occur immediately following equipment setup.

Once the bags were conditioned, the Tedlar bags were again placed inside the sampling drum and placed under a slight negative pressure. Sampling then began by activating the sampling pump. The sampling pumps were set at a sampling rate of approximately four (4) liters per minute (L/m) for three (3) minutes, completely filling the 12-liter bag. After collection, the bags were sealed, labeled and stored in black bags and kept out of direct sunlight prior to shipment to the independent odor panel for odor detection analysis. Odor sample analysis protocols recommend that the analysis be performed no more than 30 hours after sample collection. Photographs of odor sampling equipment taken during the sampling program can be found in Appendix B.

A portion of several of the odor samples were also sent to a certified air sample laboratory for an analysis of VOCs and sulfur containing compounds. The sampling methodology for odor samples that were sent for air quality analysis is described in Section 3.2.

Odorous air samples were evaluated by OS&E's professional odor panel. The panel consisted of eight (8) prescreened and trained individuals. Odor concentration and odor intensity were measured and the character of the perceived odor was recorded. Odor concentration is measured by dynamic dilution forced-choice olfactometry using OS&E's state-of-the-art dynamic olfactometer, in full compliance with the requirements of ASTM Method E679-91 for *Determining Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series Method of Limits*. Sample results were then forwarded to RTP for further analysis.

3.2 Air Quality Sampling

Air quality sampling was performed to quantify potential impacts of air contaminants associated with daily landfill operations in the vicinity of the RRSWMF. Similar to odor sampling, samples were collected both upwind and downwind of the RRSWMF. Due to the wide range of compounds of potential interest, the air quality investigation included several different sampling methods. The investigation included the sampling and analysis of VOCs, volatile organic acids (VOAs), aldehydes, ketones, methane and sulfur containing compounds. Air sampling methodology and analysis is dependent on sample media, which is dependent on the compounds of interest. The following provides the protocols for each sample media used during the study.

3.2.1 SUMMA Canister Sampling - VOCs and Methane

SUMMA canisters are evacuated stainless steel canisters typically used for many types of air quality sampling applications, and are recommended for use when very low pollutant concentrations are expected, or when sampling for more reactive and unstable compounds (e.g. light-sensitive or moisture-sensitive compounds). Once an evacuated canister is opened, air will fill the canister until equilibrium between canister pressure and atmospheric pressure is reached. A typical 6-liter canister will completely fill within 15-25 seconds, however, SUMMA canisters can be fitted with preset sampling rate flow devices.

For the RRSWMF air quality investigation, SUMMA canister air samples were collected for VOC and methane analysis. 6-liter SUMMA canisters fitted with 8-hour flow devices were deployed in the vicinity of the landfill. Prior to deployment, samples are labeled and an initial canister pressure was measured and recorded. Once sampling commenced, the canisters collected a sample over an 8-hour period. Canister sampling requires very little supervision or parameter monitoring. Periodic checks of canister pressure (pressure gauge attached to flow device) as the sampling period nears its end was the only necessary check. Sampling ends when the canister valve is closed. Photographs of SUMMA canister equipment taken during the sampling program can be found in Appendix B.

Following the 8-hour sampling period, final canister pressures were measured and recorded and the canisters were packed and shipped to Air Toxics Ltd. (Air Toxics) in Folsom, CA for analytical analysis. The canisters were analyzed for speciated VOCs and methane via EPA Test Methods Modified TO-15 (including tentatively identified compounds [TICs]) and Modified ASTM D-1945, respectively.

3.2.2 Volatile Organic Sampling Train (VOST) Sampling - VOCs

The VOST air sampling procedure followed EPA Reference Method 0030 by using a pre-conditioned Tenax sorbent tube and a Tenax/Anasorb[®] sorbent tube in series (sorbent tubes were supplied by Air Toxics Ltd., the laboratory that analyzed all air quality samples for the monitoring program. Sorbent tubes consist of a sorbent material (usually in powder or granular form) contained in a glass or plastic vial in which the compounds of interest will be trapped onto the surface of the sorbent material. The tubes were sealed with special fittings that were removed prior to sampling and replaced after sampling to maintain sample integrity. To prevent contamination, white laboratory gloves were worn when handling the sampling tubes.

The standard VOST apparatus is designed to extract and concentrate volatile organic compounds with boiling points less than or equal to 100 degrees Centigrade (°C) from stack gas effluents. The major difficulties with using a standard VOST in the field for ambient air quality work are the power requirements, setup and assembly problems, and the potential breakage of glassware. Therefore, RTP modified the EPA standard VOST unit to make it portable and incorporate air flow volumes necessary to achieve the analytical sensitivity required for ambient air programs. These VOST modifications include the use of a Teflon lined sampling cane, a pre-conditioned primary sorbent Tenax cartridge, an empty glass impinger for potential condensate collection, a pre-conditioned secondary sorbent Tenax and synthetic-based carbon (Tenax/Anasorb[®]) cartridge, a sealed T-connection port for monitoring back-pressure across the sorbent cartridges, an in-line calibrated rotameter, a flow splitter, a personal sampling pump, a gel cell power supply, an insulated container, an ice pack and a high-low thermometer to measure the temperature extremes. An SKC sampling pump, portable battery backup and rotameter were used instead of the standard VOST flow controlled sampling pump and dry gas meter. Packed ice and a condensate impinger

were used instead of the circulating ice water through two condensers described in the EPA reference method. A modified portable VOST sampler is depicted in Figure 3.1.

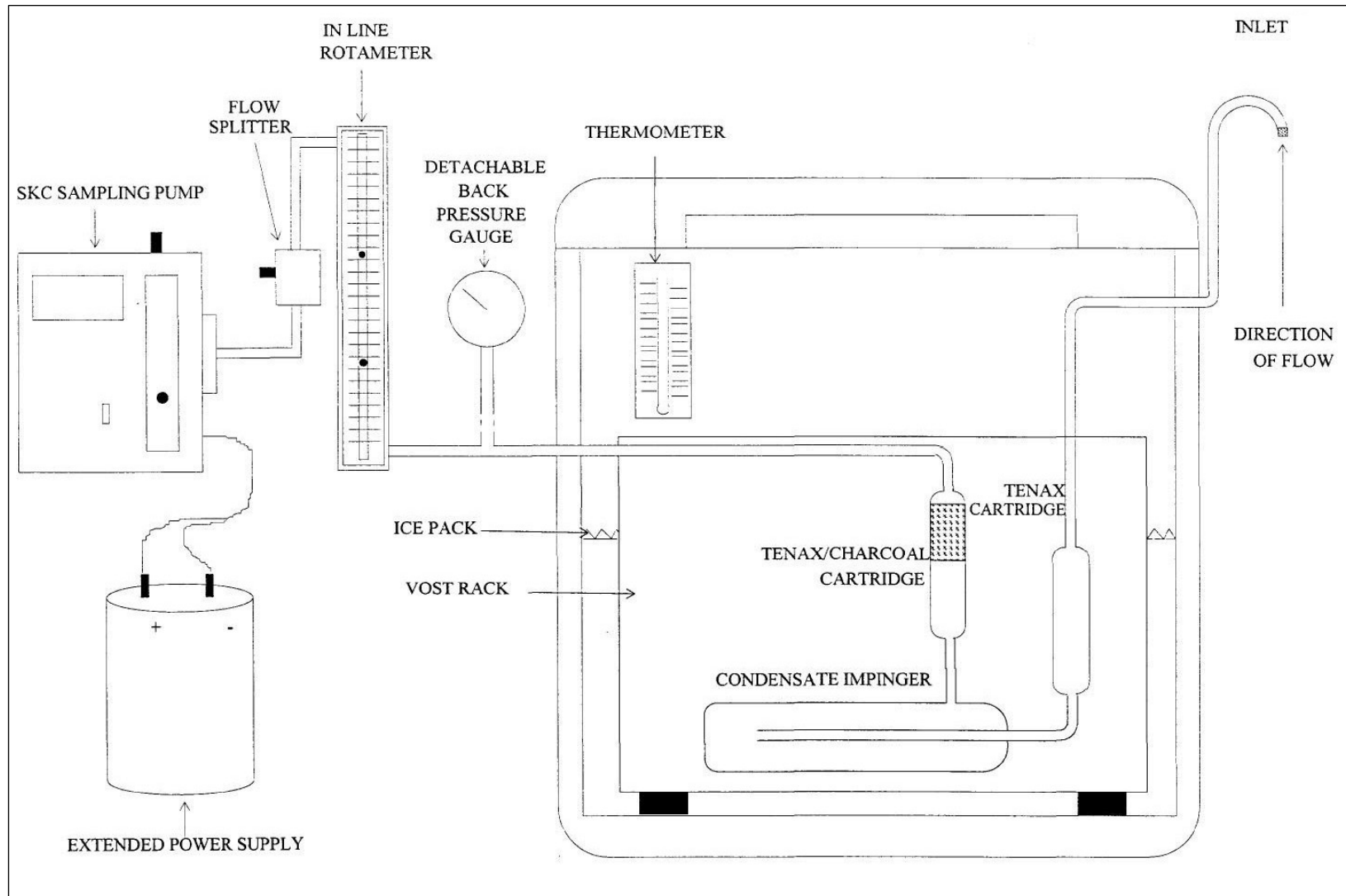
Once the VOST sampler was assembled and the media was installed, The VOST samplers were set to run at a flow rate of 0.5 liter per minute (L/m) for a total of 480 minutes (8 hours), resulting in a total collected sample volume of 240 liters. The desired sample volume of 240 liters was determined based on expected ambient air VOC concentrations and absorbent qualities of the sampling media.

Periodic checks were made at each VOST sampling location. Pump operations, VOST train integrity and sampling pump flow rates were monitored every few hours. In order to achieve uniform sampling rates, flow rates were adjusted to be within the operating window throughout the sampling period. Upon completion of sampling, the VOST cartridges were removed, sealed and placed in their respective labeled shipping tubes, packed and shipped to Air Toxics laboratory for VOC analysis via Modified EPA SW-846 Method 5041A. VOST sampling photographs taken during the sampling program can be found in Appendix B.

VOST media must be kept cold at all times, including prior to sampling, during sampling, after sampling and during transport. The VOST sampling media is either refrigerated or accompanied by frozen ice packs and/or ice cubes at all times prior to analysis.

The VOST equipment provides the lowest analytical minimum detection limits (MDLs) for VOCs from all the VOC sampling methods utilized during the RRSWMF monitoring program. Air quality sampling results which possess such a low MDL can be useful in detecting extremely low concentrations of air toxins in the ambient air. This is important when low concentration are expected in rural areas, as well as, areas located great distances from air emission sources and areas located upwind of air emission sources. In addition, the low MDLs achievable through VOST sampling allows direct sample result comparison with NYSDEC state-wide VOC monitoring results. The NYSDEC VOC monitoring program will be discussed in further detail in Section 5.2.2.2.

Figure 3.1 – Modified Portable VOST Sampler



RTP Environmental Associates, Inc.

3.2.3 Tedlar Bag Sampling – VOCs and Sulfur Compounds

In addition to VOC sampling using SUMMA canisters and VOST methodology, a portion of select odor samples (whole air Tedlar bag samples) were sent to Air Toxics laboratory for a VOC analysis via EPA Test Method Modified TO-15/TICs. The samples were also analyzed for sulfur compounds via Method ASTM D-5504. Tedlar bag sampling is the preferred sampling method for Method ASTM D-5504 analysis.

Similar to the odor sampling methodology, the 1-liter Tedlar bag was preconditioned by filling and emptying the 1-liter bag three (3) consecutive times with odor sample air. The conditioned bag is then filled again. Samples are then sealed, labeled and stored in black bags kept out of direct sunlight prior to shipment.

These samples were also important to assist with determining what compounds are potentially associated with detected odors.

3.2.4 EPA Method TO-11 Sampling - Aldehydes and Ketones

Sorbent tube sampling media was used to collect air samples for analysis of aldehydes and ketones (EPA Test Method TO-11 sorbent tubes). Aldehydes and ketones can be odorous, as well as, have negative physiological effects upon exposure to even low concentrations. Air sample collection consisted of connecting the sampling media to a Tygon sampling line and connecting the sampling line to an SKC personal sampling pump. The media were attached to a tripod with the sampling inlet approximately 3 feet off the ground. Similar to VOST sampling, to prevent contamination, white laboratory gloves were worn when handling the sampling tubes. In addition, the sample media must be kept cold at all times. Upon completion of the sampling period, the media was labeled and packed for shipment. The samples were sent to Air Toxics laboratory and analyzed via EPA Test Method Modified TO-11. TO-11 sampling photographs taken during the sampling program can be found in Appendix B.

3.2.5 Volatile Organic Acid (VOA) Sampling

VOA sampling was conducted using sorbent tube media (SKC 226-10-03 sorbent tubes) with an identical setup as TO-11 sampling. VOAs can be very odorous. After collection, labeling and packaging, the samples were shipped to Environmental Health Laboratory in Cromwell, CT and analyzed via Ion Chromatography.

3.3 LFG Sampling

LFG sample data was of interest since it would provide a concentrated sample of all constituents released along with the landfill gas. LFG samples were collected using Tedlar bag media. 10-liter Tedlar bags were placed inside a sampling drum (connected via Teflon tubing with Tygon fittings), and placed under negative pressure generated by a sampling pump. An evacuated sampling drum was required to overcome the vacuum (negative pressure) present within the LFG collection system. For sampling locations that exhibited LFG under positive pressure, the sampling drum was not needed. At certain LFG sampling locations, a different sampling pump was needed for LFG sampling than odor sampling due to the high vacuum (approximately 20-30 inches of water) associated with the landfill collection system.

Similar to the odor samples, the Tedlar bags were conditioned three (3) times prior to taking the sample by filling the bag with landfill gas and then slowly evacuating the bag. The sampling pump was set to a sampling rate of approximately 1-liter per minute (L/m) for 10 minutes, completely filling the 10-liter bag. After sample collection, the bags were sealed, labeled and stored in black bags kept out of direct sunlight prior to shipment to Air Toxics for analysis. The samples were analyzed for VOCs (via EPA Test Method Modified TO-15/TICs) and sulfur compounds (via Modified Test Method ASTM D-5504). The samples were also analyzed for compounds commonly associated with natural gas/landfill gas (via Modified Test Method ASTM D-1945) and fixed gases (oxygen, nitrogen and carbon dioxide) via Modified Test Method ASTM D-1945. These data were used for project support purposes and the results are not discussed in this report. All laboratory results are provided in Appendix C.

3.4 Meteorology Data Collection

On-site meteorological data was collected by RTP during each ambient odor and air quality monitoring event. Meteorological data provides information on ambient weather conditions occurring during the tests. The meteorological parameters of interest in this program include wind speed, wind direction, temperature, relative humidity (RH), turbulence, barometric pressure and precipitation. The meteorological equipment used included a 10-foot meteorological tower, a solid-state barometric pressure sensor, precipitation gauge, three-cup anemometer, counterbalanced wind vane coupled to a precision, low-torque potentiometer, temperature sensor and a fully programmable CR10 data logger and control module. The pressure sensor and the CR10 data logger/controller are enclosed inside a portable instrument case. The remainder of the equipment is mounted on the meteorological tower. All meteorological equipment is manufactured by Climatronics Corporation and was calibrated prior to use in this study.

During the fourth monitoring event, the wind, temperature, RH and pressure sensors as described above were replaced with a Climatronics All-in-One (A10) compact weather unit. This unit includes a sonic anemometer and Sonimometer™ for wind speed and direction measurements, a multi-element temperature sensor, capacitive relative humidity sensor, barometric pressure sensor and an internal flux-gate compass. All data was recorded using a Campbell Scientific CR850 datalogger rather than the CR-10 datalogger used in the earlier tests.

4.0 SAMPLING AND LOCATION SELECTION

An extensive monitoring network was established in an attempt to determine odor and air quality impacts from individual sources, as well as the landfill complex, as a whole. The structure of monitoring network was dependent on onsite meteorology and RRSWMF operations, which varied over the four-test monitoring program. Sample placement and sample quantities were estimated prior to the day of testing. This section details the sampling configuration and a basic chronology of each sampling event. Sample methodology has already been described in Section 3.0.

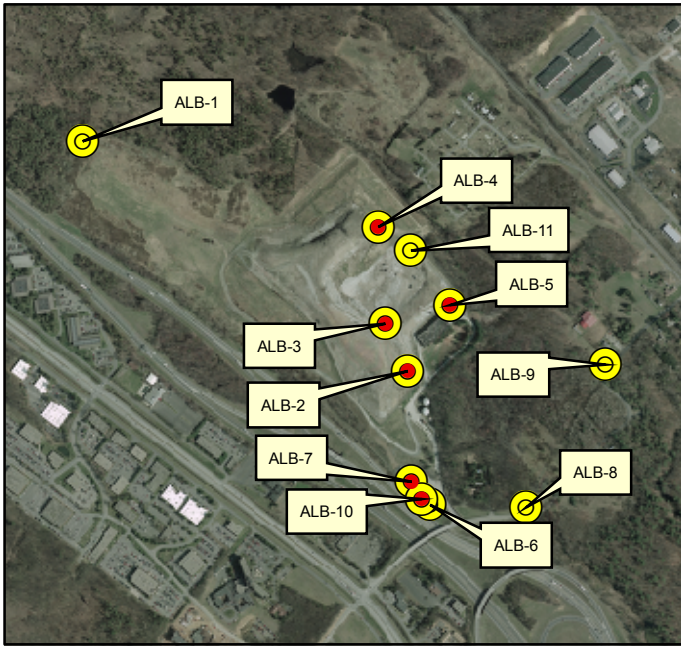
Four (4) odor and air quality sampling events were conducted on a calendar quarterly basis over the course of a year. The first test was conducted on May 3, 2007, the second on August 1 & 2 2007, the third on November 5, 2007 and the fourth and final test was conducted on January 31, 2008. The purpose of testing on a quarterly schedule was to identify and evaluate the existence of any seasonal variations. All monitoring events were scheduled when odor and air quality impacts from RRSWMF were expected to be maximized based on meteorology, which included a persistent wind direction with light to moderate wind speeds and falling atmospheric pressure over the course of the test. In addition, staggering tests over an annual period allowed for testing during different stages of typical landfill operations. Landfill operations included, routine maintenance of landfill (LFG) capture and control equipment, the combustion of LFG in internal combustion engines and in a flare, installation of LFG collection wells, management of leachate collection and storage, waste placement and movement, capping and closure of landfill sections, etc. Testing was also performed during different times of the day including during normal business hours and when the landfill complex was closed.

The first, second and the fourth tests were conducted when the landfill was open for business (approximately 6:00 AM to 5:00 PM), while the third test was conducted during the evening and overnight hours.

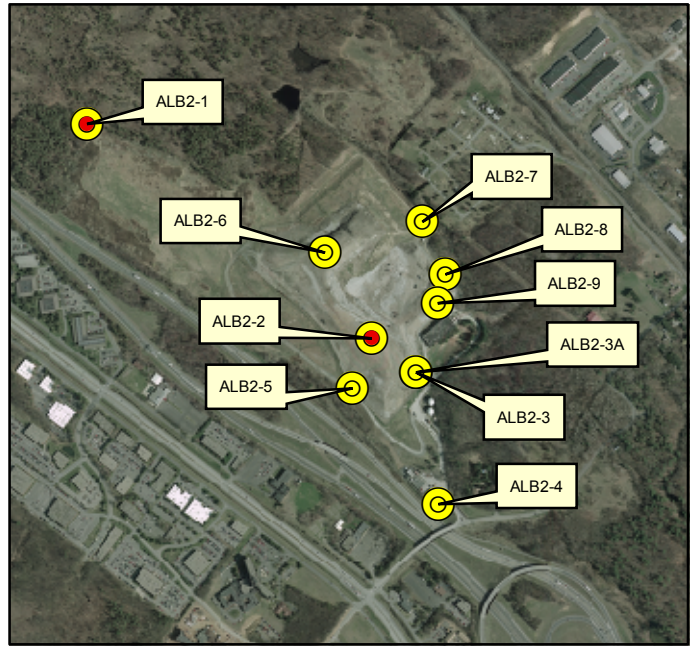
4.1 Odor Sampling

A total of 11, 9, 9 and 10 odor sampling locations were chosen for Tests 1, 2, 3 and 4, respectively, to assist in defining odor impacts in the vicinity of the landfill. The odor sample network for each test included several locations on the active portion of the landfill, and several downwind locations, scattered both on and off of landfill property. In addition, an upwind location was chosen to establish a general background value (potential odors not associated with the landfill). Sample locations were chosen based on forecast meteorology and location of potential odor sources (mainly the landfill itself). Sampling details for the four odor tests including identification and location descriptions, sample start and stop times and sampling location photographs are provided in Appendix B. Figure 4.1 provides an odor sampling location map for each of the four tests.

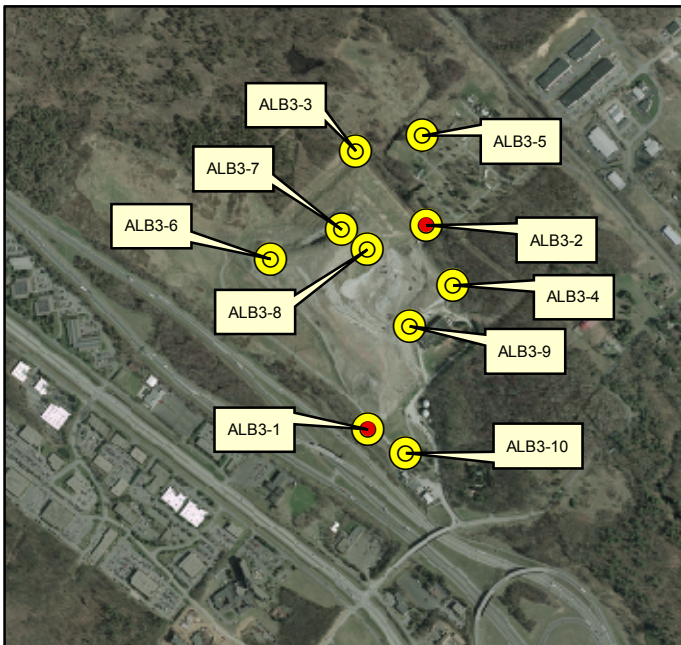
1st Test



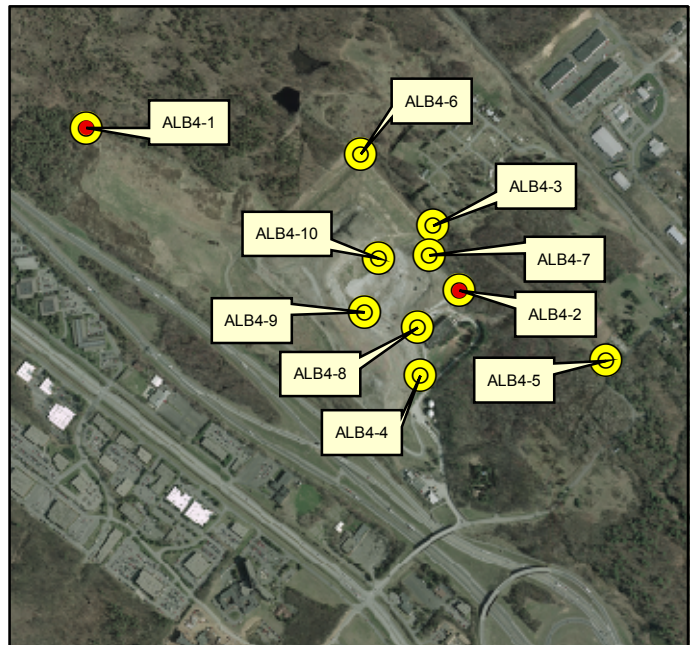
2nd Test



3rd Test



4th Test



IMAGERY SOURCE: NYSGIS CLEARINGHOUSE

Legend

-  Odor Sample Location
-  Analyzed for VOC & Sulfur Compounds

FIGURE 4.1

ODOR SAMPLING
LOCATION MAP

ALBANY LANDFILL

ALBANY, NEW YORK

0 750 1,500 3,000 Feet



RTP Environmental Associates, Inc.
400 Post Avenue
Westbury, NY 11590
P:(516) 333-4526 F:(516) 333-4571

Odor sampling was conducted over an approximate 3-4 hour time period while the 8-hour air quality samplers were running, preferably when wind speeds were forecast to be the lightest. Prior to initiating each sample, ambient hydrogen sulfide (H₂S) concentrations were monitored and recorded by using a Jerome 631-X hydrogen sulfide hand-held analyzer. In addition, a photoionization detector (PID) was used to record ambient VOC concentrations at each sampling location. Field data sheets documenting sampling parameters are provided in Appendix A. The Jerome 631-X and PID results are discussed in Section 5.0.

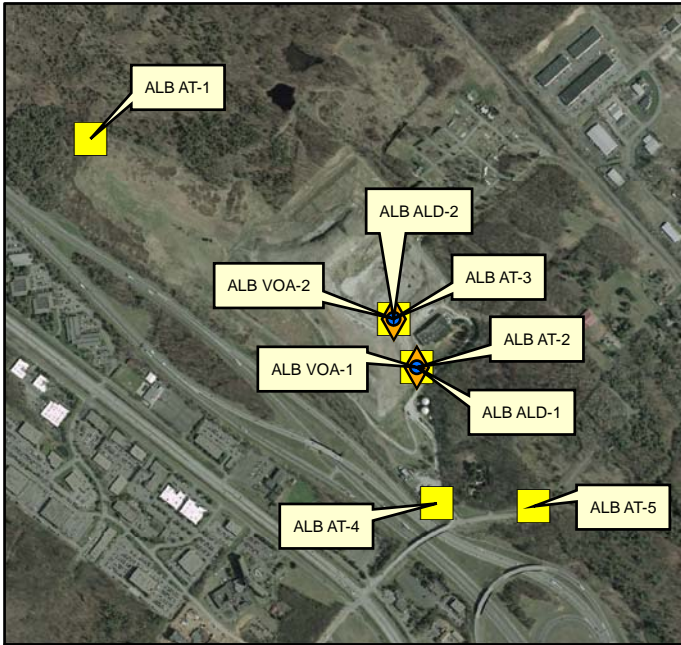
4.2 Air Quality Sampling

4.2.1 SUMMA Canister Sampling

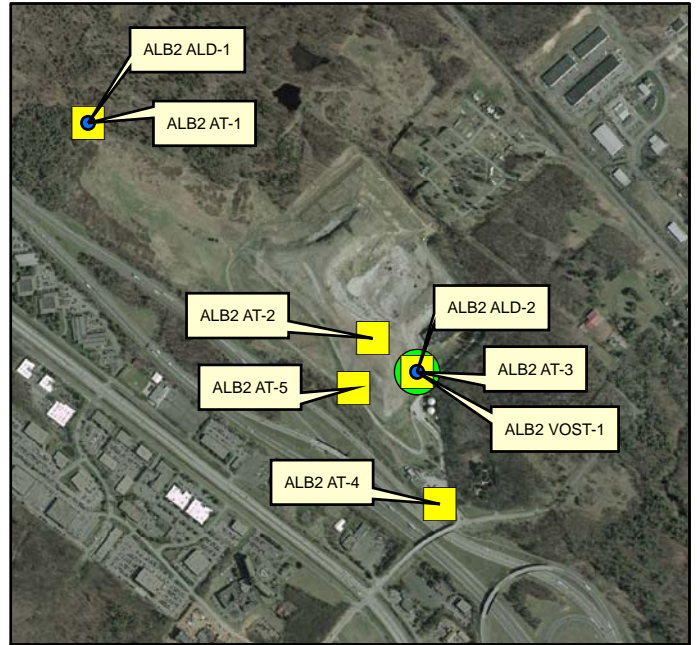
For each of the four tests, SUMMA canisters were deployed in five (5) locations and set to run continuously for approximately eight (8) hours. The SUMMA canisters collected air quality data averaged over the course of a standard 8-hour work day at the RRSWMF (except for the third test, which sampling was performed over an 8-hour period beginning in the late afternoon and ending after midnight). Canister sampling locations were chosen in an attempt to determine air quality impacts from the active landfilling area and all site activities and sources combined downwind of the landfill. Locations included sites on the active landfilling section, downwind of the landfill, beyond the property boundary downwind of the site and upwind of the site. SUMMA canister sample locations for each test are provided in Figure 4.2.

The upwind canister was normally deployed first, followed by the downwind canisters, nearest to landfill first and offsite last. During Tests 1 and 2, a canister was placed on the active landfilling face, but not during Tests 3 and 4. Results during Test 1 and 2 indicated that impacts were maximized downwind and adjacent to the landfill rather than on the active working face. Prior to initiating each sample and when the sample run was completed, ambient VOC concentrations were recorded using a PID. Details including sample identification, sampling times, location descriptions and sample location photographs are provided in Appendix B. Sampling field data sheets are provided in Appendix A.

1st Test



2nd Test



3rd Test



4th Test

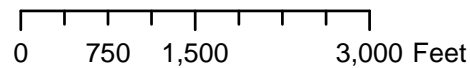


IMAGERY SOURCE: NYSGIS CLEARINGHOUSE

Legend

<ul style="list-style-type: none"> ● Aldehyde & Ketone Sample Location ◆ VOA Sample Location 	<ul style="list-style-type: none"> Summa Sample Location VOST Sample Location
--	--

FIGURE 4.2
ODOR SAMPLING
LOCATION MAP
ALBANY LANDFILL
ALBANY, NEW YORK



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4.2.2 VOST Sampling

The decision to introduce VOST sampling into the RRSWMF ambient odor and air quality testing program was based on the VOC SUMMA canister and VOC Tedlar bag results. Due to analytical MDL restrictions and low level VOC concentrations from Test 1, VOST sampling was introduced as another means of VOC sampling while achieving much lower MDLs for most compounds (over an order of magnitude, in some cases, lower than both SUMMA canister and Tedlar bag samples). In addition, in order to compare the VOC monitoring results from the RRSWMF samples with VOC monitoring data from the NYSDEC VOC monitoring program, a VOC analysis with much lower MDLs was necessary. NYSDEC VOC sampling program includes sampling methodology and analytical protocols, which unfortunately, are not available to the public. Currently, no laboratory provides analytical services similar to the methods utilized by NYSDEC. As such, VOST sampling was conducted to meet necessary MDLs for State-wide VOC comparison. VOST sampling was introduced during Test 2 where one sample was collected at a location downwind adjacent to the landfill. During Tests 3 and 4, two (2) VOST samples were collected; one upwind and one downwind of the landfill to better understand upwind concentration values. VOST samples were collocated at one or two of the SUMMA canister locations and ran for the same 8-hour sampling period.

Details including sample identification, sampling times, location descriptions and sample location photographs are provided in Appendix B. Sampling field data sheets are provided in Appendix A. Sampling locations for each test are also provided in Figure 4.2.

4.2.3 TO-11 Sampling

Two (2) TO-11 samples were collected during each of the four testing events, one at an upwind location and another at a downwind location. TO-11 samples were specific to aldehyde and ketones. The two (2) samples were collocated with the SUMMA canister and VOST samples. Samples were collected over an 8-hour period similar to the canisters and VOST samples. Details including sample identification, sampling times, location descriptions and sample

location photographs are provided in Appendix B. Sampling field data sheets are provided in Appendix A. Sampling locations for each test are also provided in Figure 4.2

4.2.4 VOA Sampling

VOA samples were collected since VOAs can be very odorous in even low concentrations. VOA Sampling was conducted during Test 1 only. VOA concentrations were below the analytical minimum detection limits established by the analytical method, and therefore, VOA sampling was discontinued. Again, two (2) samples were collected at one upwind location and one downwind location at the same sampling locations as the SUMMA canisters, VOST and TO-11 samples. Details from the first test including sample identification, sampling times, location descriptions and sample location photographs are provided in Appendix B. Sampling field data sheets are provided in Appendix A. In addition, sampling locations from the first test are provided in Figure 4.2.

4.2.5 Tedlar Bag Sampling

A small portion of the odor sample was transferred into a clean pre-conditioned 1-liter Tedlar bag from several of the odor samples. The samples were analyzed for VOCs and sulfur compounds. During the first test a total of six (6) odor samples were analyzed for VOCs and sulfur compounds (5 ambient samples and one sewer headspace sample). Based on the results from the first test, two (2) odor samples were analyzed for VOCs and sulfur compounds from each of the three following tests. The samples were collected at the same upwind and downwind locations as the SUMMA canister, VOST and TO-11 samples. The Tedlar bag sample identification coincides with the odor sample identification, and as such, sample locations are provided in Figure 4.1.

4.3 LFG Sampling

LFG sampling was performed to assist with defining the characteristics of the odor and air quality associated with the RRSWMF. Odor and air quality impacts in the vicinity of landfills are typically related to the LFG generated by waste decomposition. Compounds detected in the LFG are typically similar to compounds detected in the ambient air in the vicinity of a landfill. During Test 1, LFG sampling was conducted at four (4) locations to define the gas characteristics from different sections of the LFG collection and control system. Based on the fairly uniform results from Test 1, only one (1) LFG sample was collected during test number 2, 3 and 4. The one LFG sample was collected from a sample port just prior to LFG combustion in the main flare. This sampling location represents the composite LFG quality collected from the landfill.

4.4 Meteorology

A meteorological station was positioned atop the northwest corner of the landfill and during each sampling event. This location provided acceptable exposures for monitoring ambient and site conditions. Each sampling event was scheduled when winds were forecast from the same direction for an 8-12 hour period at light to moderate speeds, coupled with falling or steady atmospheric pressure and no precipitation. These conditions are expected to maximize landfill generate odors and air emissions. General weather conditions during the four test events are described in Table 4.1. The observed meteorology data is provided in Appendix D.

For the majority of the meteorological parameters during the four-test monitoring program, forecast conditions translated into actual conditions, except during the second test. During the testing period of the August 1 & 2, 2007 test, an unexpected wind shift caused some of the downwind samples to not be under the influence of the landfill for the entire sampling period. The maximum time any sample was not downwind of the landfill was for approximately 64% of the sampling period. In addition, actual wind speeds were less than forecast. The specific samplers influenced by the wind shift are identified in Section 5.0 and summarized in Section 6.0.

Table 4.1 – General Weather Conditions During Testing

Test No.	General Weather Conditions
Test 1	North northwest to northwest winds at light to moderate speeds with steady to slightly falling atmospheric pressure. Temperature range between 43° F and 65° F. Low relative humidity.
Test 2	Northwest winds for the beginning of the test shifting to the west for a few hours and finally shifting to the south for the final few hours of the test. Wind speeds were light. Atmospheric pressure slowly dropped, but then slightly rose during the testing period. Temperature range between 73° F and 83° F. Medium to high relative humidity levels.
Test 3	Winds generally from the south and southeast. Wind speeds were light at the beginning of the test, but then increased in speed over the course of the sampling period. Atmospheric pressure rose slightly during the first few hours of the test, but then began to fall for the remaining testing period. Temperature range between 39° F and 53° F. Medium relative humidity levels.
Test 4	Northwest winds at moderate speeds with slightly rising to steady atmospheric pressure. Temperature range between 20° F and 28° F. Medium relative humidity.

5.0 SUMMARY OF RESULTS

A summary of the sampling results from the four tests is presented below along with a comparison to applicable ambient air standard. In addition, comparisons between each test have been provided to determine various trends in the data over the course of the monitoring program.

5.1 Odor Sample Results

The odor samples were forwarded to OS&E and were subjected to a professional odor panel. Odor concentration is determined by the number of volumes of odor-free air required to dilute one volume of odorous air to the median detection threshold. The resulting value is a dimensionless ratio of the number of dilutions, abbreviated as D/T.

Odor intensity, which is the perceived strength of the odor sensation, is measured by each member of the odor panel for each dilution at which they can detect an odor by comparison to standardized concentrations of a reference odorant. The reference odorant used in this case is n-butyl alcohol (n-butanol). There are eight (8) concentrations ranging from approximately 15 ppm at level 1, with the concentration doubling at each successive level. This method is that

described in ASTM Method E544, *Standard Recommended Practice for Referencing Suprathreshold Odor Intensity*.

In addition, for each dilution at which a panelist is able to detect an odor, he or she describes the odor character. The description is given either in general terms (e.g. “sweet”, “rancid”), or in terms of common materials (e.g. gasoline, paint, plastic, etc.).

The results from the odor panel for the four sampling events are presented in Tables 5.1 through 5.4. Included are the values of the constants in the Steven’s Law relation for each sample. Steven’s Law is a psychophysical function which states that the magnitude of a sensation is proportional to the magnitude of the stimulus raised to a power. For odor this becomes:

where: $I = aC^b$

I = odor intensity on the butanol scale

C = the odor level in dilution-to-threshold ratio (D/T)

a,b = constants specific for each odor.

The odor panel results were then combined with local meteorological data and plant operations to describe the general impacts being experienced by the community.

In general the odor results show that odor concentrations decreased as distance increased from the active landfilling area. This pattern was consistent throughout the testing program. The results also show that samples collected near or beyond the downwind property boundary were similar to the background (upwind) sample results meaning that a very minimal, if any, odor concentration was detected downwind of the landfill property during the time of testing. It appears that the general background odor concentration during the four tests ranged from 6 to 12 D/T. Any sample results that show a D/T greater than this background range can potentially be associated with the RRSWMF. D/T values are established based on any type of odor, not necessarily bad odors. Therefore, it is important to look at the Odor Characters (as provided by the laboratory) for a specific sample to determine what may have potentially caused the odor for that specific sampling location. For example, the upwind sample during Test 2 (August 2007) showed an elevated odor concentration. However, this was likely caused by overgrown

Table 5.1 – Test No. 1 (May 3, 2007) Odor Sample Results

Sample			Odor Conc. D/T ¹	Stevens' Law Constants ²		Odor Character ³
Date	ID	Time		a	b	
05/03/07	ALB- 1	17:00	12	--	--	stale, swampy, clean sheets, medicinal, paint, musty, mushrooms, medical tape, oily, burning electrical wires, exhaust
05/03/07	ALB-2	17:00	19	--	--	sour, plastic, vegetation, paint, exhaust, wood alcohol, medical tape, bleach, Cl ₂ , garbage, ivory soap
05/03/07	ALB-3	17:00	18	--	--	sour, plastic, vegetation, paint, iodine, exhaust, medical tape, bleach, hot electrical wires
05/03/07	ALB-4	17:00	29	.53	.69	stove gas, natural gas, plastic, vegetation, paint, alcohol, ivory soap, Cl ₂ , Clorox cleaner, hot electrical wires, exhaust
05/03/07	ALB-5	17:00	27	.46	.95	sour, rotten, vegetation, rotten garbage, boiled eggs, Cl ₂ , feces, sewage, paint, dead animal, exhaust
05/03/07	ALB-6 ⁵	17:00	12	--	--	sour, musty, stale, plastic, vegetation, paint, exhaust
05/03/07	ALB-7 ⁵	17:00	11	--	--	sour, stale, exhaust, paint, plastic, medical tape, iodine, earthy, dirt
05/03/07	ALB-8 ⁵	17:00	11	--	--	sour, plastic, musty, vegetation, paint, exhaust, medical tape,
05/03/07	ALB-9 ⁵	17:00	10	--	--	sour, stale, exhaust, paint, plastic, medical tape, iodine, earthy, dirt
05/03/07	ALB-10 ⁴	17:00	12,299	.69	.91	sour, natural gas, stove gas, sewer gas, sewage, rotten eggs, garbage, feces, incinerated garbage, outhouse, sour milk,
05/03/07	ALB-11	17:00	53	.33	.80	sour, sewage, sewer, rotten eggs, H ₂ S, , landfill gas, natural gas

Notes:

¹ D/T = dilutions-to-threshold.

² Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.

³ Summary of all odor character descriptors used by the odor panelists at varying dilution levels.

⁴ Sample represents vapor space from sewer outfall and not ambient air.

⁵ Samples exceeded 30 hour hold time.

-- Odor level too low to develop dose response data.

Table 5.2 – Test No. 2 (August 1 &2, 2007) Odor Sample Results

Sample			Odor Conc. D/T ¹	Stevens' Law Constants ²		Odor Character ³
Date	ID	Time		a	b	
8/01/07	ALB2-1	20:43	23	.55	.90	sour vegetation, cut grass, fruity, lemon, pine, soap, detergent, paint, burning rubber, sewage
8/01/07	ALB2-2	21:04	16	--	--	sweet, sour, paint, plastic, wet newspaper ink, soap, exhaust, burning rubber, smoke, sewage, dirty socks
8/01/07	ALB2-3	18:06	11	--	--	sour, wet newspapers, grass clippings, sour vegetation, methane, paint, exhaust, burning rubber, smoke, sewage
8/01/07	ALB2-3A	23:22	11	--	--	sour, vegetation, woody, paint, plastic, exhaust, burning rubber, dirty socks, ivory soap
8/01/07	ALB2-4	23:04	13	--	--	sour vegetation, methane, paint, plastic, exhaust, burning rubber, smoke, sewage, ivory soap
8/01/07	ALB2-5	22:48	10	--	--	sour vegetation, paint, plastic, exhaust, burning rubber, smoke, sewage
8/01/07	ALB2-6	21:23	38	.44	.81	sweet, fruity, sour, rotten, fermented fruit, candy, vinegar, coconut, paint, rotten apples, sewage, landfill gas
8/01/07	ALB2-7	21:50	18	--	--	sour, musty, stale, vegetation, exhaust, paint, plastic, burning rubber, garbage fumes, sewage
8/01/07	ALB2-8	22:09	11	--	--	musty, stale, exhaust, paint, smoke, garbage dump, iodine, sewage
8/01/07	ALB2-9	22:31	11	--	--	sour, musty, stale, vegetation, paint, exhaust, burning rubber, smoke, sewage, dirty socks, landfill gas

Notes:

¹ D/T = dilutions-to-threshold.

² Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.

³ Summary of all odor character descriptors used by the odor panelists at varying dilution levels.

-- Odor level too low to develop dose response data.

Table 5.3 – Test No. 3 (November 5, 2007) Odor Sample Results

Sample			Odor Conc. D/T ¹	Stevens' Law Constants ²		Odor Character ³
Date	ID	Time		a	b	
11/05/07	ALB3- 1	11:44	10	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, medicinal
11/05/07	ALB3-2	10:56	11	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, spoiled food, medicinal
11/05/07	ALB3-3	10:38	7	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, linoleum
11/05/07	ALB3-4	11:19	7	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, adhesive hospital tape
11/05/07	ALB3-5	14:17	17	.48	.95	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, linoleum, ice milk, ivory soap
11/05/07	ALB3-6	12:12	9	--	--	sour, vegetation, plastic, sewer, exhaust, smoke, burning electrical wire, metallic, medicinal, rotten food,
11/05/07	ALB3-7	12:37	75	.60	.78	sour, sewage, rotten eggs, garbage, varnish, chemical, sour vegetation, wood burning, smoke
11/05/07	ALB3-8	12:54	9	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, medicinal, ivory soap
11/05/07	ALB3-9	15:14	9	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, linoleum
11/05/07	ALB3-10	15:36	9	--	--	sour, vegetation, plastic, exhaust, smoke, burning electrical wire, rotten food, ice milk

Notes:

¹ D/T = dilutions-to-threshold.

² Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.

³ Summary of all odor character descriptors used by the odor panelists at varying dilution levels.

-- Odor level too low to develop dose response data.

Table 5.4 – Test No. 4 (January 31, 2008) Odor Sample Results

Sample			Odor Conc. D/T ¹	Stevens' Law Constants ²		Odor Character ³
Date	ID	Time		a	b	
01/31/08	ALB4- 1	10:23	10	--	--	sour, vegetation, plastic, paint, milk, exhaust, smoke, wet metal, rotten meat, waxy
01/31/08	ALB4-2	10:48	10	--	--	sour, vegetation, plastic, paint, milk, exhaust, smoke, burning electrical wire, spoiled meat
01/31/08	ALB4-3	11:03	8	--	--	sweet, sour, vegetation, plastic, exhaust, smoke, burning electrical wire, spoiled meat, chalky
01/31/08	ALB4-4	11:19	6	--	--	sweet, sour, vegetation, plastic, paint, exhaust, molten metal, smoke, rotten food
01/31/08	ALB4-5	10:03	10	--	--	sour, vegetation, paint, milk, exhaust, smoke, metallic, metal, burning electrical wire, spoiled meat
01/31/08	ALB4-6 ⁴	11:39	12	--	--	sour, vegetation, paint, milk, exhaust, smoke, wet sheets, rotten food
01/31/08	ALB4-7	11:57	10	--	--	sour, vegetation, paint, exhaust, smoke, burning electrical wire, wet clothes, rotten meat
01/31/08	ALB4-8	12:54	8	--	--	sour, vegetation, plastic, paint, exhaust, smoke, burning electrical wire, rotten food
01/31/08	ALB4-9	15:14	12	--	--	sour, vegetation, plastic, paint, exhaust, smoke, burning electrical wire, metallic, rotten meat
01/31/08	ALB4-10	15:29	17	.46	.99	sour, rotten vegetation, sewage, garbage, rotten meat, paint, milk, burnt hair, burning rubber, exhaust, smoke

¹ D/T = dilutions-to-threshold

² Stevens' Law correlates odor concentration (C) and odor intensity (I): $I = aC^b$. The constants a and b were determined by regression analysis based on the intensity ratings of the odor panel at varying dilution levels. I = 0-8 (based on the n-butanol intensity scale), C = odor concentration (D/T) typical of ambient odor levels.

³ Summary of all odor character descriptors used by the odor panelists at varying dilution levels.

⁴ Low sample volume

vegetation, which was emitting strong vegetation type odors during the time of sampling. This odor sample was characterized as “cut grass”, “lemon”, “fruity” and “pine”. These characterizations are not normally used to describe landfill and garbage type odors and were not used to describe any of the other samples from the August test.

During the first test, an odor sample was collected from the leachate manhole cover located behind the Landfill Manager’s office. This sample produced a very high odor concentration. At the time of sampling, the release rate of this odor source was very low, and therefore, should not cause a significant odor impact on the surrounding community. However, if there are additional pathways for leachate vapors to escape from the underground leachate line before or after the line connects with the city sewer system, the underground leachate/sewer line could be a significant source of significant odor as shown by the odor panel results.

An overall downward trend can be seen from the odor sampling results from the first test to the fourth. Odor concentrations were maximized during Test 1 and the lowest during Tests 3 and 4. The decrease in odors over the course of the testing program is likely attributed to a temporary synthetic landfill cap that was installed during late summer 2007, as well as, other operational and management corrective actions taken by the City of Albany and its consultants. As mentioned earlier, testing was performed over a large spectrum of meteorology conditions, which can greatly influence odor potential from the RRSWMF. Testing occurred during very mild and cold temperatures, varying wind speeds from different directions and during different atmospheric pressure. In addition, testing was performed during the day and at night. No conclusive meteorological or diurnal trends in odor concentrations were identified from the testing program.

Since H₂S can be a primary source of odor at landfilling facilities, H₂S was recorded using a hand-held Jerome 631-X analyzer prior to the collection of each odor sample. Recorded H₂S concentrations are provided in Table 5.5. As shown, the H₂S concentration in most samples was below 1 ppb, the detection limit of the analyzer.

Table 5.5 - Hydrogen Sulfide (H₂S) Concentrations Measured at Each Odor/Air Quality Sampling Location

Test 1		Test 2		Test 3		Test 4	
Sample Location	H ₂ S (ppb)	Sample Location	H ₂ S (ppb)	Sample Location	H ₂ S (ppb)	Sample Location	H ₂ S (ppb)
ALB-01	< 1	ALB2-1	< 1	ALB3-1	1	ALB4-1	< 1
ALB-02	< 1	ALB2-2	< 1	ALB3-2	< 1	ALB4-2	4
ALB-03	6	ALB2-3	< 1	ALB3-3	1	ALB4-3	4
ALB-04	< 1	ALB2-4	< 1	ALB3-4	< 1	ALB4-4	1
ALB-05	4	ALB2-5	< 1	ALB3-5	< 1	ALB4-5	1
ALB-06	4	ALB2-6	< 1	ALB3-6	1	ALB4-6	2
ALB-07	8	ALB2-7	< 1	ALB3-7	16	ALB4-7	5
ALB-08	< 1	ALB2-8	8	ALB3-8	3	ALB4-8	< 1
ALB-09	< 1	ALB2-9	< 1	ALB3-9	3	ALB4-9	8
ALB-10	< 1	ALB2-10	--	ALB3-10	3	ALB4-10	10
ALB-11	5	ALB2-11	--	--	--	--	--

Notes:

- H₂S measured using a hand-held Jerome 631-X analyzer with a MDL of 1 ppb.
- See Figure 4.1 and Appendix B for sample location information.
- ppb - parts per billion.

5.1.1 Odor Complaint Log Summary

An odor complaint log was established and kept continuously over the entire period of the sampling program. According to Clough Harbour Associates (CHA), the complaint hotline logged 105 calls, 26 calls in April 2007, were determined to require a site visit and 11 of the complaints were confirmed to be the result of the RRSWMF. An assessment of the confirmed complaints indicated a majority of the odors could be attributed to general landfill site conditions. In an effort to reduce potential odors, in May 2007 an interim cover system was constructed over 17 acres of the west, north and east slopes of the active landfill area. The cover system consisted of a series of shallow gas collection trenches and an 8 mil geomembrane liner ballasted with tires. The interim cover was completed on May 20, 2007. In June 2007, the number of logged complaints were reduced to seven (7). The following month (July 2007) the number of complaint calls logged increased to 17, however, this increase was directly related to the installation of 19 vertical gas collection wells required to improve the LFG collection system. All but two (2) of the 17 complaints were confirmed to be associated with the well installation activities. Based on the complaint calls received, installation techniques were subsequently modified to reduce off-site odor impacts. Upon completion of the installation of the vertical gas collection wells, the number of complaints logged again decreased to seven (7) in the month of August, however only three (3) complaints were verified to be attributed to landfill activities, again, well installation. In September 2007, about five acres of the interim cover system was removed from the west slope and the final cap was constructed over this area. Since August 2007, an average of about seven (7) complaints had been logged each month, however very few of the complaints were confirmed as landfill association.

Since placement of the interim cap, installation of the vertical gas collection wells and the final cap, the number of complaint calls has been significantly reduced and in general the source of each complaint call can be identified and attributed to a specific site condition or activity. Once identified, these site conditions or activities were corrected and the odor source was mitigated.

5.2 Air Quality Sample Results

The air concentrations are presented in micrograms per cubic meters ($\mu\text{g}/\text{m}^3$) and cannot be directly compared to New York State Department of Environmental Conservation (NYSDEC) DAR-1 ambient air short- (1-hour) and long-term (annual) Air Guideline Concentrations (SGCs and AGCs, respectively). In order to provide direct comparisons, continuous hourly monitoring data over arguably a 3-year period would be required. That type of program was well beyond the scope of the efforts presented in this case. Although results from the RRSWMF monitoring program are compared to NYSDEC short- and long-term guidelines, this is not an appropriate comparison since the results are for various time frames from a few minutes up to 8-hours. The results during each of the four tests provide air quality data during four testing periods only, and therefore, the average of all data does not represent true annual average concentrations. As such, the following provides relative comparisons of the observation with available applicable regulatory limits and provides a quick check on whether ambient conditions are significantly below guideline values during the time of testing or otherwise. As mentioned earlier, testing was also scheduled when air quality impacts were expected to represent worst-case situations.

5.2.1 Volatile Organic Compound (VOC) Results

VOC results from the SUMMA canister samples, VOST samples and Tedlar bag samples are summarized in this section. The purpose of sampling VOCs using varying sampling methodology and sampling media was based on analytical MDL restrictions, different analytical methods producing different compound lists and for quality assurance purposes. A comparison of VOC results between the different sampling techniques is also provided in this section below.

5.2.1.1 SUMMA Canister Sample Results

As shown in Table 5.6, a number of compounds were detected in the SUMMA canister ambient air samples. Samples located near the downwind edge of the landfill showed the highest VOC concentrations, where as the concentration at or beyond the RRSWMF property boundary were minimal. The data shows that the most compounds and the highest concentrations occurred

Table 5.6 - SUMMA Canister VOC Results ($\mu\text{g}/\text{m}^3$)

Compound	AT-1	AT-2	AT-3	AT-4 ³	AT-5 ³	NYSDEC SGC	NYSDEC AGC
TEST 1							
Ethanol		15.0	18.0		8.0	---	45,000
Acetone	13.0	35.0	7.9	12.0	15.0	180,000	28,000
2-Propanol					8.4	98,000	7,000
2-Butanone (Methyl Ethyl Ketone)		6.1				59,000	5,000
Toluene			5.1		6.0	370,000	400
m,p-Xylene		3.8				4,300	100

TEST 2							
Ethanol		8.3				---	45,000
Acetone	39.0	31.0	13.0	16.0	18.0	180,000	28,000
Carbon Disulfide		4.0				6,200	700
Methylene Chloride	3.3					14,000	2.1
Hexane		5.1				---	200
2-Butanone (Methyl Ethyl Ketone)	3.4	6.0			3.2	59,000	5,000
m,p-Xylene		3.8				4,300	100
TIC's							
Ethylene oxide (DOT)	20.9					18	0.019

TEST 3							
Acetone	28.0	14.0		12.0		180,000	28,000
2-Butanone (Methyl Ethyl Ketone)	12.5	3.1		3.3		59,000	5,000
m,p-Xylene		3.8				4,300	100
TIC's							
1-Propene, 2-methyl-	9.6					---	---
Unknown ²	5.7					---	---

TEST 4							
Freon 12		4.1				---	12,000
Ethanol		15.0				---	45,000
Acetone			10.5			180,000	28,000
Toluene		3.0				370,000	400
m,p-Xylene		3.8				4,300	100
TIC's							
Propane, 2-methyl-		11.7				---	57,000

Compound	Average Upwind	Average Downwind	NYSDEC SGC	NYSDEC AGC
Ethanol		15.0	---	45,000
Acetone	28.0	14.0	180,000	28,000
2-Butanone (Methyl Ethyl Ketone)		3.1	59,000	5,000
m,p-Xylene		3.8	4,300	100
TIC's				
1-Propene, 2-methyl-	9.6		---	---
Unknown ²	5.7		---	---
Propane, 2-methyl-		11.7	---	57,000

Notes:

¹ A laboratory duplicate was analyzed for. For compounds that were detected in both samples, the average value is presented in the table.

For compounds that were only detected in one of the two samples, the actual value is provided in the table.

² Concentrations are provided in part per billion (ppb) rather than micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) since no molecular weight can be determined.

³ These downwind samplers were not under the influence of the landfill for approximately 64% of the sampling period due to an unexpected shift in wind direction.

- TIC - Tentatively Identified Compound

- Shaded concentration is above the level of the NYSDEC Guideline Concentration value, however does not signify an exceedance of the guideline value.

- Blank values indicate levels below analytical minimum detection limits. Minimum detection limits can be found in Appendix .

- Average only provided for compounds that were detected during at least three of the four tests.

- Sample locations provided in Figure 4.2.

during Test 2 (August 2007) and the lowest concentrations were recorded during Test 3 (November 2007). The reason for high concentrations detected during Test 2 is likely attributed to meteorology conditions including high temperatures and light wind speeds. It appears these conditions produced worst-case ambient VOC concentration as expected. The wind direction was more variable during this test although the upwind sample was not under the landfill's influence.

Compounds from the TO-15 target list that were consistently detected throughout the four tests in at least one of the downwind samples included acetone and xylene (m,p). In addition, ethanol and 2-butanone (MEK) were detected during three of the four tests. The rest of the detected compounds including any detected tentatively identified compounds (TICs) appear more random. Similar to the odor results, the concentrations from the SUMMA canister samples show higher concentrations of VOCs during Tests 1 and 2, as compared to Tests 3 and 4.

The data also shows high concentrations of certain compounds detected in the upwind samples of Tests 2 and 3. In fact, two (2) compounds; methylene chloride and ethylene oxide (DOT) concentrations during Test 2 exceed the level of their respective NYSDEC long-term (annual) standards (AGCs). Since the upwind samples were not under the influence of the RRSWMF at any time during the testing periods, the RRSWMF is not likely causing the high upwind concentrations. These concentrations are likely caused by an emission source(s) located upwind of the sampler. In addition, compounds such as acetone and MEK that were detected in the upwind samples and in certain downwind samples were also likely cause by upwind source(s).

Since Tests 2 and 3 were performed under different wind directions, the cause of the upwind VOC concentrations are likely associated with several different emission sources located on the south and west side of the New York State Thruway.

Average upwind and downwind concentrations from the four tests are also provided in Table 5.6. Averages were only calculated for compounds that were detected during at least three of the four tests. Laboratory results from the SUMMA canister samples, including analysis methods, time of analysis and minimum detection information is provided in Appendix C.

Ambient VOC concentrations were also recorded using a hand-held PID prior and following the each 8-hour testing period at the five (5) SUMMA canister sampling locations (which include all air quality sampling locations). All measured values were below 0.1 parts per million (ppm), except during Test 2, when concentrations ranged from 0.1 to 1.3 ppm. PID monitoring data is provided on the Field Data Sheets located in Appendix A.

5.2.1.2 VOST Sample Results

The VOC results from the VOST samples indicated several additional constituents in the ambient air when compared to the SUMMA canister sample results. This is primarily because of two reasons: (1) the VOST analytical method contains almost double the amount of compounds in its library as compared to the library of compounds for the canister analytical method (73 compounds as compared to 38 compounds, not including TICs); and (2) the MDL for the VOST analytical method for most compounds is two orders of magnitude lower (100 times more sensitive) than the canister analytical method. Therefore, additional compounds were detected in the VOST samples that could not have been detected in the canister samples strictly due to analytical restrictions. An upwind and downwind VOST sample were collected during Tests 3 and 4, however only a downwind sample was collected during Test 2. Laboratory results from the VOST samples, including analysis methods, time of analysis and minimum detection information is provided in Appendix C.

As shown in Table 5.7, the VOC concentrations from Test 2 are the highest as compared to the results from Tests 3 and 4, which show very similar results to one another. This trend is similar with the SUMMA canister results as explained above. Again, no VOST samples were collected during the first test, so no comparison can be provided. The data from Tests 3 and 4 shows that almost every compound that was detected in the downwind sample was also detected in the upwind sample, meaning the detected concentrations are not only associated with the RRSWMF. Exceptions to these compounds are acetone, methylene chloride, 1,1,1-trichloroethane, 1,2-dichloroethane, propylbenzene, 1,3,5-trimethylbenzene, and several TICs during Test 4 only. For the compounds detected in only the downwind sample during the fourth test, only 1,4-

Table 5.7 - VOST VOC Results ($\mu\text{g}/\text{m}^3$)

Compounds	Test 2	Test 3		Test 4		NYSDEC SGC	NYSDEC AGC
	ALB2:VOST1 Downwind	ALB3:VOST1 Upwind	ALB3:VOST2 Downwind	ALB4:VOST1 Upwind	ALB4:VOST2 Downwind		
Chloromethane	0.1	0.1	0.1	0.1	0.2	22,000	90
Freon 11	1.5	0.8	0.8	0.5	0.6	68,000	1,000
Freon 113	0.4	0.1	0.3	0.1	0.1	960,000	180,000
Acetone	2.4	0.2	0.6		0.5	180,000	28,000
Methylene Chloride	1.2	0.1	0.1		0.2	14,000	2.1
Hexane	1.9	0.3	0.3	0.2	0.6	---	700
2-Butanone (Methyl Ethyl Ketone)	4.4	0.2	0.3		1.7	68,000	5,000
Chloroform	0.40	0.039	0.050	0.045	0.051	150	0.043
1,1,1-Trichloroethane	0.2				0.5	68,000	1,000
Carbon Tetrachloride	1.0	0.4	0.5	0.4	0.3	1,900	0.067
Benzene	1.3	0.7	0.7	0.5	0.5	1,300	0.13
1,2-Dichloroethane				0.040	0.040	---	0.038
Toluene	7.2 E	1.1	1.0	0.5	2.4	37,000	5,000
Tetrachloroethene	0.3	0.2	0.1	0.1	0.5	1,000	1.0
Ethyl Benzene	1.0	0.2	0.1	0.1	0.3	54,000	1,000
m,p-Xylene	3.0	0.6	0.5	0.2	0.9	4,300	100
o-Xylene	1.2	0.2	0.1	0.1	0.3	4,300	100
1,4-Dichlorobenzene	0.20				0.10	---	0.09
Cumene	0.2					---	400
Propylbenzene	0.3				0.04	54,000	1,000
1,3,5-Trimethylbenzene	0.5				0.1	---	290
1,2,4-Trimethylbenzene	1.6	0.1	0.1	0.04	0.1	---	290
Naphthalene	0.3					79,000	3.0
Freon 12	3.6	1.9	1.8	1.7	4.0	---	12,000
TIC's	ALB2:VOST1 Downwind	ALB3:VOST1 Upwind	ALB3:VOST2 Downwind	ALB4:VOST1 Upwind	ALB4:VOST2 Downwind	NYSDEC SGC	NYSDEC AGC
Propane, 2-methyl-	0.9	0.6	0.7	0.1	2.5	---	57,000
1-Propene, 2-methyl-	0.1					---	---
Unknown	0.8	1.0	0.8	0.1		---	---
Butane, 2-methyl-	2.7	0.5	1.2	0.1	0.6	---	42,000
Pentane	0.8	0.2	0.7	0.1	0.3	---	4,200
1,4-Pentadiene	9.8					---	---
Pentane, 2-methyl-	0.3	0.4	0.4	0.2	0.3	350,000	4,200
Hexane, 3-methyl-	1.3	0.2	0.1	0.1	1.3	---	---
Heptane	1.5	0.2	0.2	0.1	1.1	210,000	3,900
Nonane	1.1					---	25,000
Nonanal		0.2	0.1			---	---
.alpha.Pinene	4.3					---	270
Benzene, 1-ethyl-2-methyl-	2.1	0.2				---	290
Bicyclo[3.1.0]hex-2-ene, 4-methyl-1-(1-m	1.2					---	---
2-[(trimethylsilyl)oxy] benzoic acid			0.4			---	---
2-butyl-1-octanol		0.7				---	---
1-Iodo-2-methylundecane		0.4				---	---
.beta.Pinene	2.7					---	270
Benzene, 1,2,3-trimethyl-	1.3					---	---
Hexane, 2,2-dimethyl-	0.2					---	---
2-methyloctane					0.2	---	---
Propylcyclohexane					0.3	---	---
2,5-dimethyloctane					0.4	---	---
2-methyldecane					0.4	---	---
2-methylhexane					0.8	---	---
Butane		0.6	1.0	0.1	1.0	---	57,000
Methylcyclopentane	0.1					---	700
2H-Imidazo[4,5]pyrazin-2-one			0.3			---	---
2-ethyl-3-methyl-1-butene			0.2			---	---
Ethane, hexachloro-	0.1					---	23.0

Notes:

- TIC - Tentatively Identified Compound
- E - Exceeds instrument calibration range
- Shaded concentration is above the level of the NYSDEC Guideline Concentration value, however does not signify an exceedance of the guideline value.
- Blank values indicate levels below analytical minimum detection limits. Minimum detection limits can be found in Appendix .
- Sample locations provided in Figure 4.2.

dichlorobenzene was in excess of its respective AGC (also in excess during the first test). However, the exceedence is based on two 8-hour average sample, and as such, it is not appropriate to compare the results directly to the AGC standards. Also, the concentration is just above the MDL, which means it could also be present in the upwind sample, but at levels below the MDL. Other compounds that were in excess of AGC values at both upwind and downwind location included chloroform, carbon tetrachloride, benzene and 1,2-dichloroethane. These compounds were not detected in the SUMMA canister samples due to the significantly higher MDL. It is also important to note that the VOC levels detected at all locations during the sampling event are very low, and therefore, it is difficult to identify slight differences in concentrations from test to test and between sample locations.

The RRSWMF VOST VOC results were compared with state-wide VOC ambient air quality levels. The reason for only providing a comparison between the VOST results and NYSDEC VOC monitoring data is due to the fact that VOST analytical protocols allow for similar MDLs for a large list of VOCs. Unfortunately, VOC sampling utilizing similar methodology to the NYSDEC VOC monitoring program cannot be performed due to analytical restrictions. Simply, no laboratory offers similar analytical services to the State's VOC monitoring analytical methodology. The average upwind and average downwind VOST concentrations from Tests 2, 3 and 4 are provided for comparison with four (4) NYSDEC VOC monitoring sites.

The NYSDEC first established an ambient air toxics monitoring program in 1985. The monitoring program expanded to a state-wide network in 1990, which measures VOCs at several locations across the State. Today there are 14 monitoring locations throughout the State measuring over 40 VOCs. The goal of the NYSDEC monitoring program is to monitor air quality related to toxics in urban, industrial, residential and rural areas. Table 5.8 provides annual average air toxic VOC concentrations from 2001 to 2003 at an urban, industrial, suburban/residential and a rural State monitoring site along with the VOC concentrations from the RRSWMF average VOST sample results. More recent data is unfortunately not available.

The nearest monitoring site to the RRSWMF is located in Troy, NY, located approximately nine (9) miles east northeast from the RRSWMF. This site is considered to represent urban site

characteristics by the NYSDEC. There are several land use characteristics immediately surrounding the landfill including industrial, urban, suburban and rural, and therefore, it is difficult to classify the results collected in the vicinity of the RRSWMF as any one land use. As such, it is important to compare the results from the RRSWMF with State monitoring data representing several different site characteristics.

As shown in Table 5.8, there are a total of 18 compounds that were detected in the VOST samples that are also monitored by the State. All 18 compounds were detected in upwind and downwind VOST samples from at least two of the three tests where VOST sampling was conducted. For several compounds, the RRSWMF downwind VOST results were below the annual average ambient air quality levels monitored at all four (4) selected NYSDEC monitoring sites, including the rural site at Whiteface Mountain located in Adirondack Park. Several other compounds exceeded the annual average ambient air quality levels monitored at the Whiteface Mountain station, but were less than the annual average ambient air quality levels monitored at the other three stations. These results were expected based on the land use characteristics surrounding the RRSWMF. Only three compounds including; methylene chloride, 1,1,1-trichloroethane and tetrachloroethane showed concentrations greater than the Troy, NY monitoring site (representing the urban location). None of the compounds monitored downwind of the RRSWMF were greater than the annual average ambient air quality levels monitored at all four stations. The table also shows that the average upwind VOST results are similar to the VOC data from other sites, suggesting that the ambient air quality levels upwind or downwind of the RRSWMF are similar to the air quality levels in other New York State locations.

It is important to note that the downwind VOST samples were located on or adjacent to the landfill and concentration at and beyond the RRSWMF property boundary are expected to be lower than concentration detected in the VOST downwind samples.

Table 5.8 also shows that for compounds from the downwind VOST sample with concentration in excess of their NYSDEC AGC values, these compounds were also in excess of their AGC values at all four NYSDEC monitoring sites. These compounds include chloroform, benzene,

Table 5.8 - Comparison of State-Wide Ambient Air VOC Concentrations (µg/m³)

Compound	NYSDEC Monitoring Locations ¹				RRSWMF Average Upwind VOST Results ²	RRSWMF Average Downwind VOST Results ³	NYSDEC AGC
	Troy, NY Uncle Sam Atrium	Lakawanna Simon St., Erie County	Whiteface Mt. Base Essex County	LaTorrette Golf Course Richmond County			
Chloromethane	1.47	1.21	1.20	1.19	0.10	0.13	90
Dichlorodifluoromethane (Freon 12)	3.56	3.14	3.33	3.08	1.80	3.13	12000
Trichloromonofluoromethane (Freon 11)	2.02	1.86	1.89	1.83	0.65	0.97	1000
Trichlorotrifluoroethane (Freon 113)	0.80	0.82	0.76	0.62	0.10	0.27	180,000
Methylene Chloride	0.32	0.33	0.48	0.59	0.10	0.50	2.1
Chloroform	0.192	0.181	0.180	0.173	0.042	0.167	0.043
1,1,1-trichloroethane	0.30	0.41	0.27	0.25		0.35	1000
Benzene	1.68	2.32	0.55	1.31	0.60	0.83	0.13
Carbon Tetrachloride	0.790	0.812	0.788	0.740	0.402	0.600	0.067
1,2-Dichloroethane	0.074	0.092	0.057	0.059	0.040	0.040	0.038
Toluene	4.26	3.22	0.89	3.25	0.80	1.70	5000
Tetrachloroethene	0.27	0.31	0.11	0.47	0.13	0.30	1.00
Ethylbenzene	0.72	0.52	0.18	0.55	0.15	0.47	1000
Xylene (m,p)	2.15	1.65	0.50	1.68	0.40	1.47	100
Xylene (o)	0.62	0.50	0.15	0.42	0.15	0.53	100
1,4-dichlorobenzene	0.46	0.20	0.14	0.17		0.15	0.09
1,3,5-trimethylbenzene	0.57	0.41	0.20	0.46		0.30	290
1,2,4-trimethylbenzene	0.95	0.51	0.18	0.75	0.07	0.60	290

Notes:

¹ Concentrations represent the annual average of NYSDEC monitoring data from 2001 to 2003, except for LaTorrette Golf Course which includes data from 2002 and 2003 only.

² Upwind average results represent two samples; one from the third test and one from the fourth test. Due to limited samples, average results do not necessarily represent annual average concentrations.

³ Downwind average results represent three downwind VOST samples; one sample was taken during test events 2, 3 & 4. Due to limited samples, average results do not necessarily represent annual average concentrations.

- Shaded concentration is above the level of the NYSDEC Annual Guideline Concentration value, however does not signify an exceedance of the guideline value.

- Blank values indicate levels below analytical minimum detection limits. Minimum detection limits can be found in Appendix C.

- NYSDEC monitoring site characteristics as follows:

Troy - Urban

Lakawanna - Industrial

Whiteface Mt. - Rural

LaTorrette GC - Suburban Residential

carbon tetrachloride, 1,2-dichloroethane and 1,4-dichlorobenzene. This demonstrates the air quality at many locales throughout New York State exceed certain State AGC guidelines. In addition, Table 5.8 shows that the average upwind concentrations for three of these five compounds also exceeds their AGC standards for the RRSWMF samples. This indicates that the ambient air quality levels upwind of the RRSWMF are similar to the air quality levels downwind of the facility, as well as, similar to other New York State locations.

It is important to remember the NYSDEC monitoring data provided in Table 5.8 represents annual average concentrations based on over 50, 24-hour samples and the RRSWMF data only represents three (3) 8-hour tests. As such, it is not appropriate to directly compare the RRSWMF test results to State AGC values, as they are only provided as a general reference. However, a relative comparison has been provided in Table 5.9 and the data clearly shows the VOST VOC results from the RRSWMF testing program are below or at worst very similar to ambient VOC concentrations collected in other parts of state, representing various land uses.

In addition, the NYSDEC data that is averaged over three (3) years, is from 2001 through 2003. Unfortunately, 2003 is the most recent NYSDEC monitoring data available. However, current ambient concentrations are expected to be similar at these sites as compared to the early 2000's, and as such, it is appropriate to compare, in a relative manner, the older NYSDEC data to the 2007 and 2008 collected at the RRSWMF.

5.2.1.3 Tedlar Bag Sample Results

As mentioned earlier, select odor samples were provided to the laboratory for VOC analysis. During the first test, several downwind odor samples were selected for VOC analysis, however during Tests 2, 3 and 4, only two (2) odor samples were analyzed for VOCs; one from the odor sample collected at the upwind sampling location and the other from the odor sample taken at the downwind sampling location where the SUMMA canister and VOST samples were collected. The downwind sample from Test 2 was damaged during transport to the laboratory, and as such, no analyzed could be performed. VOC results from the Tedlar bag sample can be found in Table 5.9. Laboratory results from the Tedlar bag samples, including analysis methods, time of analysis and minimum detection information is provided in Appendix C.

Table 5.9 - Tedlar Bag VOC Results ($\mu\text{g}/\text{m}^3$)

Compounds	Test 1						NYSDEC SGC	NYSDEC AGC	
	ALB-AT-02	ALB-AT-03	ALB-AT-04	ALB-AT-05	ALB-AT-07	ALB-AT-010 ¹			
Freon 12				2.5	2.6	11.0	---	12,000	
Vinyl Chloride						10.2	180,000	0.11	
Chloroethane						2.3	---	10,000	
Ethanol	24.0	12.0	11.0	9.9	9.7	16.0	---	45,000	
Acetone	52.0	37.0	33.0	29.0	30.0	47.5	180,000	28,000	
2-Propanol	980.0	1700.0	150.0	220.0	890.0	520.0	98,000	7,000	
Carbon Disulfide	28.0	22.0	16.0	17.0	23.0	26.0	6,200	700	
Methylene Chloride	6.9	2.6	2.5	3.4	1.9	4.5	14,000	2.1	
Hexane	2.7	1.8				4.6	---	700	
1,1-Dichloroethane						2.2	---	0.63	
2-Butanone (Methyl Ethyl Ketone)	3.8		1.6			7.5	68,000	5,000	
Benzene						21.0	1,300	0.13	
Trichloroethene						6.3	14,000	0.5	
4-Methyl-2-pentanone	2.1	2.1			2.4	3.1	31,000	3,000	
Toluene	35.0	25.0	74.0	28.0	18.0	115.0	370,000	5,000	
Tetrachloroethene						3.8	1,000	1.0	
Chlorobenzene						19.5	---	110	
Ethyl Benzene						22.0	54,000	1,000	
m,p-Xylene	3.5	2.9	4.5	3.7	2.4	31.0	4,300	100	
o-Xylene						11.5	4,300	100	
Chlorodifluoromethane						74.0	---	50,000	
Compounds	Test 2	Test 3		Test 4		Average ^{1,2}		NYSDEC SGC	NYSDEC AGC
	ALB2-AT-1 Upwind	ALB3-1 Upwind	ALB3-2 Downwind	ALB4-1 Upwind	ALB4-2 Downwind	Upwind	Downwind		
Freon 12	2.6							---	12,000
Ethanol		33.0	18	44.0	60.0	38.5	20.7	---	45,000
Acetone		31.0	23	29.0	36.0	30.0	34.3	180,000	28,000
2-Propanol		22.0	18	18.0	28.0	20.0	569.4	98,000	7,000
Carbon Disulfide	50.0	14.0	12.0	8.7	9.1	24.2	18.2	6,200	700
Methylene Chloride	19.0			1.8	2.1			14,000	2.1
Hexane	3.4							---	700
2-Butanone (Methyl Ethyl Ketone)	27.0	7.6	6.8	4.8	4.1	13.1	4.1	68,000	5,000
Toluene	17.0	9.3	8.3	8.3	9.7	11.5	28.3	370,000	400
m,p-Xylene	4.2				2.9			4,300	100
TIC's									
Propane, 2-methyl-	10.2				17.1			---	57,000
1-Propene, 2-methyl-	23.0							---	---
Acetaldehyde	6.0							4,500	0.45
Butane, 2-methyl-	18.0			8.6				---	42,000
1,3-Butadiene, 2-methyl-	20.3							---	---
Pentane, 2-bromo-	29.7					19.8		---	---
Octane	28.0							---	3,300
Octane, 4-methyl-	38.3			29.9				---	---
Heptadecane, 2,6,10,15-tetramethyl	7.0*							---	---
Undecane, 5-methyl-	38.3							---	---
1,1-difluoroethane		45.9	37.8	45.9				---	40,000
1-propoxyhexane		8.7*						---	---
3-ethyl-hexane		60.7	43.4					---	---
4,7-dimethylundecane		105.5	74.6					---	---
1-Iodo-2-methylnonane		28*	17.0					---	---
Eicosane		100.5		50.9				---	---
2-Butene, (Z)-				9.9				---	---
Pentane				9.7	7.7			---	4,200.0
Hexane, 2,3,3-trimethyl-				5.2*				---	---
Octane, 6-ethyl-2-methyl-				4.3*				---	---
Ethane, 1,1,1,2-tetrafluoro-						40.9		---	80,000
Butane						14.3		---	57,000
Unknown						4.4*		---	---
Decane, 2,4-dimethyl-						2.7*		---	---
Unknown						3.2*		---	---

Notes:

¹ Average does not include Test 1 Sample ALB-AT-10 since this sample does not represent ambient air. This sample was collected from a man-hole vent located behind the administration building.

² Average only provided for compounds that were detected during at least three of the four sampling events.

* Unable to obtain molecular weight for compound, concentration is in ppbv.

- TIC - Tentatively Identified Compound.

- Samples were not analyzed for TICs during the first test.

- Shaded concentration is above the level of the NYSDEC Guideline Concentration value, however does not signify an exceedance of the guideline value.

- Blank values indicate levels below analytical minimum detection limits. Minimum detection limits can be found in Appendix .

- Sample locations provided in Figure 4.2.

VOC results from the Tedlar bag samples varied from the VOC results of the SUMMA canister and VOST samples. One could expect considerable variance since the Tedlar bag samples are for a few minutes versus the 8-hour VOST and SUMMA canister samples. Each detected compound was compared to its respective ambient air SGC/AGC guideline value. The comparison shows that the detected air concentrations in the vicinity of the landfill were below NYSDEC standards during the time of testing, except for methylene chloride, which was in excess of its respective AGC value in the downwind samples during Test 1 and the upwind sample during Test 2. Unfortunately, no upwind Tedlar bag sample was analyzed during Test No. 1, and therefore, the source of methylene chloride is unknown. No methylene chloride was detected in the downwind SUMMA canister samples and minimal amounts of methylene chloride were detected in the downwind VOST samples, however less than the AGC value. Methylene chloride is also a common laboratory contaminant.

Since the SUMMA canister samples and the Tedlar bag sample have similar MDL values, they can be compared although there are very significant differences in sample duration (3 minutes versus 8 hours). Many additional compounds were detected in the bag samples as compared to the canisters. From a total of nine (9) compounds, not including TICs that were detected in the downwind Tedlar bag samples from at least two of the four tests, five (5) of the compounds were also detected in at least one downwind SUMMA canister sample. These compounds included; acetone, ethanol, MEK, toluene and xylene (m,p). For compounds that were detected in both the canister samples and Tedlar bag samples, bag concentrations were generally higher for most compounds. For example, from Test 1, which showed the greatest downwind Tedlar bag VOC sample concentrations, the acetone concentration was $52 \mu\text{g}/\text{m}^3$ compared to $35 \mu\text{g}/\text{m}^3$ from the canister sample. However, a closer match in concentrations were observed for some compounds during certain tests. There was only one common TIC detected between the canister and the Tedlar bag samples, which was 2-methylpropane detected during Test 4 only. 2-methylpropane concentration from the Tedlar bag sample was $17.1 \mu\text{g}/\text{m}^3$ and the canister sample was $11.7 \mu\text{g}/\text{m}^3$.

Sample ALB-AT-10 collected during Test No. 1 was collected from the leachate collection system manhole cover vent and is representative of vapor losses associated with the leachate collection system. The sample results show that if a significant quantity of leachate vapors are released to the atmosphere, there is the potential for additional air toxic impacts from the site. However, additional leachate collection vents or vapor leaks were not identified, and therefore, off-site impacts from the leachate collection network may not be occurring.

One of the reasons for higher concentrations of VOCs in the Tedlar bag samples is that Tedlar bags are normally not recommended for use when very low levels of VOC are expected. However, to analyze for sulfur compounds, SUMMA canisters are not recommended due to their stainless steel construction, which can react with sulfur, and therefore, it was necessary to utilize both types of sample media during the test effort. The laboratory has also advised RTP that minimal VOC concentrations can be present in clean, unused Tedlar bags. As such, a new, clean, empty Tedlar bag was shipped to the laboratory for analysis. The laboratory filled the bag with certified clean gas (100% pure nitrogen) and analyzed the sample as a “blank”. The results are presented in Table 5.10.

Table 5.10 – Blank Tedlar Bag Results ($\mu\text{g}/\text{m}^3$)

Compound	Concentration
2-Propanol	26.0
Carbon Disulfide	3.3
Methylene Chloride	2.8
Toluene	9.3
Ethyl Benzene	10.0
m,p-Xylene	48.0
o-Xylene	22.0

As shown in Table 5.10, minimal concentrations were detected from the blank Tedlar bag, although these values are comparable to the observed SUMMA canister concentrations. Therefore, the reason(s) for uncertainties with the difference in sample results between the Tedlar bag ambient air results and the SUMMA canister results probably relate to very different sampling periods as explained below.

The difference in sampling times may have had an effect on the VOC results. The SUMMA canisters and VOST samplers were run over a continuous 8-hour period where meteorology and landfill operating activities may have varied over the sampling period. The Tedlar bag samples were collected over a 3-minute period, while an odor was present. As such, the Tedlar bag samples may have been much more concentrated over a 3-minute sampling interval, where fluctuations in wind direction and speeds limited potential sample dilution are reflected in the SUMMA canister and VOST results. In addition, the Tedlar bag samples show a very significant decrease between the first test and subsequent tests. These differences are likely associated with the fact that the most odorous samples were selected for VOC analysis from Test 1, but not for subsequent tests. Also, improved control of landfill gas emissions likely attributed to the decrease in concentrations.

5.2.2 Sulfur Compound Results

The Tedlar bag odor samples that were analyzed for VOCs were also analyzed for sulfur compounds including hydrogen sulfide, a common constituent typically associated with landfills. Sulfur results from the four tests are provided in Table 5.11. Table 5.11 shows that only carbonyl sulfide (detected during Tests 1 and 2 only) and carbon disulfide (detected during only Test 2). No sulfur compounds were detected during Tests 3 and 4. Table 5.11 also shows the comparison between carbonyl sulfide and carbon disulfide and their respective SGC/AGS guideline values. As shown, carbonyl sulfide exceeds its respective AGC value for the downwind sample closest to the landfill during Test 1 and at both the upwind and downwind samples during Test 4. Unfortunately, no upwind Tedlar bag sample was analyzed during Test 1, and therefore, the source of carbonyl sulfide is unknown. Nevertheless, since each sample represents only a 3-minute average sample, it is definitely not appropriate to directly compare the results from the Tedlar bag samples to long-term standards (AGCs).

Table 5.11 also includes results from a sample pulled from the leachate collection system manhole cover vent behind the onsite administration building. This sample should not be compared to AGC/SGC ambient air standards since this is not an ambient sample. Laboratory

Table 5.11 - Tedlar Bag Sulfur Compound Results (ug/m³)

Compounds	Test 1						Test 2		Test 3	Test 4	NYSDEC SGC	NYSDEC AGC
	ALB-AT-02	ALB-AT-03	ALB-AT-04	ALB-AT-05	ALB-AT-07	ALB-AT-010 ¹	ALB2-AT-1	ALB-AT-010	ALB3-1 ALB3-2	ALB4-AT-1 ALB4-AT-2		
Hydrogen Sulfide									<i>No Compounds Detected</i>	<i>No Compounds Detected</i>		
Carbonyl Sulfide	44.2	24.6	12.3	9.8	24.6	68.7	51.6	39.3			250.0	28.0
Methyl Mercaptan												
Ethyl Mercaptan												
Dimethyl Sulfide												
Carbon Disulfide							37.4	31.0			6,200	700
Isopropyl Mercaptan												
tert-Butyl Mercaptan												
n-Propyl Mercaptan												
Thiophene												
Isobutyl Mercaptan												
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide												
Diethyl Sulfide												
Dimethyl Disulfide												
Tetrahydrothiophene												
2-Ethylthiophene												
2,5-Dimethylthiophene												
Diethyl Disulfide												

Notes:

¹ Average does not include Test 1 Sample ALB-AT-10 since this sample does not represent ambient air. This sample was collected from a man-hole cover vent located behind the administration building.

- Shaded concentration is above the level of the NYSDEC Guideline Concentration value, however does not signify an exceedance of the guideline value.

- Blank values indicate levels below analytical minimum detection limits. Minimum detection limits can be found in Appendix .

- Sample locations provided in Figure 4.2.

results including analysis methods, time of analysis and minimum detection information can be found in Appendix C.

5.2.3 Methane Results

The monitoring protocol included an analysis of methane in the SUMMA canister samples. Methane (along with carbon dioxide) is typically the most abundant constituent present in landfill gas generated from MSW landfills, and therefore, any detection of methane would indicate the presence of landfill gas migration to the surrounding community.

The methane results from the five (5) canister samples collected during each of the four tests are presented in Table 5.12. The normal atmospheric concentration of methane is 1.7 ppm. As shown in Table 5.12, both the background samples (upwind samples – “AT-1”) and the samples at or beyond the downwind property boundary (downwind samples “AT-4” and “AT-5”) are near normal atmospheric methane concentrations. The results from the samples collected near the landfill surface (downwind samples “AT-2” and “AT-3”) show slightly elevated methane concentrations with the exception of Test 2 where methane concentrations were elevated further downwind from the site. The results indicate that methane concentrations present in the ambient air in the vicinity of the RRSWMF are low and pose no health, explosion or environmental threat. Laboratory results including analysis methods, time of analysis and minimum detection information can be found in Appendix C.

5.2.4 Aldehyde and Ketone Results

A separate analytical method was required to detect an expanded list of aldehydes and ketones. Two (2) aldehyde and ketone samples were collected during each of the four tests; one upwind and one downwind. However, during Test 1, two (2) downwind samples were collected to determine the onsite variation of the compounds and no upwind sample was collected. The two downwind samples were collocated with the two (2) downwind SUMMA canister samples located nearest the landfill. During Tests 2, 3 and 4 the two (2) aldehyde and ketone samples were located with the two (2) VOST samples. Analytical results and respective SGC/AGC

guideline values are provided in Table 5.13. Compounds detected above the MDL include formaldehyde, acetaldehyde, propanol, acetone, crotonaldehyde, MEK/butyraldehydes and hexanal. Formaldehyde, acetaldehyde and acetone were detected in both the upwind and downwind samples during three test events, where as propanol and hexanal was only detected in the upwind sample during Test 2 and MEK/butyraldehydes was only detected during Test 3 (both upwind and downwind). Due to the amount of aldehydes in the upwind samples during the last three tests, it is difficult to determine if a trend in the downwind sample results exist over the course of the monitoring program. Laboratory results including analysis methods, time of analysis and minimum detection information can be found in Appendix C.

Table 5.12 – SUMMA Canister Methane Results

		Sampling Location and Methane Concentration (ppm)				
Test 1	ALB-AT-1	ALB-AT-2	ALB-AT-3	ALB-AT-4	ALB-AT-5	
	2.0	4.4	4.2	2.2	2.0	
Test 2	ALB2-AT-1	ALB2-AT-2	ALB2-AT-3	ALB2-AT-4	ALB2-AT-5	
	2.0	3.2	3.4	2.4	4.0	
Test 3	ALB3-AT-1	ALB3-AT-2	ALB3-AT-3	ALB3-AT-4	ALB3-AT-5	
	6.4	2.9	3.5	2.2	2.2	
Test 4	ALB4-AT-1	ALB4-AT-2	ALB4-AT-3	ALB4-AT-4	ALB4-AT-5	
	2.2	5.3	3.9	4.9	2.5	

Notes:

- See Figures 4.2 and Appendix B for sample location information.
- ppm - parts per million.

Table 5.13 - Aldehyde and Ketone Sample Results ($\mu\text{g}/\text{m}^3$)

Compound	Test 1		Test 2		Test 3		Test 4		Average ¹		NYSDEC SGC	NYSDEC AGC
	ALB1-ALD1 Downwind	ALB1-ALD2 Downwind	ALB2-ALD-1 Upwind	ALB2-ALD-2 Downwind	ALB3-ALD1 Upwind	ALB3-ALD2 Downwind	ALB4-ALD1 Upwind	ALB4-ALD2 Downwind	Upwind	Downwind		
Formaldehyde	1.5	1.8	6.0	4.6	4.1	1.4	0.6	0.6	3.6	2.0	5.3	0.1
Acetaldehyde	3.3	5.8	2.8	2.1	1.7	1.0	0.6	0.6	1.7	2.6	4,500	0.45
Propanal			0.6						0.6		---	590
Acetone	9.1	11.0	2.5	2.5	2.7	2.8	1.9	7.8	2.4	6.6	180,000	28,000
Crotonaldehyde	9.0	9.1								9.0	86	---
Methyl Ethyl Ketone/Butyraldehydes					3.6	4.4			3.6	4.4	13,000	5,000
Benzaldehyde											---	---
Isopentanal											---	---
Pentanal											---	420
o-Tolualdehyde											---	---
m,p-Tolualdehyde											---	---
Hexanal			0.6						0.6		---	---

Notes:

¹ Average only provided for compounds that were detected during at least three of the four sampling events.

- All upwind samples were analyzed twice for analytical QA/QC purposes. The value presented in the table, represents the average of both analyses.

- Blank values indicate levels below analytical minimum detection limits. Minimum detection limits can be found in Appendix C.

- Shaded concentrations indicate exceedance of the NYSDEC Annual Guideline Concentration (AGC) value.

- Sample locations provided in Figure 4.2.

- Concentration depicted by red test indicates an exceedance of the NYSDEC Short-term Guideline Concentration (SGC) value.

However, formaldehyde presence in the ambient air can range between 1 and 20 micrograms per cubic meters. See Appendix E for details.

Table 5.13 also shows that both formaldehyde and acetaldehyde were detected in excess of their respective long-term NYSDEC guideline values (AGC). However, the data shows that these compounds were detected in the upwind and downwind samples, suggesting that the RRSWMF may have had a minor impact on the detected formaldehyde and acetaldehyde concentrations.

Further, formaldehyde was detected in excess of its respective short-term (1-hour) NYSDEC guideline value (SGC) at the upwind sample during Test 2. Research shows that low concentrations of formaldehyde exist in the ambient air, and therefore, exceedances of the short- and long-term standards are not uncommon. Literature regarding ambient formaldehyde concentrations is provided in Appendix D.

5.2.5 VOA Sampling Results

A list of six (6) volatile organic acid (VOA) compounds was analyzed from the two (2) downwind VOA samples that were collected during the first test. The two (2) samples were collected on specialized media at SUMMA canister locations nearest the landfill. The results indicated no compounds were present above their respective minimum detection limit during the time of testing, and as such, VOA sampling was discontinued for the remaining tests.

5.3 LFG Sample Results

LFG samples were collected to assist with characterizing ambient odor and air quality sample results and to determine the extent (if any) impacts LFG may have on ambient air quality and odors. Tedlar bag LFG samples were analyzed for VOCs and sulfur compounds. VOC results are provided in Table 5.14 and sulfur compound results are provided in Table 5.15. Also included in Table 5.14, are the ambient downwind VOST VOC samples. These results are provided to make a direct comparison between VOCs detected in the LFG and VOCs detected in the ambient air downwind of the landfill. Ambient sample sulfur results were not included in Table 5.15, because none of the same compounds were detected in the LFG samples and ambient samples. Please refer to Table 5.11 for ambient sulfur compound sample results. Laboratory

Table 5.14 - Comparison of VOCs in Landfill Gas and Ambient Air Downwind of the RRSWMF ($\mu\text{g}/\text{m}^3$)

Compounds	Test 1 ⁵		Test 2		Test 3		Test 4	
	LFG Sample ¹	Ambient Sample ²	LFG Sample ¹	Ambient Sample ³	LFG Sample ¹	Ambient Sample ³	LFG Sample ¹	Ambient Sample ³
Freon 12	4,100		6,200	3.6	7,000	1.8	5,600	4.0
Chloromethane				0.1		0.1		0.2
Vinyl Chloride	560						1,100	
Chloroethane							470	
Freon 11	330		2,900	1.5	2,300	0.8	2,100	0.6
Ethanol	13,000	15.0	130,000 E		64,000		94,000 E	
Acetone	19,000	35.0	20,000	2.4	13,000	0.6	14,000	0.5
2-Propanol	13,000		25,000		13,000		19,000	
Carbon Disulfide	580		3,100	34.2 ⁴	850		1,100	
Methylene Chloride			2,000	1.2	1,700	0.1	1,200	0.2
Hexane	1,300		5,100	1.9	3,600	0.3	4,700	0.6
1,1-Dichloroethane	180		640				530	
2-Butanone (Methyl Ethyl Ketone)	30,000	6.1	32,000	4.4	20,000	0.3	25,000	1.7
Chloroform				0.4		0.05		0.05
1,1,1-Trichloroethane			370	0.2				0.5
Carbon Tetrachloride				1.0		0.5		0.3
Benzene	2,500		3,700	1.3	2,800	0.7	4,300	0.5
1,2-Dichloroethane	210		610				690	0.04
Trichloroethene	2,500		3,700		1,300		3,700	
1,2-Dichloropropane							210	
4-Methyl-2-pentanone	2,200		2,300		1,600		2,600	
Toluene	21,000		41,000	7.2	33,000	1.0	52,000	2.4
Tetrachloroethene	1,800		4,000	0.3	3,100	0.1	3,900	0.5
Ethyl Benzene	5,600		12,000	1.0	9,800	0.1	15,000	0.3
m,p-Xylene	8,000	3.8	21,000	3.0	18,000	0.5	27,000	0.9
o-Xylene	2,300		6,300	1.2	4,700	0.1	8,300	0.3
1,4-Dichlorobenzene			610	0.2			920	0.1
Dichlorofluoromethane	680		3,800				2,400	
Chlorodifluoromethane	940		4,400		4,500		4,100	

Notes:

¹ Landfill gas (LFG) sample was collected from the main flare sampling port.

² No VOST VOC sample was collected during the first test event, therefore VOC results from SUMMA sample ALB-AT-2 was used.

³ Represents downwind VOST ambient air sample.

⁴ Concentration is the average of two downwind Tedlar bag samples.

⁵ The lack of VOCs present in the ambient during the first test may be attributed to minimum detection limit issues with using SUMMA canisters.

- E - Exceeds instrument calibration range

- Ethanol was not on the VOST target list of compounds, and therefore, it was not detected in VOST samples.

- See Appendix C for analysis compound list and minimum detection limits.

Table 5.15 – LFG Sulfur Compound Results (ppm)

Compound	Test 1	Test 2	Test 3	Test 4
Carbonyl Sulfide				
Methyl Mercaptan				4.6
Ethyl Mercaptan				
Dimethyl Sulfide				
Carbon Disulfide				
Isopropyl Mercaptan		13.0	4.8	6.2
tert-Butyl Mercaptan				
n-Propyl Mercaptan				
Thiophene				
Isobutyl Mercaptan				
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide				
Diethyl Sulfide				
Dimethyl Disulfide				
Tetrahydrothiophene				
2-Ethylthiophene				
2,5-Dimethylthiophene				
Diethyl Disulfide				
Hydrogen Sulfide	2,150	1,900	685	890
Hydrogen Sulfide Drager Colorimetric Tube	1,500	2,000	1,200	1,000

Notes:

- MDL for all compounds is 4.0 ppm.
- The Drager reading was taken from the collected Tedlar bag sample just prior to sample shipment.

results from the LFG samples including analysis methods, time of analysis and minimum detection information can be found in Appendix C.

The LFG samples were collected from a sampling port located on the main flare, just prior to gas combustion. As mentioned earlier, additional LFG samples were collected during Test 1, however, the results were used specifically for project support, and therefore, the results are not discussed in this report.

When comparing the landfill gas VOC results with the ambient air VOC results, for the majority of compounds, a distinct relationship can be seen between the landfill gas and ambient air samples. However, as mentioned above, this was not the case with the sulfur compound results. There are mainly two (2) discrepancies noted when comparing the landfill gas and ambient sulfur compound results. The first being the absence of carbonyl sulfide in the landfill gas, but detected in the ambient air. This can simply be explained by the fact that since H₂S concentrations were very high in the landfill gas, the laboratory required several thousand dilutions to bring the H₂S concentration within the calibration range of the analytical instrumentation. Dilution of the samples would cause any other sulfur compound with a very low concentration (including carbonyl sulfide) to dilute below the minimum detection limit. As such, carbonyl sulfide was not detected from the landfill gas samples.

The other discrepancy between the landfill gas sulfur compound results and the ambient air sulfur compound results is the presence of H₂S in the landfill gas (as expected), but the absence of H₂S in the ambient air samples. As shown in Table 5.5, H₂S as monitored using a Jerome 631-X portable monitor, confirms that H₂S ambient concentrations were above the H₂S analytical MDL of 4 ppb (albeit slightly) at certain Tedlar bag sampling locations during the Tests 1 and 4, however no H₂S was detected in those samples. When dealing with concentrations so close to the MDL, the lack of H₂S detected in the ambient samples is possibly associated with instrument error with both the Jerome unit and/or the analytical method.

6.0 CONCLUSIONS

Four (4) odor and air quality sampling events were conducted on a calendar quarterly basis over the course of a year. The first test was conducted on May 5, 2007 and the fourth and final test was conducted on January 31, 2008. The program intentionally attempted to capture worst-case odor and air quality levels in the vicinity of the RRSWMF. Therefore, the four (4) tests were performed during a wide array of meteorological conditions, during both the day and at night and during and between many different RRSWMF activities. Several conclusions can be drawn from the odor and air quality sample results, however most importantly two distinct trends can be identified from the odor and air quality data collected. They are as follows:

1. The results indicate that the landfill's odor and air quality impacts on the surrounding community were, in the majority, minimal based on the data obtained from each test. Further, downwind impacts are expected to decrease with distance increasing from the RRSWMF property due to atmospheric diffusion, and
2. Measured Odor and air quality levels associated with the RRSWMF decreased over the course of the testing program. This was primarily due to several operational and management corrective actions taken by the City of Albany and its consultants over the course of the program.

In addition to the above findings, analysis of the sample results has determined several other important conclusions, including:

- Maximum odor and air quality levels were observed during Test 2 (August 1& 2, 2007). Reasons for the high concentrations may be attributed to one or more of the following; landfill operations, meteorology and/or nighttime testing. The results from this test likely represent worst-case odor and air quality levels in the vicinity of the RRSWMF.
- Air quality levels were slightly higher immediately downwind of the RRSWMF (on-site) when compared to levels at locations upwind of the RRSWMF. However, air quality levels downwind of the RRSWMF are, in general, lower than other locations in New York State monitored by the NYSDEC.
- For compounds measured above NYSDEC long-term standards (AGCs) downwind of the RRSWMF, the same compounds ALL were measured above AGCs at ALL four NYSDEC monitoring sites used in this analysis.
- Ambient VOCs air quality levels in the vicinity of the RRSWMF were fairly low, in fact, it would have been difficult to quantify impacts without using VOST sampling methodology or a sampling method with equivalent minimum analytical detection

limits. SUMMA canister and Tedlar bag ambient air sampling for VOCs is only appropriate for compounds with higher concentrations, as well as, for quality assurance and quality control purposes.

- Aldehyde results indicated the presence of three (3) compounds consistently present downwind of the RRSWMF, however all three (3) were detected upwind of the RRSWMF as well. Therefore, the RRSWMF emissions are likely to have a minimal impact on ambient air quality. Further, formaldehyde, which was consistently detected at both upwind and downwind sampling locations, is naturally present in ambient air. In fact, formaldehyde concentrations were greater at the upwind sampling locations as compared to the downwind sampling locations for the majority of the tests.
- Only slightly elevated methane concentrations were detected downwind of the landfill as compared to the upwind or background methane concentrations, meaning that methane concentrations in the ambient air downwind of the RRSWMF are low and likely pose no significant health, explosion or environmental threat. This is in no minor part due to the collection of LFG for energy generation or flaring.
- Sulfur compound results indicated that sulfur compounds are below analytical MDLs in the ambient air in the vicinity of the RRSWMF with the exception of carbonyl sulfide and carbon disulfide which were detected during the first two test events. However high concentrations of carbonyl sulfide were detected upwind of the RRSWMF (and at higher concentration than downwind locations), and therefore, the impacts are not necessarily associated with the RRSWMF. No sulfur compounds were detected in any samples during the third and fourth tests.
- LFG results indicate that the gas composition consists of several VOCs (less than 0.01%, v). Based on a comparison of LFG and ambient air sample results, it appears the majority of the VOCs detected in the ambient air are related to fugitive landfill gas emissions. However, based on the ratio of VOCs in the LFG and the ambient downwind VOC concentrations, it appears that only a small amount of LFG is

escaping to the atmosphere. The methane and sulfur sampling results also confirm a high degree of control of LFG generated at the landfill.

- Hydrogen sulfide was detected in the LFG (at approximately 1000 ppm), but was not detected in the ambient air due to concentrations likely being below the minimum detection limit (MDL), which was approximately 4 ppb).
- No VOAs were detected above their respective analytical MDL during Test 1, and therefore, VOA levels downwind of the landfill are probably at very low concentrations.

If current operations at the RRSWMF continue, odor and air quality impacts in the vicinity of the RRSWMF are likely to remain similar to levels documented in this report.