SCS ENGINEERS

AIR QUALITY IMPACT ANALYSIS AND AIR TOXICS RISK ASSESSMENT FOR PROPOSED LANDFILL PROJECT 2018 FORWARD LANDFILL MANTECA, CALIFORNIA

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June 2018, Revised February 2019
File No. 01205164.02 Task 19

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This Air Quality Impact Analysis and Air Toxics Risk Assessment Report for the Forward Landfill Project, dated February 2019, was prepared and reviewed by the following:

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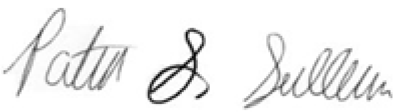

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
AERMOD	American Meteorological Society (AMS)/Environmental Protection Agency (EPA) Regulatory Model
AQIA	Air Quality Impact Analysis
ATC	Authority to Construct
BACT	Best Available Control Technology
CA	Current Actual Conditions
CAA	Clean Air Act
CAP	Criteria Air Pollutant
CARB	California Air Resources Board
CCR	California Code of Regulations
CDI	Chronic Daily Intake
CEQA	California Environmental Quality Act
CFM	cubic feet per minute
CFR	Code of Federal Regulation
CO	Carbon Monoxide
COPC	Chemicals of Potential Concern
CP	Current Permitted Conditions
CSF	Cancer Slope Factor
CY	Cubic yards
DEIR	Draft Environmental Impact Report
DTSC	California Environmental Protection Agency Department of Toxic Substances Control
EG	Emission Guidelines
EPA	U. S. Environmental Protection Agency
EPC	Exposure Point Concentration
FAA	Federal Aviation Administration
GHG	Greenhouse Gases
GLC	Ground Level Concentrations
HAPs	Hazardous Air Pollutants
HI	Hazard Index
HQ	Hazard Quotient
HRA	Health Risk Assessment
LCRS	Leachate Collection and Recovery System
LFG	Landfill Gas
LOAELS	Lowest Observed Adverse Effect Levels

µg	Micrograms
MACT	Maximum Achievable Control Technology
MW	Megawatts
MSL	Mean Sea Level
MSW	Municipal Solid Waste
NA	Not Applicable
NAAQS	Nation Ambient Air Quality Standards
NIOSH	National Institute of Occupational Safety and Health
NMOC	Non-Methane Organic Compound
NOAELS	No Observed Adverse Effect Levels
NO_2	Nitrogen Dioxide
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	Ozone
OEHHA	Office of the Environmental Health Hazard Assessment
O&M	Operations and Maintenance
Pb	Lead
PCE	Tetrachloroethylene
PM	Particulate Matter
PPM	Parts Per Million
PTO	Permit to Operate
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
REL	Reference Exposure Level
RfC	Reference Concentration
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RWQCB	Regional Water Quality Control Board
SAAQS	State Ambient Air Quality Standards
SCREEN3	EPA's screening air dispersion model
SCS	SCS Engineers
SEM	Standard Emissions Monitoring
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_x	Sulfur Oxides

SWF	Solid Waste Facility
SWFP	Solid Waste Facility Permit
SWICS	Solid Waste Industry for Climate Solutions
TAC	Toxic Air Contaminant
TBACT	Best Available Control Technology for Toxics
TCE	Trichloroethene
TPD	Tons Per Day
UATS	Urban Air Toxics Strategy
USACE	U.S. Army Corps of Engineers
ug/m^3	micrograms per cubic meter
VC	Vinyl Chloride
VOC	Volatile Organic Compound

AIR QUALITY IMPACT ANALYSIS AND
AIR TOXICS RISK ASSESSMENT
FOR PROPOSED LANDFILL PROJECT 2018
FORWARD LANDFILL
MANTECA, CALIFORNIA

EXECUTIVE SUMMARY

INTRODUCTION

This Air Quality Impact Analysis (AQIA) and Air Toxics Risk Assessment Report was prepared by SCS Engineers (SCS) on behalf of Forward, Inc. (Forward). It was developed to provide supporting documentation for a Supplemental Environmental Impact Report (SEIR) for Forward's proposed permit revision of the Forward Landfill (the Project) in Manteca, California. This SEIR supplements the certified *Forward Landfill Expansion Final Environmental Impact Report* (Grassetti Environmental Consulting, May 2013) (2013 FEIR), which proposed a larger expansion of Forward (2013 Project). Although the 2013 FEIR was certified, the project was not implemented due to issues concerning the Airport Land Use Plan.

In this AQIA, SCS evaluated criteria air pollutant (CAP), toxic air contaminant (TAC), and greenhouse gas (GHG) emission levels for the Forward Landfill (Forward, Site, or Facility) under four scenarios, including two pre-Project or Baseline scenarios and two Project scenarios. The two Baseline scenarios are: Current Actual (CA) emissions, determined using 2016 and 2017 operational data; and Current Permitted (CP) emissions, based on emissions of landfill sources at maximum permitted levels. The Post-Project or Future Potential (FP) scenario was estimated assuming full implementation of the Project as described in the SEIR and this AQIA under two different Project scenarios. Briefly, the Project includes a proposed lateral expansion of the Landfill within the existing permitted boundary, a creek re-location, and associated site modifications necessitated by the expansion. The proposed expansion does not include any increase in the rate of landfill-related activities, and the waste acceptance rate at the landfill will not be increased.

Two baseline scenarios are discussed in this document. For purposes of the California Environmental Quality Act (CEQA), the baseline scenario is the CA baseline, which reflects actual conditions in 2016 and 2017 based on the San Joaquin Valley Air Pollution Control District (SJVAPCD) definition of "current." This analysis includes an assessment of the CP scenario because it more properly reflects the way landfill emissions increase over time due to the cumulative emissions of waste placed over several years. Unlike most emission sources, landfill gas (LFG)-derived emissions will increase over time even if the fundamental activity rate (waste placement) remains the same.

Two Project scenarios were evaluated. The first scenario assumes that all LFG in excess of what is currently permitted for destruction in the Ameresco, Inc. (Ameresco) LFG to energy (LFGTE) facility will be destroyed in a flare. The second scenario assumes that all LFG in excess of the current actual quantity of LFG sent to the flares is destroyed in existing and future LFGTE facilities.

In total, four scenarios are evaluated:

1. CA baseline to Project with flared gas
2. CA baseline to Project with gas to LFGTE
3. CP baseline to Project with flared gas
4. CP baseline to Project with gas to LFGTE

In addition to an analysis of CAP and TAC emissions, the AQIA includes an air toxics Health Risk Assessment (HRA), which assesses the human health risks attributable to the TAC emissions associated with the Project.

PROJECT DESCRIPTION

The proposed physical and operational changes and a brief discussion of their environmental impacts in relation to the original project are described below.

Allow Development of Additional Landfill Disposal Cells Within Currently Permitted Landfill Boundary

Development of additional landfill cells would increase the disposal footprint from approximately 355 acres to 372 acres. The proposed additional development area includes two areas within the currently permitted landfill boundary; approximately 8.72 acres in the northeast corner of the site and approximately 8.61 acres in the south area. The acreage added in the south area is gained by shifting the existing disposal footprint north and realigning the creek to the southern and eastern boundaries of the site. The maximum elevation of refuse fill in the additional development areas would be approximately 190 feet above mean sea level (MSL), lower than the permitted maximum height of 210 feet MSL for the existing Forward Landfill. The footprint of the refuse fill would be set back a minimum of 100 feet from the east property boundary.

The additional development area would have a base liner and Leachate Collection and Recovery System (LCRS) consistent with currently constructed modules and in compliance with pertinent regulatory requirements.

The projected total remaining airspace for the Forward Landfill, as of January 2017 is approximately 16.6 million cubic yards (mcy). The proposed expansion would add approximately 8.1 mcy of disposal airspace, which would allow disposal at the Forward Landfill to extend to 2036. While all of the proposed expansion would be Class II landfill space, it is anticipated that Class III waste would be disposed in the expansion areas along with Class II waste.

In comparison to the 2013 Project, the proposed Project is anticipated to significantly reduce most of the environmental impacts identified in the 2013 FEIR. The proposed Project adds only 8.1 million cy of landfill capacity versus the 32 million cy in the original project and the projected landfill closure date is 2036 versus 2039 for the original proposed project. The smaller added landfill capacity and earlier closure date reduces air quality, traffic, and noise impacts when compared to the original project. Since development will not extend onto the Brocchini parcel, there will be less potential biological and cultural resource impacts. The impact on visual quality will be similar to existing permitted conditions.

The reduced infill development area of the proposed project is all outside a 10,000-foot radius from the end of the runway at the Stockton Metropolitan Airport. It is within the horizontal and conical zone of the Stockton Airport Land Use Plan but under these surfaces. It is also not on any parcels with Williamson Act Contracts. Therefore, Land Use impacts are significantly less than the original project.

Relocate South Branch of the South Fork of Littlejohns Creek

To provide further separation of the creek from the landfill, create a contiguous disposal area, and optimize landfill airspace, an approximately 2,900-foot reach of the South Branch of the South Fork of Littlejohns Creek would be relocated to the eastern and southern boundaries of the landfill. The creek relocation is intended to:

(1) provide adequate flood control (i.e., to have capacity to carry the 100-year flow within its banks), and;
(2) provide a stable channel design that meets or exceeds the functions and values of the existing creek.

The relocated creek would be 3,300 feet in length. The existing creek traversing the landfill is generally a trapezoidal channel with 10 to 12 foot banks and a 10- to 15-foot bottom width. The channel measures, on average, 60 feet from bank top to bank top. This equates to a 4.13-acre creek zone. There is little riparian habitat because the creek channel is regularly cleared of emergent vegetation by County personnel.

The existing channel would be moved approximately 1,000 feet to the south to accommodate the further development of the Forward Landfill. The proposed relocated channel would be approximately 3,300 feet long and would have greater flood control ability than the existing channel. To address Federal Aviation Administration (FAA) concerns regarding creation of bird habitat, riparian habitat restoration/creation is proposed to be mitigated offsite versus being incorporated within the relocated creek channel. The proposed relocation would create approximately 1.41 acres of U.S. Army Corps of Engineers (USACE) jurisdictional areas that are inundated on a regular basis. Constructing the channel would require moving approximately 50,000 cubic yards of material. Litter control in the relocated creek would follow established litter control practices at the site. A combination of monitored litter fences, screening, and litter pickers would be used.

A bridge will be constructed to cross the relocated creek. The bridge will provide a clear span of the creek with foundations located in the creek embankment.

The environmental impacts of the creek relocation would be the same as discussed in the 2013 FEIR[1].

Ancillary Facilities

It is currently anticipated that refuse filling will continue on the northern portion of the site in the valley between the former Austin Road Landfill and the original Forward Landfill and then in the northeast infill. Development of the south infill will occur after realignment of the South Branch and completion of refuse filling in the northern area, except for the easternmost cell that parallels Austin Road. This easternmost cell will be reserved for operations soil management until the remainder of the landfill is constructed.

After the easternmost cell that parallels Austin Road is constructed, the existing office trailer will be relocated just north of waste management unit (WMU) A, so that a sedimentation pond can be constructed in its place. The main entrance will remain in its current location, except for periods of time when refuse filling is occurring in the northeast or south infill. At these times, the entrance/exit may be relocated to the north or south landfill entrance/exit. The scales will be relocated depending on the entrance/exit being used and will be sited in a location that allows sufficient space for queuing within the facility boundary.

Once the South Branch is relocated, the existing permitted leachate/compost pond, WMU F South, would be relocated adjacent to the existing leachate pond, WMU F-North. The existing permitted sedimentation basin would be combined with the existing sedimentation basin located directly north of the existing leachate pond, WMU F-North. Closure and relocation of the leachate and sedimentation basin would be in accordance with applicable regulations and as approved by the regulatory agencies.

ENVIRONMENTAL SETTING

The environmental setting for the proposed Project was evaluated in order to describe existing local and regional air quality conditions prior to initiation of the Project. An environmental setting for a project includes existing meteorological conditions, current pollutant levels, applicable laws and regulations, and other local and/or regional characteristics, which will affect the impact that a proposed project might have on air quality. The environmental setting of the proposed Project with respect to air quality is described in greater detail within Section 2.0 of this AQIA Report.

CRITERIA AIR POLLUTANTS

Both the United States Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) have established air pollution standards in an effort to protect human health and welfare. Geographic areas are designated "attainment" if these standards are met and "non-attainment" if they are not met (i.e., the National Ambient Air Quality Standards (NAAQS)

1 *Forward Landfill Expansion Final Environmental Impact Report* (Grassetti Environmental Consulting, May 2013)

or the State Ambient Air Quality Standards (SAAQS) are exceeded). Classifications for the San Joaquin Valley Air Basin (SJVAB) for both state and federal CAP standards are presented in the following table.

Table ES-1. San Joaquin Valley Area Air Basin CAP Attainment Status

Pollutant	Federal Standard Classification	State Standard Classification
Carbon Monoxide	Attainment/Unclassified	Attainment/Unclassified
Ozone (8 hr)	Nonattainment/Extreme	Nonattainment
PM_{10}	Attainment	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
Nitrogen Dioxide	Attainment/Unclassified	Attainment
Sulfur Dioxide	Attainment/Unclassified	Attainment

In general, air quality in the SJVAB is most affected by elevated levels within the basin of ozone, respirable particulate matter with a diameter of less than 10 microns (PM_{10}), and suspended particulate matter with a diameter of less than 2.5 microns ($PM_{2.5}$), which have caused the air basin to be designated as non-attainment for the federal and state standards. Therefore, sources of ground level ozone, such as volatile organic compound (VOC) and oxides of nitrogen dioxide (NO_2) emissions, sources of PM_{10} (e.g., fugitive dust, combustion sources, etc.), and fine particulate matter with a diameter of less than 2.5 microns $PM_{2.5}$ are of greatest concern for the SJVAB.

TOXIC AIR CONTAMINANTS

In addition to the CAPs, TACs are airborne substances that are capable of causing short-term (acute) and/or long-term (chronic or carcinogenic; i.e., cancer-causing) adverse health effects to humans. TACs include both organic and inorganic chemical substances. Landfills are sources of TACs, particularly from LFG emissions and diesel exhaust. TACs are regulated separately from the CAPs at both the federal and state levels; however, the impacts of TAC emissions must be considered under CEQA for landfill projects. This AQIA evaluated TAC impacts for the Project through estimates of TAC emissions and through the completion of the human HRA presented in Section 4.

Localized levels of TAC emissions from the proposed Project were evaluated against existing health-based standards and CEQA guidelines in order to fully evaluate Project impacts.
The primary sources of LFG-derived emissions associated with Forward include VOC and TAC emissions from uncollected (fugitive) LFG and TAC emissions from LFG combustion. Combustion of Forward gas occurs in the landfill's two enclosed flares and in the internal combustion engines at the existing LFGTE facility at the landfill. The Project does not involve an increase in the rate of haul vehicle or mobile equipment activities; therefore, there is no increase in haul vehicle related activities for the CP to FP scenario. The exposure durations evaluated in this HRA are 70 years for all sources, though haul vehicle and equipment emissions would decrease or cease when the landfill reaches capacity. In the CA baseline, the number of

haul vehicles is less than the permitted number of vehicles, so there is an increase in haul vehicle emissions from the CA baseline to the FP.

CRITERIA AIR POLLUTANT EMISSIONS FROM CURRENT CONDITIONS

A summary of the total CAP emissions from LFG-derived and vehicle-derived sources for both Baseline scenarios (CA and CP) are provided in the following Tables ES-2 and ES-3. A more detailed discussion of the methodology used to estimate emissions is presented in Section 3.0.

TOXIC AIR CONTAMINANTS FROM CURRENT CONDITIONS

TAC constituents within LFG typically consist of benzene, chloroform, methylene chloride, perchloroethylene, trichloroethylene, vinyl chloride, as well as other TACs. TACs are also known as hazardous air pollutants (HAPs) under EPA regulations, though under California regulations, there are additional TACs beyond the federal HAPs. TAC emissions calculations are described in Section 3.0 of the AQIA Report. The risk evaluation for these TAC emissions is summarized below and presented in greater detail in Section 4.0.

PROJECT IMPACTS FROM CAP EMISSIONS

EMISSION CALCULATIONS

Using the methodology discussed in Section 3.0, Post-Project or FP CAP emissions for LFG-derived sources were estimated assuming two separate options: (1) additional Project LFG is controlled either by additional flare capacity (flare option) or (2) LFG engines at a new LFG to energy facility (LFG engine option). Detailed emission calculation tables are provided at the end of Section 3.0. A summary of Post-Project emissions under each of these conditions is provided in the following tables (ES-4 and ES-5).

The CAP impact emissions were established by determining the year of maximum LFG generation based on the EPA Landfill Gas Emissions Model (LandGEM) gas generation models. The methodology used in the modeling is discussed in Section 3.0. The model outputs for Baseline and Post-Project gas generation are provided in Tables 3-1A and 3-1B at the end of Section 3.0. A summary of model inputs and assumptions is provided as ***Appendix A***.

Please note that the use of the peak year for emissions under CEQA is the convention, but is a conservative assumption when evaluating LFG-derived emissions. Because LFG generation rises to a peak for only one single year (typically the year after landfill closure) and then decreases every year after that, the emissions from the peak year represent the maximum possible emissions for the landfill, and emissions for every other year will be less than the maximum values presented herein. Also, the peak LFG generation usually occurs in a year (again, typically the year after landfill closure) where other landfill sources are no longer operating or have reduced in magnitude.

The increase in CAP emissions attributable to the Project (Project emissions) was determined by comparing Baseline to Post-Project (FP) emissions. Table ES-6 presents a summary of Project CAP emissions using the CA scenario for Baseline emissions. Table ES-7 presents a summary of Project CAP emission using the CP scenario for Baseline emissions. It should be noted that recent CEQA decisions by California courts have established the practice of using the CA emissions for Baseline emissions, but this AQIA also includes discussion of CP emissions, which are more reflective and representative of the change in emissions from the Project.

Construction emissions were calculated for two construction operations attributable to the Project, the relocation of Littlejohn Creek, and the construction of a new landfill cell, which were assumed to occur in the same year. The emissions were calculated using the California Emissions Estimation Model (CalEEMod), a model developed by CARB to quantify emissions from land-use and construction projects for the purpose of evaluation under CEQA. Construction emissions are shown in Table ES-9.

Table ES-9 – Construction Emissions

Source	Emissions (tons/year)					
	ROG	CO	NOx	SO2	PM10	PM2.5
Cell Construction (equipment)	0.36	1.34	3.19	0.003	0.12	0.12
Cell Construction (worker trips and other sources)	0.19	0.91	1.80	0.000	0.08	0.08
Cell Construction (dust)					0.62	0.02
Creek Movement	0.31	1.74	2.38	0	0.08	0.08
Creek Movement (dust)					0.18	0.09
Total	0.86	3.99	7.37	0.00	1.08	0.39

THRESHOLDS OF SIGNIFICANCE

Based on the SJVAPCD's CEQA guidelines, project impacts are considered significant under CEQA if the project resulted in a net emissions increase of the following:

- 10 tons per year of VOC,
- 10 tons per year of NOx,
- 15 tons per year of PM_{10},
- 15 tons per year of $PM_{2.5}$,
- 27 tons per year of oxides of sulfur (SOx),
- 100 tons per year of CO.

As summarized on Table ES-8, Unmitigated Project impacts for VOC, NOx, and CO would be considered significant under all Project scenarios presented. SOx, PM_{10}, and $PM_{2.5}$ would be significant prior to mitigation for some scenarios.

SJVAPCD Rule 2201 requires that CAP emissions over rates set in Table 4-1 be offset by the acquisition of emission offsets. Because compliance with offset requirements is required under SJVAPCD rules, Project emissions from stationary sources would be considered not significant after permitting due to SJVAPCD rules requiring the purchase of emissions offsets. In the unlikely case that stationary source emissions would be permitted and the required Emission Reduction Credits (ERCs) would not be sufficient to reduce the increase in emissions below significance levels, additional ERCs would be obtained to reduce emissions to less than significant levels. Some increases from the CA Baseline have already been offset due to offsets acquired during the permitting of the existing sources when the Site obtained permits from the SJVAPCD. Recommended measures for addressing potentially significant impacts identified herein are summarized later in this Section and discussed in more detail within Section 5 of this AQIA.

ODOR IMPACTS

The SJVAPCD identifies a sanitary landfill as a type of facility that is a potential odor source. Because there are one or more sensitive receptors with the screening trigger distance of one mile from the landfill property, potential odor impacts from the Project must be considered. The District has established the following significance threshold for odor problems:

- More than one confirmed complaint per year averaged over a three-year period, or
- Three unconfirmed complaints per year averaged over a three-year period.

The facility has not received more than one odor complaint per year averaged over a three year period. Therefore, the odor impact for the Forward Project is not expected to be significant, and no additional measures to reduce odor impacts are recommended.

GREENHOUSE GASES

Global warming is an issue that has gained increased public attention over the last decade. Unlike emissions of criteria and toxic air pollutants, which have local or regional impacts, emissions contributing to global warming have a broader global impact. Landfills are a source of carbon dioxide and methane, which are greenhouse gasses (GHGs); however, the carbon dioxide is biogenic and would have been emitted whether the landfill existed or not. As biogenic emissions, carbon dioxide is not included in the GHG emissions, which is consistent with how carbon dioxide is treated in state and federal GHG programs. Methane is a result of the anaerobic conditions in the landfill and is anthropogenic (i.e., it is considered man-made).

In 2006, California passed Assembly Bill 32 (AB32), which requires the CARB to conduct GHG inventories. Landfills are included in the CARB GHG inventories, and account for 1.8% of California GHG emissions for the 2015 inventory.

SJVAPCD has issued guidance for the assessment of GHG significance from stationary sources. Projects can demonstrate that the associated GHG emissions are not significant by complying with SJVAPCD Best Performance Standards (BPS). SJVAPCD guidance indicates that the BPS for landfills could be compliance with the CARB Landfill Methane Rule (LMR). Forward is subject to LMR and is fully compliant with it; therefore, GHG emissions are not significant.

HEALTH RISK ASSESSMENT

In accordance with the SJVAPCD's CEQA guidelines, an HRA was conducted to evaluate Project impacts related to emissions of chemicals of potential concern (COPCs), including TACs, from the proposed Project scenario landfill. This HRA is summarized below and presented in greater detail in Section 4 of the AQIA Report.

OBJECTIVE

The primary objective of this HRA was to provide upper-bound, health conservative estimates of the potential human health impacts that may be attributable to COPC emissions from the surface emissions of LFG and LFG gas control devices.

CHEMICALS OF POTENTIAL CONCERN

The following categories of chemicals were considered potential contaminants at the Project site due to their presence in LFG. They have been the focus of previous investigative and monitoring efforts at Forward:

- VOCs present in LFG, such as benzene, vinyl chloride, etc.;
- Heavy Metals and other inorganic constituents present in LFG, such as mercury;

From these categories, a final list of specific COPCs was chosen for further risk analysis. A total of 28 compounds were identified or were expected to be present in LFG, emissions from control devices, or diesel engines present at the Project sites. These final COPCs became the focus of the HRA, including the exposure assessment, toxicity evaluation, and risk characterization steps.

EXPOSURE ASSESSMENT

Current Office of the Environmental Health Hazard Assessment (OEHHA) guidance requires the assessment of the inhalation, soil ingestion, dermal exposure, and mother's milk exposure pathways at a minimum. These exposure pathways were included in the HRA as required. The inhalation pathway is the risk driving pathway.

Upon completion of the emission estimates, exposure point concentrations (EPCs) for relevant chemicals were determined by conducting air dispersion modeling. Air modeling was used to approximate ground level concentration (GLC) at the point of exposure for each specific receptor scenario. Receptor locations were placed at fenceline locations and in a Cartesian grid per SJVAPCD guidance. Not all modeled receptor locations are occupied, but the unoccupied receptors are included in the risk analysis as a conservative approach. Impacts at the maximally impacted occupied receptor were calculated as well.

HUMAN INTAKE OF COPCS

The EPCs were then combined with various exposure factors (e.g., inhalation rate, exposure duration, body weight, etc.) for each receptor type to estimate the chronic daily intake (CDI) of the chemicals by humans. CDI is a measure of the amount of a particular chemical that will actually be taken into the body through the respiratory system and could potentially affect body organs.

The CDI values were evaluated in light of the toxicity of each particular chemical to determine health risk. For risk assessment purposes, chemicals are separated in two categories of toxicity, depending on whether they are carcinogenic (i.e., cancer-causing) or non-carcinogenic (i.e., causing health effects other than cancer, such as reproductive, liver, or nervous system disorders). Some chemicals can be both carcinogenic and non-carcinogenic (causing cancer as well as other, non-cancer health effects). This distinction reflects the current scientific opinion that the mechanisms of action for each category are different.

For chemicals exhibiting non-carcinogenic effects, reference doses (RfDs) and Reference Exposure Level (REL) were used to determine how potent the chemical is in causing health effects.

The acute REL is based on no-observed-adverse-effect-levels (NOAELs) or lowest-observed adverse effect levels (LOAELs) in the absence of NOAELs and is expressed in units of micrograms per cubic meter (ug/m^3). The chronic REL is derived from human population studies in an epidemiological, clinical, case, or experimental exposure setting, or they may involve experimental studies with animals. RELs are based on the most sensitive relevant adverse health effect reported in the medical and toxicological literature. To determine if the level of exposure to a population is unacceptable, the REL is compared directly to the EPCs.

For chemicals exhibiting carcinogenic effects, a cancer slope factor (CSF) is used to determine how potent the chemical is in causing cancer. The CSF is most often derived from animal studies and is expressed in units of ($[mg/kg/day]^{-1}$). The CSF is an expression of the cancer-causing potential of a particular contaminant; the larger the CSF, the greater the potential for that contaminant to cause cancer.

Regulatory default toxicity values (e.g., RfDs, RELs and CSFs) set forth by California EPA and/or U.S. EPA were used during the completion of this HRA.

RISK CHARACTERIZATION

Non-Carcinogens

The chronic non-carcinogenic risks were presented as the ratio of the CDI to the RfD (CDI:RfD) resulting in a number called the Hazard Quotient (HQ). In addition, the acute risks for residential receptors were presented as the ratio of the receptor concentration or EPC to the Reference Exposure Levels (RELs) (EPC:REL). The sum of all of the CDI/RFD or EPC/REL ratios (i.e., HQs) of chemicals under consideration is called the Hazard Index (HI). If the CDI or EPC is smaller than the RfD or REL, the HQ will be less than 1.0. If the CDI or EPC is larger than the RfD or REL, the HQ will be greater than 1.0.

An HQ less than 1.0 indicates that there is not likely to be any adverse health effects from the exposure. An HQ greater than 1.0 indicates that there is a potential health hazard for the exposed population.

When a human population is exposed to several chemicals contaminants, such as with the Project, HQs for each of the contaminants are added together to produce the HI. As with the HQs, an HI less than 1.0 indicates that there is not likely to be any adverse health effects from the exposure while an HI greater than 1.0 indicates that there is a potential health hazard.

The SJVAPCD CEQA guidelines have an HI threshold of significance of 1.0. This HI threshold of 1.0 was used as the CEQA significance level for evaluating the proposed Project scenarios.

Carcinogens

To determine the lifetime cancer risk for a particular chemical contaminant, CSFs are multiplied by the CDI of the contaminant under consideration. The total lifetime cancer risk for a site is determined by summing all the individualized cancer risks for the various chemicals of concern. The SJVAPCD CEQA guidelines define a significant risk as one greater than 20 in 1,000,000 ($2x10^{-5}$), and this $2x10^{-5}$ level was used in the HRA as the threshold of significance for the proposed Project.

RISK CHARACTERIZATION RESULTS

Risk characterization results for the Project sites are summarized below. Please note that since chronic non-carcinogenic and carcinogenic risks were based on the average COPC emissions from the worst-case 30 years of emission levels. The 30-year average values were considered appropriate for calculating long-term human health risks, which are generally based on 30 years of exposure rather than short-term exposure levels. When estimating acute hazard indices, the maximum 1-hour airborne concentration was used when determining EPCs.

RISK SUMMARY

Non-Carcinogenic Health Hazard

The total HI for the current conditions and the Project scenario was calculated to be less than 1.0; therefore, the non-carcinogenic human health hazard for the Project off-site populations is acceptable, as compared to all relevant regulatory standards.

Carcinogenic Risk

The total carcinogenic risk for the current conditions and the Project scenario was calculated to be less than $2x10^{-5}$ at the point of maximum impact (PMI), an unoccupied fenceline receptor.

Health conservative methodologies were used in this HRA in order to estimate potential health risks. These methodologies are anticipated to overestimate non-carcinogenic and carcinogenic health risk, possibly by an order of magnitude or more. For carcinogenic risks, the actual probabilities of cancer formation in the populations of concern due to exposure to carcinogenic COPCs are likely to be lower than the risks derived using the HRA methodology. Further explanation of the conservative nature of the methodologies is provided throughout the body of the AQIA document.

RECOMMENDATIONS

Measures can be taken to reduce emissions of CAPs resulting from the Project. These recommendations are proposed in order to reduce the Project impacts to less-than-significant or to the lowest level feasible.

Project VOC Emissions

Project VOC emissions are estimated to exceed the SJVAPCD's threshold of significance for all scenarios except Current Permitted to Project Flare scenario.

Recommendations Proposed as Part of the Project

Any Project VOC emissions from stationary sources in excess of the SJVAPCD threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during the permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. Mobile source VOC emissions are less than the VOC threshold of significance.

Results after Implementing Recommendations

Because all VOC emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by acquisition of emission offsets and VOC emissions from mobile sources are less than the threshold of significance, the Project impact from VOC emissions would be considered not significant after implementation of these recommendations.

Project NOx Emissions

Project NOx emissions are estimated to exceed the SJVAPCD's threshold of significance for all Baseline to Project scenarios considered for the AQIA except the Current Permitted to Project Engine scenario.

Recommendations Proposed as Part of the Project

Any Project NOx emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations.

Results after Implementing Recommendations

Because all NOx emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets, and NOx emissions from mobile sources are less than the SJVAPCD threshold of significance, the Project impact from NOx emissions would be considered not significant after implementation of these recommendations.

Project PM10 Emissions

Project PM_{10} emissions are estimated to exceed the SJVAPCD's threshold of significance for both Current Actual baseline scenarios.

Recommendations Proposed as Part of the Project

Any Project PM_{10} emissions from permitted stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. The Site is also subject to the District's Fugitive Dust Rules (Regulation VIII), which reduces dust emissions.

Results after Implementing Recommendations

Because all PM_{10} emissions from permitted stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets, and PM_{10} emissions from mobile sources are less than the SJVAPCD threshold of significance, the Project impact from PM_{10} emissions would be considered significant due to dust emissions and only when the Current Actual Baseline is considered. However, the Project does not propose a change in any of the dust generating activities as part of the Project; therefore, it is reasonable to use the Current Permitted Baseline to determine the significance of PM_{10} resulting from dust emissions.

Project PM2.5 Emissions

Project $PM_{2.5}$ emissions are estimated to exceed the SJVAPCD's threshold of significance for both Current Actual baseline scenarios.

Recommendations Proposed as Part of the Project

Any Project $PM_{2.5}$ emissions from stationary permitted sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. The Site is also subject to the District's Fugitive Dust Rules (Regulation VIII), which reduces dust emissions.

Results after Implementing Recommendations

Because all $PM_{2.5}$ emissions from stationary permitted sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets, and $PM_{2.5}$ emissions from mobile sources are less than the SJVAPCD threshold of significance, the Project impact from $PM_{2.5}$ emissions would be considered significant due to dust emissions and only when the Current Actual Baseline is considered. However, the Project does not propose a change in any of the dust generating activities as part of the Project; therefore, it is reasonable to use the Current Permitted Baseline to determine the significance of $PM_{2.5}$ resulting from dust emissions.

Project CO Emissions

Project CO emissions are estimated to exceed the SJVAPCD's threshold of significance for all scenarios except the Current Permitted to Project Flare scenario.

Recommendations Proposed as Part of the Project

Project CO emissions from stationary sources in excess of the SJVAPCD threshold will are likely to be offset by the acquisition of emission offsets during the air permitting process or have already been offset during the permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. It is possible for stationary sources to avoid the need for CO offsets through a modeling of CO emissions and demonstrating that impacts will not conflict with SJVAPCD limits. If offsets are avoided this way by the Site, the Site has effectively demonstrated that ground level CO impacts are not significant even if the CO emission threshold is exceeded. Mobile source CO emissions are less than the CO threshold of significance.

Results after Implementing Recommendations

Because all CO emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by acquisition of emission offsets and CO emissions from mobile sources are less than the threshold of significance, the Project impact from CO emissions would be considered not significant after implementation of these recommendations.

PROJECT ODOR IMPACT

The SJVAPCD's Odor threshold of significance is based on the history of odor complaints received. A review of odor complaints received for the Forward Landfill indicates the Project odor impact is not expected to be significant.

Recommendations Proposed as Part of the Project

No odor impact reduction measures are required. Forward will continue to implement its current odor control practices.

INCREASED GHG EMISSIONS FROM LFG

As discussed above, the GHG emissions from the project are not significant. The site will comply with the AB 32 LMR and thus can be considered to be not significant and the project results in a net reduction in atmospheric emissions of carbon due to the long term storage of carbon in the landfilled waste.

CUMULATIVE IMPACTS

SJVAPCD's *Guide for Assessing and Mitigating Air Quality Impacts* indicates that any proposed project that would individually have a significant impact on air quality would also be considered to have a significant cumulative air quality impact. By reducing emissions from the Project to less than significant through offsets, the Project is not expected to have a significant cumulative impact except for dust impacts when using the Current Actual Baseline. Since the Project does not include a change in the activity rate for dust generating sources, it is appropriate to use the Currently Permitted Baseline in determining the significance and cumulative significance of dust emissions.

SJVAPCD's GHG guidance document *Climate Change Action Plan: Addressing GHG Emissions Impacts under CEQA*, states that Projects meeting the BPS would not be cumulatively significant.

TABLE ES-2. CURRENT ACTUAL (CA) BASELINE LANDFILL EMISSIONS

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Baseline (Current Actual) Emissions						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (CA)	0.00	0.00	0.00	0.00	0.00	8.41
Landfill Gas Flare (CA)	13.64	54.55	9.27	9.27	5.86	3.08
Mobile Sources (CA)	4.21	1.54	0.08	0.08	0.01	0.62
Fugitive Dust (CA)			*130.86*	*130.86*		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
Total CA Baseline Emissions	**24.34**	**133.91**	**142.37**	**142.37**	**18.22**	**20.08**

TABLE ES-3. CURRENT PERMITTED (CP) BASELINE LANDFILL EMISSIONS

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Baseline (Current Permitted) Emissions						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (CP)	0.00	0.00	0.00	0.00	0.00	11.84
Landfill Gas Flare (CP)	35.48	141.91	24.13	24.13	15.26	8.02
Mobile Sources (CP)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (CP)			*326.78*	*326.78*		
Ameresco Plant (LFG Engines) (CP)	8.73	104.70	2.91	2.91	12.35	7.97
Total CP Baseline Emissions	***54.73***	***250.46***	***354.01***	**354.01**	***27.63***	***29.38***

TABLE ES-4. FUTURE POTENTIAL (POST-PROJECT) LANDFILL EMISSIONS (EXCESS PROJECT GAS TO FLARES)

Source	Criteria Pollutant Emissions					
	NOx	**CO**	**PM10**	**PM2.5**	**SOx**	**VOCs**
	(tons per year)					
Post Project Potential To Emit						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (Project)	0.00	0.00	0.00	0.00	0.00	13.48
Landfill Gas Flares (CP)	35.48	141.91	24.13	24.13	15.26	8.02
Mobile Sources (Project)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (Project)	0.00	0.00	*326.78*	*326.78*	0.00	0.00
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
New Flare (Project-flares)	7.14	28.55	4.85	4.85	3.07	1.61
Total Post Project Potential Emissions	***59.63***	***252.12***	***358.12***	***358.12***	***30.70***	***32.63***

TABLE ES-5. FUTURE POTENTIAL (POST-PROJECT) LANDFILL EMISSIONS
(EXCESS PROJECT GAS TO NEW LFG ENGINES)

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Post Project Potential To Emit						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (Project)	0	0	0	0	0	13.48
Landfill Gas Flare (CA)	13.64	54.55	9.27	9.27	5.86	3.08
Mobile Sources (Project)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (Project)			326.78	326.78		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
New LFGTE Engines (Project-engines)	20.08	240.93	6.69	6.69	38.24	24.68
Total Post Project Emissions	**50.73**	**377.15**	**345.11**	**345.11**	**56.48**	**50.76**

TABLE ES-6. BASELINE (CURRENT ACTUAL) VS POST-PROJECT POTENTIAL TO EMIT EMISSIONS

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Flare Option						
Total Baseline Emissions	24.34	133.91	142.37	142.37	18.22	20.08
Total Post-Project (Future Potential) Emissions	59.63	252.12	358.12	358.12	30.70	32.63
Project Emissions - Flare Option	**35.29**	**118.21**	**215.75**	**215.75**	**12.47**	**12.54**
LFG Engine Option						
Total Baseline Emissions	24.34	133.91	142.37	142.37	18.22	20.08
Total Post Project (Future Potential) Emissions	50.73	377.15	345.11	345.11	56.48	50.76
Project Emissions - LFG Engine Option	**26.39**	**243.23**	**202.73**	**202.73**	**38.25**	**30.67**

TABLE ES-7. BASELINE (CURRENT PERMITTED) VS POST-PROJECT POTENTIAL TO EMIT EMISSIONS

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Flare Option						
Total Baseline Emissions	54.73	250.46	354.01	354.01	27.63	29.38
Total Post-Project (Future Potential) Emissions	59.63	252.12	358.12	358.12	30.70	32.63
Project Emissions - Flare Option	**4.90**	**1.67**	**4.11**	**4.11**	**3.07**	**3.25**
LFG Engine Option						
Total Baseline Emissions	54.73	250.46	354.01	354.01	27.63	29.38
Total Post-Project (Future Potential) Emissions	50.73	377.15	345.11	345.11	56.48	50.76
Project Emissions - LFG Engine Option	**-4.00**	**126.69**	**-8.91**	**-8.91**	**28.85**	**21.38**

TABLE ES-8. PROJECT (NET) EMISSIONS - ALL SCENARIOS
(NET EMISSIONS: FUTURE POTENTIAL MINUS BASELINE)

Scenario	Criteria Air Pollutant Emissions					
	NOx	**CO**	**PM10**	**PM2.5**	**SOx**	**VOCs**
	(tons/yr)					
Future Potential - Current Actual (Flare Option)	35	118	216	216	12	13
Future Potential - Current Actual (LFG Engine Option)	26	243	203	203	38	31
Future Potential - Current Permitted (Flare Option)	5	2	4	4	3	3
Future Potential - Current Permitted (LFG Engine Option)	-4	127	-9	-9	29	21
CEQA Significant Impact Threshold [1]	10	100	15	15	27	10

[1] All CEQA significance thresholds listed are from *Air Quality Thresholds of Significance - Criteria Pollutants*

REPORT ORGANIZATION

The main body of this AQIA Report is organized as follows. Section 1 contains introductory material; a summary of the proposed Project, and a description of general site features, history, and past facility operations. Section 2 contains information on the environmental setting of the project, including topography and meteorology, regulatory setting, a summary of ambient air quality, existing emissions from the landfill, and information on sensitive receptors. Section 3 provides detail on the methodology for all of the emission calculations utilized in the estimation of CAP and TAC emissions. Section 4 contains the HRA utilized to evaluate risks associated with TAC emissions from the Project sites, and includes identification of chemicals of potential concern (e.g., TACs), identification of potentially exposed populations and exposure pathways, estimation of exposure point concentrations (EPCs), estimation of chronic daily intakes (CDIs) of the chemicals of concern were estimated, and risk characterization. Section 5 summarizes the Project impacts and measures recommended to reduce Project impacts. References used in the creation of this report are contained in Section 6.

Tables are numbered by report section, set forth in numerical order, and provided at the end of each section. An index of tables is provided at the end of each section. Figures are provided at the end of the document and before the Appendices.

Appendices A, B, C, D, E, and F include additional information and documentation on: (A) LFG modeling, (B) air dispersion modeling, (C) dispersion modeling files, (D) permits, (E) copies of relevant data from source test reports and emission factor documentation, and (F) CalEEMod output.

AIR QUALITY IMPACT ANALYSIS AND
AIR TOXICS RISK ASSESSMENT
FOR PROPOSED LANDFILL PROJECT 2018
FORWARD LANDFILL
MANTECA, CALIFORNIA

1 INTRODUCTION

This Air Quality Impact Analysis (AQIA) and Air Toxics Risk Assessment Report was prepared by SCS Engineers (SCS) on behalf of Forward, Inc. (Forward). The resumes of the primary SCS personnel responsible for the preparation of this report are attached hereto as Exhibit A. This report was developed to provide supporting documentation for a Supplemental Environmental Impact Report (SEIR) for Forward's proposed permit revision of the Forward Landfill (the Project) in Manteca, California. This SEIR supplements the certified *Forward Landfill Expansion Final Environmental Impact Report* (Grassetti Environmental Consulting, May 2013) (2013 FEIR), which proposed a larger expansion of Forward (2013 Project). Although the 2013 FEIR was certified, the project was not implemented due to issues concerning the Airport Land Use Plan. Implementation of the Project would also entail relocation of the south branch of the south fork of Littlejohns Creek, and some landfill structures and activities.

In order to assess the potential air quality impacts from the proposed Project, regional and local climatic conditions were evaluated insofar as they were expected to influence the nature of air pollution originating from the Project site. Air quality standards and regulations applicable to municipal solid waste (MSW) landfills were identified and analyzed for applicability to the Project site. Current levels of air quality pollution in the San Joaquin Valley Air Basin (SJVAB) were researched in order to determine the baseline air quality conditions prior to the implementation of the Project and to assess the Project-specific and potential cumulative air quality impacts of the Project.

From an air quality perspective, the implementation of the Project would potentially affect landfill gas (LFG)-related emissions (i.e., fugitive LFG and emissions from LFG control devices) and mobile source emissions from the increased haul vehicle activity (i.e. fugitive dust from roads). In this AQIA, SCS evaluated both current actual and current permitted air quality conditions prior to implementation of the Project as well as the future potential impacts to air quality attributable to criteria air pollutant (CAP), toxic air contaminant (TAC), and greenhouse gas (GHG) emissions from the Project. Implementation of the Project would consist of increasing the landfill capacity by expanding the landfill laterally. The Project involves no increase in the rate of landfilling or any increase in the rate of landfill-related equipment, so onsite equipment and haul vehicle emissions are not expected to change from the CP baseline The vehicle emissions would increase from the CA baseline because CP traffic levels are well above CA traffic. Landfills generally operate well below permitted traffic levels because they must have the permitted traffic capacity to accept peak traffic levels and they cannot control the need of third parties to dispose of waste. Furthermore, waste management jurisdictions are required to maintain waste disposal capacity for future waste generation. That waste generation is generally assumed to grow as population served grows.

The projected CAP increases in emissions from the Project were estimated and compared to levels of significance established by the San Joaquin Valley Air Pollution Control District (SJVAPCD) in their *Guide for Assessing and Mitigating Air Quality Impacts*, March, 2015 (CEQA Guidelines or GAMAQI). GHG emissions were evaluated using SJVAPCD guidance in *District Policy Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA* (December 2009). Recommendations, if necessary to reduce pollutants impacts, were considered.

In addition to the estimation of CAP and TAC emissions, the AQIA included an air toxics health risk assessment (HRA), which assessed the human health risks attributable to the TAC emissions associated with the current actual (CA), the current permitted (CP), and the future potential (Project) conditions.

BACKGROUND

The original Forward Landfill was permitted as a landfill in 1973. In 2002, the original landfill and Austin Road Landfill were merged to create the current landfill configuration. The facility is not open to the public. The remaining permitted capacity as of January 2017 is 16.6 million cy. This includes the total potential volume of all landfilled waste, cover material, and caps. Forward is proposing a lateral expansion of the refuse footprint from 355 acres to 372 acres, and relocating the south branch of the south fork of Littlejohns Creek. The proposed lateral expansion of the Class II refuse footprint would result in an approximate increase of 8.12 million cubic yards of landfill capacity.

SITE DESCRIPTION AND HISTORY

The project site, which is located in central San Joaquin County at 9999 South Austin Road in Manteca, California, provides refuse disposal for San Joaquin County and the greater area. Adjacent land use is agricultural to the east, west and south. A criminal detention facility is located approximately 1,900 feet north of the project site. One residence is located approximately 500 feet from the project site, across Austin Road; Forward currently leases this residence. Two residences are located approximately 0.5 miles southeast of the project site. A vicinity map is provided in ***Figures 1-1***. A map of the landfill is provided in ***Figure 1-2***. The property boundary and landfill surfaces are approximated as polygons. The difference in the shape of these polygons and the actual boundaries is not expected to impact modeling results.

In 2000, Forward purchased the Austin Road Landfill from the City of Stockton. The merger of the two landfills in 2002 created an approximately 567-acre project site; approximately 355 acres of the project site comprise the refuse footprint. Also located within the project site, is a transfer station/materials recovery facility (MRF) for processing recyclable materials, composting, and other green waste, which operates under a separate solid waste facility permit (SWFP).

The majority of the project site consists of several waste management units (WMUs) that are designed to contain Class II and III wastes and leachate. ***Figure 2*** shows the approximate WMU locations. The project site also includes a leachate collection and removal system (LCRS). The former Austin Road Landfill, which is located in the northern portion of the project site, began accepting municipal solid waste in 1954 and does not contain a base liner or a LCRS. Several WMUs overlie the top deck of the former Austin Road Landfill.

The MRF is adjacent to the southernmost landfill entrance and includes a scale, office trailer and processing and composting pads. The MRF is permitted to process up to 500 tons per day of construction and demolition debris, consumer recyclables, and green waste. Additional facilities associated with the landfill operation include: the landfill office, a maintenance and storage area, a LFG flare station that consist of two enclosed flares, leachate evaporation basins and sedimentation basins. Forward formerly operated a LFG to energy (LFGTE) plant along with a field of extraction wells, located at the former Austin Road Landfill. The LFGTE facility was formerly operated by a third party, Covanta, and was shut down in 2012. Another third party, Ameresco Inc. (Ameresco), constructed a new facility, which commenced operation in February 2014.

The landfill is operated under permits issued to Forward, Inc. Forward is a Class II sanitary landfill facility as defined by the State Water Resources Control Board. Uses currently allowed on sites such as the project site, with the SW (solid waste) designation, include landfills and ancillary activities such as equipment maintenance, collection and processing of recycled materials, composting, and energy/transformation operations.

Under Forward's current SWFP, 355 acres of the permitted landfill area will be used for refuse disposal. Austin Road provides primary access to the project site. Paved and unpaved roads are located throughout the project site. The peak landfill elevation for Forward is 210 feet above MSL at the southern portion of the existing fill area. Final fill contours slope from 210 feet MSL to a final deck elevation of 170 feet MSL in the northwestern portion of the project area. The proposed lateral expansion will result in a maximum final fill elevation of 190 feet MSL.

Forward is currently permitted to accept Class II and III wastes; asbestos with greater than one percent friable asbestos and treated auto shredder waste were granted a variance to be disposed of in the Class III waste area. Non-hazardous solid wastes, which include commercial and industrial waste, are accepted at Forward. These wastes include sewage sludge, dredge and fill materials, soils contaminated with petroleum hydrocarbons and other soluble solids, metals-contaminated wastes, etc. Forward also accepts construction and demolition wastes, processed tires, residential waste, agricultural wastes, etc., agricultural wastes, and construction/demolition wastes.

High liquid content wastes, or wastes that contain more than 50 percent water by weight, are not accepted at Forward except for sludges that meet specific criteria which are accepted for disposal in the lined areas of the landfill with a LCRS. Designated wastes are also accepted at Forward.

Forward's SWFP permits allow it to accept a maximum of 8,668 tons per day (tpd) on any one operating day and 46,080 tons per week, which equates to a maximum of approximately 2,396,160 tons of solid waste disposed per year.

Landfill Gas to Energy Plants and Flares

The Ameresco facility includes two Jenbacher JGS616 lean-burn compression ignition engines that utilize LFG from the landfill to power two 2.71 Megawatt (MW) electrical generators. The generated electricity is sold to Pacific Gas and Electric Company (PG&E).

Forward currently maintains two LFG destruction flares with a combined capacity of approximately 5,330 standard cubic feet per minute (scfm). LFG must be destroyed or otherwise properly managed for air quality purposes. The existing flares are located in the northeastern portion of the landfill.

PROJECT DESCRIPTION

The proposed physical and operational changes and a brief discussion of their environmental impacts in relation to the original project are described below.

Allow Development of Additional Landfill Disposal Cells Within Currently Permitted Landfill Boundary

Development of additional landfill cells would increase the disposal footprint from approximately 355 acres to 372 acres. The proposed additional development area includes two areas within the currently permitted landfill boundary; approximately 8.72 acres in the northeast corner of the site and approximately 8.61 acres in the south area. The acreage added in the south area is gained by shifting the existing disposal footprint north and realigning the creek to the southern and eastern boundaries of the site. The maximum elevation of refuse fill in the additional development areas would be approximately 180 feet above MSL, lower than the permitted maximum height of 210 feet MSL for the existing Forward Landfill. The footprint of the refuse fill would be set back a minimum of 100 feet from the east property boundary.

The additional development area would have a base liner and LCRS consistent with currently constructed modules and in compliance with pertinent regulatory requirements.

The projected total remaining airspace for the Forward Landfill, as of January 2017 is approximately 16.6 million cubic yards (mcy). The proposed expansion would add approximately 8.1 mcy of disposal airspace, which would allow disposal at the Forward Landfill to extend to 2036. While all of the proposed expansion would be Class II landfill space, it is anticipated that Class III waste would be disposed in the expansion areas along with Class II waste.

In comparison to the 2013 Project, the proposed Project is anticipated to significantly reduce most of the environmental impacts identified in the 2013 FEIR. The proposed Project adds only 8.1 million cy of landfill capacity versus the 32 million cy in the original project and the projected landfill closure date is 2036 versus 2039 for the original proposed project. The smaller added landfill capacity and earlier closure date reduces air quality, traffic, and noise impacts when compared to the original project. Since development will not extend onto the Brocchini parcel, there will be less potential biological and cultural resource impacts. The impact on visual quality will be similar to existing permitted conditions.

The reduced infill development area of the proposed project is all outside a 10,000-foot radius from the end of the runway at the Stockton Metropolitan Airport. It is within the horizontal and conical zone of the Stockton Airport Land Use Plan but under these surfaces. It is also not on any parcels with Williamson Act Contracts. Therefore, Land Use impacts are significantly less than the original project.

Relocate South Branch of the South Fork of Littlejohns Creek

To provide further separation of the creek from the landfill, create a contiguous disposal area, and optimize landfill airspace, an approximately 2,900-foot reach of the South Branch of the South Fork of Littlejohns Creek would be relocated to the eastern and southern boundaries of the landfill. The creek relocation is intended to:

(1) provide adequate flood control (i.e., to have capacity to carry the 100-year flow within its banks), and;
(2) provide a stable channel design that meets or exceeds the functions and values of the existing creek.

The relocated creek would be 3,300 feet in length. The existing creek traversing the landfill is generally a trapezoidal channel with 10 to 12 foot banks and a 10- to 15-foot bottom width. The channel measures, on average, 60 feet from bank top to bank top. This equates to a 4.13-acre creek zone. There is little riparian habitat because the creek channel is regularly cleared of emergent vegetation by County personnel.

The existing channel would be moved approximately 1,000 feet to the south to accommodate the further development of the Forward Landfill. The proposed relocated channel would be approximately 3,300 feet long and would have greater flood control ability than the existing channel. To address Federal Aviation Administration (FAA) concerns regarding creation of bird habitat, riparian habitat restoration/creation is proposed to be mitigated offsite versus being incorporated within the relocated creek channel. The proposed relocation would create approximately 1.41 acres of U.S. Army Corps of Engineers (USACE) jurisdictional areas that are inundated at a regular basis. Constructing the channel would require moving approximately 50,000 cubic yards of material. Litter control in the relocated creek would follow established litter control practices at the site. A combination of monitored litter fences, screening, and litter pickers would be used.

A bridge will be constructed to cross the relocated creek. The bridge will provide a clear span of the creek with foundations located in the creek embankment.

The environmental impacts of the creek relocation would be the same as discussed in the 2013 FEIR[2].

Ancillary Facilities

It is currently anticipated that refuse filling will continue on the northern portion of the site in the valley between the former Austin Road Landfill and the original Forward Landfill and then in the northeast infill. Development of the south infill will occur after realignment of the South Branch and completion of refuse filling in the northern area, except for the easternmost cell that parallels Austin Road. This easternmost cell will be reserved for operations soil management until the remainder of the landfill is constructed.

After the easternmost cell that parallels the Austin Road is constructed, the existing office trailer will be relocated just north of WMU A, so that a sedimentation pond can be constructed in its place. The main entrance will remain in its current location, except for periods of time when refuse filling is occurring in the northeast or south infill. At these times the entrance/exit may be relocated to the north or south landfill entrance/exit. The scales will be relocated depending on the entrance/exit being used and will be sited in a location that allows sufficient space for queuing within the facility boundary.

Once the South Branch is relocated, the existing permitted leachate/compost pond, WMU F South, would be relocated adjacent to the existing leachate pond, WMU F-North. The existing permitted sedimentation basin would be combined with the existing sedimentation basin located directly north of the existing leachate pond, WMU F-North. Closure and relocation of the leachate and sedimentation basin would be in accordance with applicable regulations and as approved by the regulatory agencies.

[2] *Forward Landfill Expansion Final Environmental Impact Report* (Grassetti Environmental Consulting, May 2013)

2 ENVIRONMENTAL SETTING

The environmental setting for the proposed Project was evaluated in order to describe existing local and regional air quality conditions prior to initiation of the Project. An environmental setting for a project includes existing meteorological conditions, current pollutant levels, applicable laws and regulations, and other local and/or regional characteristics, which will affect the impact that a proposed project might have on air quality.

Federal and state air quality standards have been established for CAPs, including: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), suspended particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead (Pb). The United States Environmental Protection Agency (EPA) has promulgated National Ambient Air Quality Standards (NAAQS) for these CAPs to protect public health and welfare; the State of California has also published standards (termed State AAQS or SAAQS) for these pollutants. The federal and state ambient air quality standards for the CAPs are listed on ***Table 2-1***, provided at the end of this Section.

Documented health effects from the exposure to these pollutants include acute respiratory infections, chronic bronchitis, pulmonary emphysema, and bronchial asthma. These pollutants are emitted from a variety of industrial sources including power plants, wastewater treatment facilities, hospitals, oil refineries, natural gas production facilities, gasoline stations, and automobiles. Landfills can also be a source of these CAPs.

The ability of a state or designated air basin within California to meet these standards becomes the basis for how sources of CAPs are regulated within that basin, including how CAP emissions from proposed projects are evaluated under CEQA. Since landfills are a source of these CAPs, landfill operational emissions must be considered in any CEQA analysis for a proposed landfill expansion.

In addition to the CAPs, TACs are airborne substances that are capable of causing short-term (acute) and/or long-term (chronic or carcinogenic; i.e., cancer-causing) adverse human health effects (e.g., injury or illness). TACs include both organic and inorganic chemical substances. They are also emitted from a variety of common sources including gasoline stations, automobiles, dry cleaners, industrial operations, and painting operations. Chemical and biological research facilities and landfills are also sources of TACs. TACs are regulated separately from the CAPs at both federal and state levels.

TOPOGRAPHY AND METEOROLOGY

The primary factors that determine air quality are the locations of air pollutant sources and the amounts of pollutants emitted. Topographical and meteorological conditions are also important. The project site is located in San Joaquin County, which lies within the northern portion of the SJVAB.

The SJVAB is approximately 250 miles long and averages 35 miles wide. It is defined by the Sierra Nevada mountains in the east, the Coast Ranges in the west, and the Tehachapi mountains in the south (SJVAPCD, 2015). The valley of the SJVAB, which opens to the sea at the Carquinez Straits where the San Joaquin-Sacramento Delta empties into the San Francisco, is nearly flat with a slight downward gradient to the northwest.

Generally, marine air flows into the basin from the San Joaquin River Delta. However, the region's topographic features restrict air movement through and out of the basin (SJVAPCD, 2015). The Coast Range impedes wind access into the valley from the west, the Tehachapi's inhibit southerly passage of airflow, and the Sierra Nevada range forms a significant barrier to the east. The topographic features of these ranges result in weak air flow, which becomes blocked vertically by high barometric pressure over the San Joaquin valley (SJVQPCD, 2015). As a result, the SJVAB is extremely susceptible to pollutant contamination over time.

Temperature and Precipitation

The SJVAB has an "inland Mediterranean" climate with over 260 sunny days per year (SJVAPCD, 2015). The valley is characterized by warm, dry summers and cool winters. Summer temperatures often exceed 100 degrees Fahrenheit (F), averaging in the low 90s in the northern valley and high 90s in the south (SJVAPCD, 2015). The daily summer temperature variation can reach nearly 30 degrees F.

During the winter, the cyclonic storm track moves southward, and the storm systems moving in from the Pacific Ocean bring a maritime influence to the SJVAB (SJVAPCD, 2015). The Sierra Nevada Mountains to the east prevent the cold, continental air masses of the interior from influencing the valley. Therefore, the winters tend to be mild and humid, with temperatures below freezing very unusual. Average high temperatures are in the 50s but temperatures of 30 to 40 degrees F can occur on days with persistent fog. The average daily low is 45 degrees F (SJVAPCD, 2015).

Precipitation at the project site is typical of the Central Valley region, with approximately 90 percent of the seasonal rainfall falling between November and April. The Department of Public Works divides San Joaquin County into three rainfall zones; the project site is located in the Zone 2 indicating a mean annual precipitation of 13.5 inches.

LAWS AND REGULATIONS

Regulation of air quality is achieved through both federal and state standards and emission limits for individual sources of air pollutants. The following subsections provide a synopsis of federal, state and regional air regulations that are pertinent to the Project landfill.

Federal

The 1977 federal Clean Air Act (CAA) and the 1990 amendments to the CAA required the EPA to identify NAAQS to protect public health and welfare. NAAQS have been established for the following CAPs: O_3, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and Pb. EPA publishes criteria documents to justify the choice of standards. Current standards for these pollutants are listed in Table 2-2.

In 1997, EPA adopted new national ozone standards, but subsequently revoked the 1-hour standard in June 2005. In October 2015, EPA lowered the 8-hour ozone standard from 0.08 parts per million (ppm) to 0.07 ppm. In 2006, EPA lowered the national 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. EPA designated the attainment status of SJVAPCD as nonattainment for the new standard by December of 2009. Additional details pertaining to the federal and state AAQS can be found in Table 2-2.

Pursuant to the 1990 CAA Amendments (CAAA), the EPA has classified air basins (or portions thereof) as either “attainment” or “non-attainment” for each criteria air pollutant, based on whether or not the NAAQS have been achieved.

The CAA requires each state to prepare an air quality control plan referred to as the State Implementation Plan (SIP). The 1990 CAAA additionally required states containing areas that violate NAAQS to revise their SIPs to incorporate additional control measures to reduce air pollution. The EPA has responsibility to review all state SIPs to determine if they conform to the mandates of the CAAA and will achieve air quality goals when implemented.

Regulation of TACs, termed Hazardous Air Pollutants (HAPs) under federal regulations, is achieved through federal and state controls on individual sources. Federal law defines HAPs as non-criteria air pollutants with short-term (acute) and/or long-term (chronic or carcinogenic) adverse human health effects. The 1977 CAA required the EPA to identify and set forth National Emission Standards for Hazardous Air Pollutants (NESHAPs) to protect public health and welfare.

The 1990 CAAA established a technology-based approach for reducing air toxics, such that designated HAPs are regulated under a two-phase strategy. The first phase involves requiring facilities to install Maximum Achievable Control Technology (MACT). MACT includes measures, methods and techniques, such as material substitutions, work practices, and operational improvements, aimed at reducing toxic air emissions. There are currently MACT standards for 174 source categories. In addition, the CAA requires the EPA to review and revise the standards, if necessary, to account for improvements in air pollution controls and/or prevention every 8 years after implementing the MACT standards. The final MACT standard for MSW landfills was promulgated on January 16, 2003 and took effect a year later. Forward is subject to this MACT standard.

In September 1999, the EPA promulgated the Urban Air Toxics Strategy (UATS), which identifies pollutants and sources that have been determined to be issues in urban areas and is the second phase of the agency’s two-phase process for regulation of air toxics. Landfills are included on the regulated source list for the UATS due to emissions of vinyl chloride, benzene, and other TACs. However, Forward is not subject to the UATS regulations since the regulation is defined to affect minor sources not captured by the NESHAPs/MACT.

New landfills, as defined by the EPA, are regulated under Section 111(b) of the federal CAA; existing landfills are controlled under the guidelines of Section 111(d). Collectively, these regulations are known as New Source Performance Standards (NSPS) for MSW as set forth under 40 Code of Federal Regulations (CFR) Part 60, Subpart WWW. NSPS and its associated Emission Guidelines (EG) for MSW landfills (40 CFR 60, Subpart Cc) can have a substantial effect on landfill operations. New NSPS and EG rules (40 CFR Part 60, Subpart XXX and 40 CFR 60 Subpart Cf) were promulgated on August 29, 2016; however, Forward is not presently subject to these new regulations. If this proposed expansion is approved, and when Forward commences construction on it, Forward will become subject to the new NSPS rule (Subpart XXX). Prior to that time, Forward could become subject to the new EG rule is one covering the SJVAPCD is approved by EPA.

The intent of the NSPS rule and EG is to reduce emissions of LFG. The pollutants of concern contained within LFG are non-methane organic compounds (NMOC) and methane. Compliance requirements are based on the design capacity of the landfill and its NMOC emission rate to be calculated using the EPA's Landfill Generation Emissions Model (LandGEM) and default model inputs. If a landfill exceeds a threshold of 50 Megagrams (Mg) per year of NMOC emissions (34 Mg/year under the new rules), then the operator must install LFG collection and control systems to extract and destructively combust LFG (i.e., in a flare, boiler, or engine generator). Operations, monitoring, record keeping, and reporting for the collection/control system must be implemented in accordance with stated requirements.

The NSPS rule applies to all new MSW landfills. A new landfill under Subpart WWW is defined as a MSW landfill that started construction, or began initial waste acceptance on or after May 30, 1991. Forward falls into this category. A landfill modification (e.g., expansion) that occurs after July 17, 2014 would subject the landfill to the new NSPS rule under Subpart XXX. MSW landfills that meet the above date criteria and have a design capacity greater than 2.5 million Mg (or 2.5 million cubic meters) of waste must evaluate NMOC emissions to determine their requirements under the NSPS rule. Forward's design capacity exceeds these thresholds, and its NMOC emissions exceed the limits under both the old and new rules.

The EG apply to all existing landfills (as opposed to the NSPS, which applies to new landfills), . The requirements of EG are similar to those of NSPS, except that the state in which the landfill is located plays a role in establishing the actual regulations through the SIP process.

Forward is currently subject to the new EG rule (Subpart Cf) , based on the fact that the landfill accepted waste after November 8, 1987, but has not commenced construction on an expansion after July 17, 2014. The EG rule is not fully effective until the State of California submits an EG rule that conforms to Cf, and the rule is approved by the EPA. As such, Forward currently has no obligations under the new rule.

However, as soon as construction is commenced on the proposed expansion, Forward will officially be subject to 40 CFR Part 60, Subpart XXX. Until such time as the expansion occurs or California receives approval for the new EG rule, Forward will remain subject to the exiting NSPS rule under Subpart WWW.

Under the federal 1990 CAAA, major stationary sources are required to obtain Title V operating permits. Title V is a federally-enforceable state operating permit program set forth under 40 CFR

Part 70. Major sources of CAPs or TACs are required to apply for and obtain Title V operating permits. The Title V programs are developed at the state or local level, as outlined in 40 CFR Part 70. All landfills subject to NSPS or EG are also subject to Title V, regardless of emissions or major source status. A Title V permit is an umbrella permit, which consolidates all federal, state, and local air quality regulations and requirements into one permit. Although the Title V permit is required in addition to any Authority to Construct (ATC) permits or Permits to Operate (PTO) required by any local agency, these additional permits are incorporated into the Title V permit and, thus, the Title V permit becomes the overall guiding document for air quality compliance at a site. Currently, Forward has a Title V Operating Permit (No. N-339-0-3).

Starting in 2010 reporting year, Forward has been required to report its GHG emissions to the EPA under the federal Mandatory Reporting Rule (MRR). The MRR does not prohibit or limit GHG or other emissions. The MRR requires that Forward monitor and report GHG emissions, including calculated methane generation and stationary combustion of fossil fuels. The Project will not change the status or requirements for Forward under the MRR.

State

The California Air Resources Board (CARB), California's state air quality management agency, regulates mobile emissions sources and oversees the activities of local Air Pollution Control Districts (APCDs) and regional Air Quality Management Districts (AQMDs). The CARB regulates local air quality indirectly through the SAAQS and vehicle emission standards, by conducting research activities, and through its planning and coordinating activities. Other CARB duties include monitoring air quality in the state. The CARB has established and maintains, in conjunction with local APCDs and AQMDs, a network of sampling stations that monitor what the pollutants levels are actually present in the ambient air.

California has adopted ambient standards that are more stringent than the federal standards for the CAPs and are shown in Table 2-2. Under the California Clean Air Act (CCAA), patterned after the federal CAA, areas have been designated as attainment or non-attainment with respect to SAAQS.

California state law defines TACs as air pollutants having carcinogenic or highly toxic non-carcinogenic effects. The State Air Toxics Program was established in 1983 under AB 1807 (Tanner). Over 200 substances have been designated TACs under California law; they include the 188 (federal) HAPs adopted in accordance with AB 2728 and additional chemicals regulated by the state.

The Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources; however, AB 2588 does not directly regulate or limit air toxics emissions. TAC emissions from individual facilities are quantified and prioritized. Under AB 2588, "high-priority" facilities are required to perform an HRA and, if specific thresholds are violated, are required to communicate the results to the public in the form of notices and public meetings. Depending on the risk levels, emitting facilities are required to implement varying levels of risk reduction measures. The SJVAPCD implements AB 2588 and is responsible for prioritizing facilities that emit air toxics in the SJVAB through its permitting program. Forward has recently submitted a Toxic Emission Inventory Plan (TEIP) and a Toxic Emission Inventory Report (TEIR) to the SJVAPCD as part of AB2588's requirements.

California has implemented air emissions regulations for landfills under the state's air pollution control authority. The state has established control criteria, collection and control system requirements, testing and reporting requirements, and exemption criteria for MSW landfills. Control criteria include levels of tested air contaminants, average maximum concentrations of total organics over a certain area, and maximum concentration of organic compounds as methane at any location along the landfill surface. These requirements have been incorporated into the rules and regulations of the SJVAPCD.

The Calderon Amendments to the California Health and Safety Code (H&SC Section 41805.05) require that all landfills perform gas and ambient air testing for ten compounds (vinyl chloride, benzene, ethylene dibromide, ethylene dichloride, methylene chloride, perchloroethylene, carbon tetrachloride, methyl chloroform, trichloroethylene, and chloroform) and report the results to the local air districts. The primary objective of these tests, the so-called air quality solid waste assessment tests (Air SWATs), is to provide a screening basis to characterize landfill air releases and subsurface gas migration at landfills. The Calderon program is no longer being implemented in the state, rather compliance activities are assumed to occur as part of the AB 2588 air toxic emission inventory program.

In 2006, California passed Assembly Bill 32 (AB32), which requires the CARB to conduct GHG inventories. Landfills are included in the CARB inventories, and account for 1.4% of California GHG emissions for 2008 in the most recent inventory. Implementation of early action measures and mandatory reporting requirements are recently promulgated, and will directly affect landfills. Forward is not currently required to report its GHG emissions under the AB32 mandatory reporting program but may be required to report as LFG combustion emissions increase or if electrical generation is added to the site, which is owned and operated by Forward. If that LFGTE capacity is developed by a third party, that third party will be responsible for reporting emissions. CARB has developed a statewide cap and trade program; however, landfills are not capped sources under the regulation.

In response to AB32, CARB passed the Landfill Methane Rule, (LMR), which is intended to reduce methane emissions from landfills. The LMR requires additional monitoring and collection of LFG at landfills subject to the rule. Forward is subject to the rule, and the Project will not impact the status of Forward with respect to the LMR.

Regional

The SJVAPCD was formed in 1991 to oversee air quality matters in the SJVAB. The main office of the SJVAPCD is located in the Fresno with regional offices located in Bakersfield in the Southern Region and Modesto in the Northern Region. The SJVAPCD is responsible for controlling stationary sources of pollution, as well as implementing transportation control measures to reduce mobile source emissions.

The SJVAPCD is responsible for implementing and enforcing the NSPS, EG, MACT, and Title V programs for landfills. In the future, they will likely be required to implement the UATS regulations. The SJVAPCD also issues PTO, for facilities, including Forward, which meet the permitting criteria specified in Regulation II, Rule 2010.

SJVAPCD Rule 2010 specifies ATC and permitting requirements for new or modified sources. An ATC/PTO is required to be obtained from the SJVAPCD for the proposed Forward expansion project. During the permitting process, the Project will evaluate additional SJVAPCD permitting requirements, such as dust control requirements.

SJVAPCD Rule 2201 describes new source review (NSR) requirements. The Rule applies to all new and modified emission sources subject to applicable Rule 2010 permitting requirements. The purpose of the Rule is to provide for the review of new and modified sources and provide mechanisms, including the use of Best Available Control Technology (BACT), BACT for toxics (TBACT), and emission offsets, by which ATCs for such new and modified sources may be granted. This Rule implements the no net increase requirements of Section 40919 (a)(2) of the California Health and Safety Code.

Each of these regulations, as well as the NSPS/EG requirements, will be incorporated into the SJVAPCD ATC/PTO and Title V permit revision for the Forward expansion project.

CRITERIA AIR POLLUTANTS

The air quality of the SJVAB is determined by routinely monitoring changes in the quantities of criteria pollutants in the ambient environment. Air quality in the area is a function of the criteria pollutants emitted locally, the existing regional ambient air quality, and the meteorological and topographic factors, which influence the intrusion of pollutants into the area from sources outside the immediate vicinity.

The CARB and SJVAPCD maintain ambient air quality monitoring stations at numerous locations throughout the basin. The stations provide information on average concentrations of criteria air pollutants. These data are measured against the air quality standards the EPA and CARB have established in an effort to protect human health and welfare. These standards are listed in Table 2-2 at the end of this section. Geographic areas are designated “attainment” if these standards are met and nonattainment if they are not met. Attainment classifications for the SFBAAB for both state and federal CAP standards are presented below:

Table 2-1. San Joaquin Valley Air Basin CAP Attainment Status

Pollutant	Federal Standard Classification	State Standard Classification
Carbon Monoxide	Attainment/Unclassified	Attainment/Unclassified
Ozone (8 hr)	Nonattainment/Extreme	Nonattainment
PM_{10}	Attainment	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
Nitrogen Dioxide	Attainment/Unclassified	Attainment/Unclassified
Sulfur Dioxide	Attainment/Unclassified	Attainment

Air Pollutant Properties, Effects, and Sources

The following section describes the pollutants of greatest importance in the SJVAB, including a description of the physical properties, the health and other effects of the pollutant, and its sources. In general, air quality in the SJVAB is most affected by elevated ozone, $PM_{2.5}$, and PM_{10} levels within the basin, which have caused the air basin to be designated as non-attainment for the state standards. Therefore, sources of ground level ozone, such as volatile organic compounds (VOCs) and NO_2 emissions, and sources of PM_{10} (e.g., fugitive dust, combustion sources, etc.), and $PM_{2.5}$ are of greatest concern for the SJVAPCD. CO levels within the basin are also of concern but to a lesser extent. CO has not exceeded federal or state CO standards at a monitoring station since 1991 but localized CO hotspots may still occur. SOx, is not considered to be a pollutant of concern for this Project, and is not currently an air quality issue within the SJVAB. Ambient levels of SOx are well below federal or state standards.

Ozone (O_3)

O_3 is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere. Through a complex series of photochemical reactions, in the presence of strong sunlight and ozone precursors (NO_x and VOCs), O_3 is created. Motor vehicles are a major source of O_3 precursors. O_3 causes eye and respiratory irritation, reduces resistance to lung infection, and may aggravate pulmonary conditions in persons with lung disease.

Carbon Monoxide (CO)

CO is an odorless, invisible gas usually formed as a result of incomplete combustion of organic substances and is primarily a winter pollution problem. Motor vehicle emissions are the dominant source of CO in the SJVAB. CO concentrations are influenced by the spatial and temporal distributions of vehicular traffic, wind speed, and atmospheric mixing. High levels of CO can impair the transport of oxygen in the bloodstream, thereby aggravating cardiovascular disease and causing fatigue, headaches, and dizziness.

Respirable and Fine Particulate Matter (PM)

PM_{10} and $PM_{2.5}$ consist of particulate matter 10 microns and 2.5 microns, respectively, or less in diameter (one micron is one one-millionth of a meter), which can be inhaled. Relatively small particles of certain substances (e.g., sulfates and nitrates) can cause lung damage directly, or can contain adsorbed gases (e.g., chlorine or ammonia) that may be injurious to health. Primary sources of PM emissions in the SJVAB are entrained road dust, industrial operations, and fugitive windblown dust.

The amount of particulate matter, PM_{10}, and $PM_{2.5}$ generated is dependent on the soil type and the soil moisture content. Vehicle traffic generates particulate matter and PM_{10} emissions through entrainment of dust and dirt particles that settle onto roadways and parking lots.

Sulfur Oxides (SOx)

SOx is not considered to be a pollutant of concern for this project, and is not currently an air quality issue within the SJVAB. Ambient levels of SO_X are below federal or state standards.

EXISTING LANDFILL EMISSIONS

Air Emissions

Landfills are potential sources of gas mixtures generated from the natural decomposition of organic wastes and vapors from volatile compounds present in the waste. Volatile organics are produced by biological processes or chemical reactions in the landfill. Transport mechanisms, such as diffusion, convection, and displacement, transport a volatile constituent present in the vapor phase to the surface and into the atmosphere. The major factors affecting the air emission production mechanisms are composition of waste, moisture content, temperature, age of landfill, pH, and availability of oxygen and nutrients for bacteria. The major factors affecting transport are soil porosity, concentration gradient, compatibility of waste, amount of compaction, overburden weight, and rate of precipitation and evaporation.

LFG, consisting primarily of methane and carbon dioxide (CO_2), is produced by the actions of microorganisms in the landfill under anaerobic conditions. Initially decomposition is aerobic until the oxygen supply is exhausted. Anaerobic decomposition produces relatively high concentrations of CO_2 and methane. This two-stage process consists of altering complex organic material into simple organic materials by a group of facilitative and anaerobic bacteria, commonly called "acid formers," and then the consumption of these simple organic compounds, normally organic fatty acids, by methanogenic bacteria to form methane and CO_2.

LFG consists of approximately 50% CO_2 by volume, 50% methane, and trace amounts of NMOCs. Other constituents of LFG can include ammonia, hydrogen sulfide, nitrogen, oxygen, and CO, along with a variety of NMOCs, some of which are VOCs. Organic air emissions from landfills may include some toxic compounds and hazardous compounds with carcinogenic and non-carcinogenic health effects.

The five major effects of LFG emissions are: (1) human health and vegetation effects from ozone produced by VOC emissions, (2) carcinogenicity and other possible non-cancer health effects from TAC emissions, (3) global warming effects from methane emissions, (4) explosion hazards, and (5) odors and nuisance.

Criteria Air Pollutants

The current Forward Landfill has been in operation and generating LFG since 1954. Currently, the site has an LFG collection and control system consisting of a network of gas collection wells and a LFG blower/flare station with two enclosed flares. The north eastern area of the site contains a LFGTE facility owned and operated by Ameresco, Inc. As such, the primary sources of landfill operational emissions originating from Forward include VOC emissions from uncollected LFG, CAP emissions from LFG control equipment, and emissions of PM_{10} and $PM_{2.5}$ from fugitive dust sources (e.g., disturbances of earth, dumping of waste, application of daily cover, etc.).

This AQIA is concerned primarily with CAP emissions from LFG-derived sources and secondarily with CAP emissions from landfill equipment and traffic. A summary of current emissions from the landfill is provided in ***Table 3-6A*** in Section 3.

Toxic Air Contaminants

Based upon data from other landfills, TAC constituents within LFG typically consist of benzene, chloroform, methylene chloride, perchloroethylene (PCE), trichloroethylene (TCE), vinyl chloride (VC), as well as other TACs. TACs are also known as HAPs in federal regulations and the two terms are used interchangeably in this AQIA. Information about current TAC emissions from the landfill are presented in various tables provided at the end of Section 3.0. In addition, an HRA for TACs was performed as part of this AQIA, and is presented in Section 4.0.

Odorous Emissions

As bacterial decomposition proceeds, odoriferous compounds can escape from the landfill surface through cracks in the surface cover. Other possible sources of odors are the actual wastes. Some household and consumer products contain substances with distinctive odors. The major contribution to odors comes from two groups of compounds: the first group is dominated by esters and organosulfurs, and the second group consists of alkyl benzenes and limonene. Together with hydrocarbons, the second group is probably responsible for the background smell associated with a landfill.

The sensory perception of odorants has four major dimensions: detectability, intensity, character, and hedonic tone. Odor detectability consists of a detection threshold and a recognition threshold. The detection threshold is the lowest concentration of an odorant that will elicit a sensory response in 50 percent of the population. There is an awareness of the presence of an added substance, but not necessarily an odor sensation. The detection thresholds are determined using human subjects and sophisticated dilution equipment.

Detection thresholds are published for more than 900 chemicals. The recognition threshold is the minimum concentration that is recognized as having a characteristic odor quality by a segment of the population. Odor intensity refers to the perceived strength of the odor sensation, and odorant character is what the substance smells like (e.g., fishy, rancid, hay, sewer, turpentine, ammonia, etc.). Hedonic tone is a category judgment of the relative pleasantness or unpleasantness of the odor, and is influenced by factors such as subjective experience and frequency of occurrence (Cha, 1991). For example, roses have been demonstrated to possess an odor with pleasant hedonic tone. Garbage has been demonstrated to possess an odor with an unpleasant hedonic tone.

Because offensive odors rarely cause any physical harm and no requirements for their control are included in state or federal air quality regulations, the SJVAPCD does not currently have any rules or regulations that place quantifiable limitations on emissions of odorous substances, other than its nuisance Rule 4102. Any actions related to odors are based on citizen complaints to local governments and the District.

GHG Emissions

As waste decomposes in landfills, it generates LFG, a gas consisting of approximately 50 percent methane and 50 percent carbon dioxide. Both carbon dioxide and methane are GHG, which absorb energy and contribute to global warming and climate change; however, LFG derived carbon dioxide (including carbon dioxide from LFG combustion) are considered biogenic and part of the normal carbon cycle. Unlike CAPs and TACs, which have regional impact, GHG have global impact.

SENSITIVE RECEPTORS

Some receptors are considered more sensitive than others to air pollutants. The reasons for greater sensitivity than average include pre-existing health problems, proximity to the emissions source, or duration of exposure to air pollutants. Land uses such as primary and secondary schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because the very young, the old, and the infirm are more susceptible to respiratory infections and other air quality-related health problems than the general public.

Residential areas are considered sensitive to poor air quality because people in residential areas are often at home for extended periods. Recreational land uses are moderately sensitive to air pollution, because vigorous exercise associated with recreation places a high demand on the human respiratory function. Child and adult residential receptors have been considered in the HRA as a sensitive receptor.

Specific sensitive receptors as they pertain to this Project are considered in detail in the HRA presented in Section 4.0.

SECTION 2. INDEX OF TABLES

Table 2-1 San Joaquin Valley Air Basin CAP Attainment Status
Table 2-2 State and National Ambient Air Quality Standards

Table 2-1 is provided in the section text. Table 2-2 is provided on the following page.

Table 2-2. STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards[1] Concentration	California Standards[1] Attainment Status	National Standards[2] Concentration[3]	National Standards[2] Attainment Status
Ozone	8 Hour	0.070 ppm (137μg/m³)	N	0.075 ppm 147 μg/m³	NEx
	1 Hour	0.09 ppm (180 μg/m³)	NSv		
Carbon Monoxide	8 Hour	9.0 ppm (10 mg/m³)	AU	9 ppm (10 mg/m³)	AU
	1 Hour	20 ppm (23 mg/m³)	AU	35 ppm (40 mg/m³)	AU
Nitrogen Dioxide	1 Hour	0.18 ppm (338 μg/m³)	A	0.1 ppm (189 μg/m³)	AU
	Annual Arithmetic Mean	0.030 ppm (56 μg/m³)	A	0.053 ppm (100 μg/m³)	AU
Sulfur Dioxide	24 Hour	0.04 ppm (105 μg/m³)	A	0.14 ppm (365 μg/m³)	AU
	3 hour			0.5 ppm (1330 μg/m³)	AU
	1 Hour	0.25 ppm (655 μg/m³)	A	0.075 ppm (200 μg/m³)	AU
	Annual Arithmetic Mean			0.030 ppm (80 μg/m³)	AU
Particulate Matter (PM10)	Annual Arithmetic Mean	20 μg/m³	N		
	24 Hour	50 μg/m³	N	150 μg/m³	A
Particulate Matter - Fine (PM2.5)	Annual Arithmetic Mean	12 μg/m³	N	12 μg/m³	N
	24 Hour			35 μg/m³	N
Sulfates	24 Hour	25 μg/m³	A		
Lead	Calendar Quarter			.15 μg/m³	U
	30 Day Average	1.5 μg/m³	A		
Hydrogen Sulfide	1 Hour	0.03 ppm (42 μg/m³)	U		
Vinyl Chloride (chloroethene)	24 Hour	0.010 ppm (26 μg/m³)	A		
Visibility Reducing particles	8 Hour(1000 to1800 PST)	See Footnote 4	U		

A=Attainment N=Nonattainment U=Unclassified S=Serious Sv= Severe Ex=Extreme

mg/m³=milligrams per cubic meter ppm=parts per million μg/m³=micrograms per cubic meter

Table 2-2. STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1-hour and 24-hour), nitrogen dioxide, suspended particulate matter - PM10, and visibility reducing particles are values that are not to be exceeded. The standards for sulfates, Lake Tahoe carbon monoxide, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour or 24-hour average (i.e., all standards except for lead and the PM10 annual standard), then some measurements may be excluded. In particular, measurements are excluded that ARB determines would occur less than once per year on the average. The Lake Tahoe CO standard is 6.0 ppm, a level one-half the national standard and two-thirds the state standard.

2. National standards other than for ozone, particulates and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent three-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than one. The 8-hour ozone standard is attained when the 3-year average of the 4th highest daily concentrations is 0.08 ppm or less. The 24-hour PM10 standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 µg/m3. The 24-hour PM2.5 standard is attained when the 3-year average of 98th percentiles is less than 65 µg/m3.

Except for the national particulate standards, annual standards are met if the annual average falls below the standard at every site. The national annual particulate standard for PM10 is met if the 3-year average falls below the standard at every site. The annual PM2.5 standard is met if the 3-year average of annual averages spatially-averaged across officially designed clusters of sites falls below the standard.

3. National air quality standards are set at levels determined to be protective of public health with an adequate margin of safety.

4. Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

3 EMISSIONS CALCULATIONS

To determine air emissions impacts resulting from the current conditions and the Project scenario, emissions estimates for LFG-derived sources, including LFG surface emissions and LFG control equipment, and landfill vehicle emissions were calculated. This section provides a discussion of the methodology used to estimate Current Actual, Current Permitted, and Future Potential emissions from Project. The increased emissions from the Current Actual baseline also results in increases in emissions associated with an increase in on-site vehicle trips and equipment, as previously discussed. The Project would also include the movement of the Littlejohn Creek and construction of new landfill cells. Construction emissions from these two projects have been included in this evaluation.

Current landfill emissions were based on the current in-place refuse tonnage and current waste disposal projections, which were derived from the SWFP and discussions with and data provided by Forward, as well as control device data provided by Forward and SCS Field Services.

All emission calculation results discussed in Section 3 are provided in tables at the end of the Section.

LFG GENERATION MODELING

The LFG generation rate estimates for the Current Actual and Current Permitted, and Future Potential (Project) scenarios were based on the EPA's LandGEM . Inputs for the model included in-place and projected refuse amounts, period of operation (years) ultimate methane generation potential ("L_0" value), and the refuse decay rate coefficient ("k" value). The inputs and assumptions used in the LFG generation modeling are presented as ***Appendix A***. LFG generations modeling results are presented at the end of this Section as follows:

LFG Modeling Results Summary Tables:

Current Actual / Current Permitted Scenarios	Table 3-1A
Future Potential Conditions	Table 3-1B

Refuse data were derived from information provided by Forward, with projected disposal rates based on the existing permit limit. EPA AP-42 default values for "L_0" and "k" of 3,204 ft^3/ton and 0.02, respectively, were used. The "k" value for dry sites was used based on annual average rainfall of 15 inches for Manteca, California. Projected refuse tonnage increase was calibrated based on future disposal through the year 2030, when the currently permitted landfill capacity is projected to be reached.

Methane content was assumed to be 50 percent. The most recent source test report for the landfill indicates an actual methane content of 44.3 percent, but all estimates were normalized to 50 percent methane as is standard practice.

Based on the expected cover types for all three scenarios, SCS determined gas collection system efficiency for all three scenarios of 95.31 percent per methodology described in the Solid Waste Industry for Climate Solutions (SWICS) report dated January 2009. This collection efficiency is similar to the collection efficiency of 95.37 percent used in the 2014 AQIA.

A summary of the LFG modeling inputs and assumptions is provided in ***Appendix A***.

TAC EMISSIONS MODELING

Modeling of TACs emissions was included in the modeling runs for CAPs for the landfill surface, flares, the LFGTE plant, future LFG-fired engines, and landfill vehicle traffic. These runs were performed using peak year inputs for the current actual, current permitted, and future potential scenarios. For the current actual scenario, the average LFG generation rate from past years (2016 and 2017) was used, which is consistent with what the SJVAPCD regulations consider as current actual.

TACs emissions data were used to perform an HRA for the Project. For the purpose of conducting an HRA to assess chronic exposure, it is more appropriate to use average emissions over an extended period rather than peak year emissions data. Therefore, because landfill surface emissions represent the primary contributor to Project emissions, additional TACs modeling runs were performed for these average emission scenarios. For the current permitted and future potential scenarios, the worst-case 30-year span was used; 2018 through 2047 for current permitted, and 2029 through 2058 for future potential. For baseline scenario calculations, chronic exposure was calculated assuming 30 years of exposure to 2016-2017 emissions. Acute risk was calculated for each scenario based on the year of peak LFG production for each scenario.

These additional TACs modeling runs are summarized in Tables 4-1 through 4-10 provided at the end of Section 4.0. The results of the HRA performed for this AQIA is presented in Section 4.0.

CAP EMISSIONS MODELING

Unlike TAC emissions, CAP emissions are a regional air quality problem. As such, the peak year emissions are used for the current permitted and the future potential.

LFG-derived CAP Emissions

The LFG-derived emissions for the current actual scenario are based upon the annual LFG generation averaged over the past two years (2016 and 2017) as well as actual data for the various control devices over that period. The LFG-derived emissions for the current permitted scenario are based on the peak year of LFG generation (2031) under current permitted limits for landfill surface emissions and permitted capacities for exhaust emissions from the flares. The LFG-derived emissions for the future potential scenario are based on the peak year of LFG generation (2037) under the proposed expansion. As previously noted, peak year emissions are very conservative, as the LFG generation gradually increases each year until the year following landfill closure, then gradually declines every year thereafter. However, use of peak year LFG generation is established practice for CEQA review, and we have used it in our analysis.

On-Site Vehicle-derived Combustion and Fugitive Dust Emissions

The vehicle-derived dust emissions for the current actual scenario are based upon operational data provided by Forward and dust calculation methods from EPA's AP-42 Chapters 13.2.1 and 13.2.2. These data include average daily vehicle count, average vehicle weight, average load weight, and average distances traveled on both paved and unpaved surfaces per vehicle trip.

The vehicle-derived emissions for the current permitted scenario are based on the refuse and MFR material tonnage projected for the current permitted peak year of 2030, as indicated on Table 3-1A and the maximum vehicle count of 620 per day allowed under the SWFP. The estimated current permitted tonnage and vehicle trips were combined to get an average vehicle load weight. The average unloaded vehicle weight value used for the current actual scenario was retained in calculating current permitted scenario emissions.

Because the Project includes no increase in permitted disposal rates, the Project fugitive dust emissions are based on the emissions that would be permitted after the Project, which are equivalent to the CP emissions. Current Actual levels of vehicle activity are not at permitted levels, so there is a difference between Current Actual and Current Permitted emissions.

On-site vehicle derived CAP emissions were calculated using the same vehicle counts and total haul distances, as well as emission factors calculated using the Emission Factor (EmFac2017) model developed by CARB. As with dust emissions, there is an increase from the Current Actual CAP emissions to the Current Permitted emissions, but there is no increase from the Current Permitted levels from the Project. This difference in results is the result of the Current Actual vehicle trip rate being well under the Current Permitted rate and the fact that the Project does not seek an increase in the amount of permitted trips.

Surface Emissions of LFG

For all three scenarios, all of the LFG that is not collected by the LFG collection system was assumed to be emitted through the surface of the landfill. As such, fugitive emissions of total VOCs as well as individual toxic VOCs in LFG were accounted for within this AQIA and accompanying HRA.

For the purposes of this AQIA, a list of "regulated toxic compounds" was developed from the current list of HAPs regulated by the EPA under the federal CAA and chemicals regulated by the CARB under the AB 2588 air toxic "hot spots" program. These lists were cross-referenced against the list of toxic substances expected to be present in LFG, as identified in the EPA's AP-42 section on landfills.

Concentrations of the regulated toxic compounds in LFG were determined in one of three ways. If analytical data were available for a particular compound, the site-specific concentrations were used in lieu of any regulatory default value. If actual measured concentrations were not available, average concentrations of compounds were derived from the Waste Industry Air Coalition (WIAC 2001) report on toxics in LFG. If actual measured concentrations of WIAC data were not available, default concentrations were derived from AP-42 for only those compounds that are expected to be present in LFG. Analytical data used for determining actual measured concentrations of compounds were taken from the report of the results of the source test conducted at Forward on May 3, 2007 by SCEC. The source test report is dated June 4, 2007. A copy is provided in ***Appendix B***.

The concentration of NMOC in LFG which was used in the landfill surface emission calculations is the AP-42 default value of 595 parts per million by volume (ppmv). As the NMOC concentration in LFG is typically variable, actual data were not used in the analysis for estimating peak emissions.

Using the individual contaminant concentrations determined as previously described and the amount of LFG that was expected to escape collection, SCS estimated the chemical-specific emission rates that were anticipated to occur through the surface of the landfill.

Measured and Calculated Emissions from LFG Control Devices

Emissions were calculated for LFG combustion in the various control devices in which Forward gas is combusted. Control devices fall into three categories: 1) enclosed flares located at landfill and owned and operated by Forward; 2) two LFG to energy engines which are owned and operated by Ameresco and 3) LFG-fired engines currently being considered as an option for future control of Project LFG. It is assumed that any additional LFG-fired engines would have emissions similar to the existing Ameresco engines and that any additional flares would have emissions similar to the existing flares.

Emission factors for the enclosed flares for all CAPs were taken from the limits listed in Forward's SJVAPCD Title V permit   A copy of the permit is provided in Appendix D. Emission factors for the Ameresco LFG-fired electrical generation facility were taken from the Ameresco SJVAPCD permit.

LFG throughput for the flares and the Ameresco LFGTE engines was determined for the current actual scenario from operating records obtained from SCS Field Services, Forward, and Ameresco Inc. LFG throughput for the flares for the current permitted scenario is based on the combined permitted capacity of both flares. It should be noted that operation of the LFGTE engine was assumed to remain constant at the current actual level for all scenarios. For the Future Potential scenario, two options were developed. The Flare Future Potential option assumes all collected LFG above the LFGTE current actual level goes to current and future flare capacity. The LFG Engine Future Potential option assumes all collected LFG above the LFGTE current actual and flare current permitted levels is combusted in new LFGTE engines.

Please note that the use of the peak year for emissions under CEQA is a conservative assumption when evaluating LFG-derived emissions. Because LFG generation rises to a peak for only one single year (typically the year after landfill closure) and then decreases every year after that, the emissions from the peak year represent the maximum possible emissions for the landfill, emissions for every other year for the current permitted and future potential scenario will be less than the maximum value presented herein.

Landfill Flares

Emissions of CAPs from the landfill flares for all three scenarios are calculated using the actual and predicted LFG flow rate to the flares and the following emission factors:

- 0.05 lbs/MMBtu NOx, per Title V Permit limit (Appendix E)
- 0.20 lbs/MMBtu for CO, per Title V Permit limit (Appendix E)
- 0.0113 lbs/MMBtu for NMOC/VOC, per Title V Permit limit (Appendix E)
- 0.034 lbs/MMBtu for PM_{10}, per Title V Permit limit (Appendix E)
- 0.0215 lbs/MMBtu for SOx as TRS, per Title V Permit limit (Appendix E)

LFGTE Plant Engines

Emissions of CAPs from the IC engines in the Ameresco LFGTE plant for all three scenarios are calculated using the actual LFG flow rate to the engines, assuming 50% methane content, and the following emission factors:

- 0.15 g-NOx/bhp-hr for NOx, per District Permit (Appendix E)
- 1.8 g-CO/bhp-hr, per District Permit (Appendix E)
- 0.20 g-VOC/bhp-hr for NMOC/VOC, per District Permit (Appendix E)
- 0.05 g-PM10/bhp-hr for PM_{10}, per District Permit (Appendix E)
- 150 ppmv TRS for SO_X, per District Permit (Appendix E)

IC-Engines - New Landfill Gas to Energy Facility

Emissions of CAPs from the IC engines in a new LFGTE facility for the Future Potential scenario are calculated using the predicted methane flow rate to the engines, assumed 50% methane content, and the following emission factors:

- 0.15 g/bhp-hr for NOx, per current BACT
- 1.8 g/bhp-hr for CO, per current BACT
- outlet concentration of 20 ppmv at three percent oxygen for NMOC/VOC, per current BACT
- 0.07 g/bhp-hr for PM_{10}, per current BACT
- 150 ppmv TRS for SO_X, equal to flare limit per current BACT

Please note that assuming current permitted emission factors for future flares and engines is conservative as it is likely that more stringent emission requirements in the future would result in lower emission rates for such equipment.

Estimated Current Actual, Current Permitted, and Future Potential (Post-Project) Scenario Emissions from Forward Landfill

The calculations that were used to develop emissions estimates for the current actual, current permitted, both options of future potential scenarios are detailed on the tables listed below and provided at the end of Section 3. The emissions calculations are a combination of the LFG modeling, emission factors for CAPs, analytical and regulatory default data on TACs in LFG, and other information discussed previously in this Section. These various parameters are used to generate emission estimates for CAP and TACs.

Emission Summary Tables

TAC and CAP emissions from landfill fugitive emissions, LFG control devices, and vehicle traffic for the three scenarios are presented at the end of the Section in the following tables:

Current Actual	Landfill Fugitive Emissions:	Table 3-2A
	Landfill Flares:	Table 3-3A
	LFGTE Engines:	Table 3-4A
	Vehicle Dust:	Table 3-5A
	Vehicle CAP Emissions	Table 3-5B
	Operating Equipment	Table 3-15
Current Permitted	Landfill Fugitive Emissions:	Table 3-2B
	Landfill Flares:	Table 3-3B
	LFGTE Engines:	Table 3-4A
	Vehicle Dust:	Table 3-5A
	Vehicle CAP Emissions	Table 3-5B
	Operating Equipment	Table 3-15
Future Potential	Landfill Fugitive Emissions:	Table 3-2C
(Flare Option)	Landfill Flares:	Table 3-3C
	LFGTE Engines:	Table 3-4A
	Vehicle Dust:	Table 3-5A
	Vehicle CAP Emissions	Table 3-5B
	Operating Equipment	Table 3-15
Future Potential	Landfill Fugitive Emissions:	Table 3-2C
(LFG Engine Option)	Landfill Flares:	Table 3-3B
	LFGTE Engines:	Table 3-4A
	New LFGTE Facility:	Table 3-4B

Vehicle Dust:	Table 3-5A
Vehicle CAP Emissions	Table 3-5B
Operating Equipment	Table 3-15

GREENHOUSE GAS EMISSIONS

Global warming is an issue that has gained increased public attention over the last decade. Unlike emissions of criteria and toxic air pollutants, which have local or regional impacts, emissions contributing to global warming have a broader global impact. Landfills are a source of carbon dioxide and methane, which are greenhouse gasses (GHGs).

In 2005, California Governor Arnold Schwarzenegger signed Executive Order (EO) S-3-05, which established a GHG reduction level for 2050 of 80% reduction of 1990 GHG emissions in California. In 2006, California passed Assembly Bill (AB) 32, which requires the CARB to conduct GHG inventories. Landfills are included in the CARB inventories, and account for 1.8% of California GHG emissions for 2015 in the most recent inventory.

When conducting its inventories, CARB uses default values from EPA's AP-42 document and NSPS rules. CARB assumes that gas collection and control systems (GCCSs) collect 75% of the generated LFG from a landfill, 10% of methane passing through the landfill cover is oxidized, and 98% of methane sent to flares and other control devices is destroyed.

SWICS believes that these default values are very conservative and out of date. SWICS has developed collection efficiency, methane oxidation, and methane destruction rates based on recent research (SWICS, 2009). These SWICS values are based on the cover type at the landfill, the results of surface emissions monitoring (SEM), and the liner type at the landfill. Because Forward has multiple cover types, the weighted average of the cover types is used to determine the collection efficiency, and methane oxidation rates. Both the CARB default values and the SWICS site specific values are shown in Table 3-8 below.

Table 3-8. CARB and SWICS Values Used to Calculate GHG Emissions

	Collection Efficiency	Methane Oxidation in Landfill Cover	Methane Destruction Efficiency in Flare	Methane Destruction Efficiency in Engines
CARB Default Value	75%	10%	98%	98%
SWICS Calculated Value	95.31%	25%	99.96%	98.34%

Landfills are also a place where carbon is stored, removing it from the carbon cycle and preventing its emission as carbon dioxide. When waste is placed in a landfill, not all of the carbon decomposes into methane and carbon dioxide. The carbon that does not decompose is sequestered in the landfill.

Though CARB acknowledges that some of the carbon placed in landfills is never emitted, their most recent inventory does not include a line item for the carbon stored in landfills. Instead, they include a line item for carbon sinks under the forestry/land use section of the inventory. This line item includes carbon sequestered in landfills as well as other sinks related to forestry and land use. CARB does not have a methodology for the storage of carbon in landfills, and does not count the sequestered carbon as a GHG emission reduction.

Carbon dioxide emissions from landfills and the combustion of LFG are considered to be biogenic. Methane emissions are considered to be anthropogenic because they are caused by the artificially anaerobic conditions in the landfill. Though most GHG inventories do not include biogenic emissions or put them in a separate category from anthropogenic emissions, the GHG estimates for this document include the biogenic carbon dioxide emissions in the inventory.

The Current Actual GHG emissions are calculated based on the emissions and storage from 1990, the baseline year defined in AB32, through 2050, the final year of state commitments for GHG reductions. The Current Actual scenario assumes no waste is placed after 2017. The Current Permitted scenario assumes waste placement continues until the currently permitted capacity is reached. The Future Potential GHG emissions were calculated using the proposed Project scenario which allows additional waste to be stored at the landfill. Year 2050 was chosen as the final year of the inventory based on the GHG reduction goals set in EO S-3-05. It also allows a long enough period after closure to show emissions of GHG after the landfill closure, when no additional sequestration is occurring since waste disposal has ceased.

GHG emissions were calculated for four scenarios:

- Current Actual, which assumes waste placement at Forward stops in 2017;
- Current Permitted, which assumes waste placement continues until the site reaches its current permit limit;
- Future Permitted (flare), which is the Project scenario assuming all LFG not sent to the LFGTE or Ameresco facilities is destroyed in a flare;
- Future Permitted (engine), which is the Project scenario assuming all LFG resulting from the Project is destroyed in an engine and the energy is recovered as electricity.

These GHG calculations assume the same collection and destruction rates over the years considered. They neglect the fact that there was a period before the gas collection and control system (GCCS) was installed during which no LFG was collected. Emissions from that period would be the same for all four scenarios and would not affect the conclusions drawn regarding the change in emissions due to the project since the relative differences are the same.

GHG emission reductions were calculated for energy displaced based on the GHG emission factor determined by the EPA's Emissions and Generation Resource Integrated Database (eGRID) program. It is assumed that energy generated from the LFG displaces energy that would have been produced elsewhere in the CAMX region. Energy production from the LFG is assumed to change proportionally to the LFG generation, and LFGTE developers will utilize their unused capacity of the existing energy projects. Additional energy generation is under development by Ameresco and additional generation may be explored. ***Table 3-9*** shows the energy displacement for each scenario. The total GHG emissions displaced is included in the GHG totals below as a credit for the landfill.

Table 3-10 shows the total GHG emissions from the landfill for the current actual and future potential scenarios. As discussed above, the methane emission is anthropogenic and is always considered a GHG emission from the landfill. The carbon dioxide emission is biogenic, but is also considered as an emission from the landfill, but should not be attributed to the landfill since carbon dioxide from refuse would normally occur in the natural carbon cycle. The energy displacement credit is a credit for the landfill. The carbon sequestration is also a credit for the landfill. The total GHG emissions from Forward are the sum of the methane and carbon dioxide emissions minus the power displacement and carbon sequestration credits. Negative totals indicate that more GHG is displaced and carbon is stored in the landfill than is GHG is emitted.

It should be noted that the amount of carbon sequestered is greater than the GHG emissions from the landfill for all scenarios. When carbon storage is included in the GHG total for the project, the Project lowers the GHG emissions of Forward because more carbon is sequestered in the landfill where it will not be emitted as either methane or carbon dioxide.

SJVAPCD guidance states that projects that comply with District Approved Best Performance Standards (BPS) are not significant. For landfills, the BPS could be compliance with CARB's LMR, California Code of Regulation (CCR) Subchapter 10, Article 4, Subarticle 6, Sections 95460 to 95476. Forward is subject to the LMR and complies with the requirements of the regulation. As such, it meets the BPS and the GHG emissions are not significant per SJVAPCD guidance.

CONSTRUCTION EMISSIONS

Two types of distinct construction phases were identified for the Project. The first distinct construction project is the relocation of the Littlejohn Creek. The second type of project is the construction of new landfill cells. For purposes of the evaluation of construction emissions, it was assumed that the creek relocation would occur at the same time as the construction of a new cell. This assumption is conservative and would result in the maximum peak construction emissions for a given year.

Littlejohn Creek Relocation

California Emissions Estimation Model (CalEEMod) was used to quantify the emissions from the relocation of the Littlejohn Creek. CalEEMod is an emission model developed by CARB and replaces the Urban Emission Model (URBEMIS). It is the preferred model for estimating emissions from construction projects.

The relocation of the Littlejohn Creek would occur over 1.41 acres and require the movement of 50,000 cubic yards of soil. This construction project is smaller than the construction project proposed to move the Littlejohn Creek in as part of the 2014 AQIA. The impacts of that construction project were determined to be less than significant, therefore the impacts of the currently proposed relocation project are less than significant. Detailed construction equipment information is not available, so CalEEMod default values for rough grading have been used. CalEEMod default phases that would not occur (e.g. building construction, architectural coatings) were removed from the modeling. CalEEMod results are included as Appendix F. CalEEMod has been updated since the 2014 AQIA, but the changes are not expected to materially change the calculated emissions.

New Cell Construction

Construction equipment use during new cell construction was available from previous cell construction projects. This information includes equipment lists, hours of operation, quantities of soil moved, and the construction schedule. Due to the availability of detailed construction equipment use, the emissions from that equipment was calculated outside of CalEEMod and is shown in ***Table 3-11***. Calculations mimic the CalEEMod calculation methodology and use the emission factors, operating hours, and load shown in ***Table 3-11***. Emissions from other sources (e.g. worker trips, soil movement) was calculated using CalEEMod and are included as Appendix F. CalEEMod has been updated since the 2014 AQIA, but the changes are not expected to materially change the calculated emissions.

Total construction emissions are shown in ***Table 3-12***.

Table 3-12 – Construction Emissions

Source	Emissions (tons/year)					
	ROG	CO	NOx	SO2	PM10	PM2.5
Cell Construction (equipment)	0.36	1.34	3.19	0.003	0.12	0.12
Cell Construction (worker trips and other sources)	0.19	0.91	1.80	0	0.08	0.08
Cell Construction (dust)					0.62	0.02
Creek Movement	0.31	1.74	2.38	0	0.08	0.08
Creek Movement (dust)					0.18	0.09
Total	0.86	3.99	7.37	0.003	1.08	0.39

Off-Site Haul Vehicle Emissions

Off-site Haul vehicles emit pollutants as they transport waste to the Site. The emissions are directly related to the distance traveled. To quantify the emissions from the haul vehicles, the average haul distance was calculated for major waste origins. These distances and the average are shown in Table 3-13. Emissions from the haul vehicles were quantified and are shown in Table 3-14. Emission factors for the vehicles were modeled using the Emission Factor 2017 (EmFac2017) model, a model developed by CARB to quantify emissions from highway vehicles. All haul vehicles were assumed to be heavy duty diesel vehicles traveling at 55 miles per hour for purposes of determining the emission factor.

Emissions for the Current Actual scenario are based on the distance from the centroid of each major waste origin area to the Site and the amount of waste originating in that region. Waste origins were obtained from the CalRecycle Disposal Reporting System.

The Current Permitted emissions are scaled up from Current Actual results based on annual tonnage limits. Tonnages were provided by Forward. The difference between Current Actual and Current Permitted emissions is not attributable to the Project because any truck taking waste to the Site would otherwise be headed to an alternative landfill. That is, the amount of waste generated within the region is independent of the Project. Because fuel consumption and driving time are considerations when determining the destination of waste, it is reasonable to conclude that many haul vehicles use Forward for disposal because it is the closest available landfill. When Forward closes, those vehicles will have to choose alternative sites that are likely to be further away. Historically, the alternative sites have included haul distances as far as 130 miles.

These off-site emissions have not been included in summary tables as they are not directly attributable to the Site and would not be impacted by the Project.

Table 3-13 – Off-Site Haul Vehicle Travel Distances

Waste Origin[1]	Tons	% of total	Quantity of Trips	Distance to Forward
Citrus Heights	34,030	4%	5,051	69
El Dorado County	50,195	6%	7,450	133
Elk Grove	58,580	7%	8,695	41
Manteca	42,813	5%	6,355	7
Modesto	74,456	8%	11,051	22
Rancho Cordova	32,974	4%	4,894	63
Sacramento (city)	90,984	10%	13,504	56
Sacramento (county)	94,623	11%	14,045	46
San Leandro	40,626	5%	6,030	62
Santa Clara	44,627	5%	6,624	79
Stanislaus	43,567	5%	6,466	31
Stockton	160,316	18%	23,795	11
Other	120,623	14%	17,904	N/A
Total	888,414		131,864	
Weighted Average				44.3

Table 3-14 – Off-Site Haul Vehicle Emissions

Scenario	ROG	CO	NOx	SO2	PM10	PM2.5	CO2
	tons per year						
Current Actual	1.2	4.7	36	0.1	0.9	0.9	9,236
Current Permitted	4	14	106	0.3	3	3	27,011

Landfill Equipment Emissions

The operational equipment emissions were calculated for the Current Actual scenario based on the Site's list of equipment, the recorded run time for each piece of equipment, the brake horsepower (bhp) for that equipment, the typical load factor for that type of equipment, and the emission factor for that piece of equipment. The operating time and bhp were obtained for Site records. The load factor and emission factors for each pollutant were obtained from the CalEEMod documentation and are based on Offroad2007 emission factors. Emission factors are based on the year, equipment type, and horsepower of each piece of equipment. Current Actual emissions from operating equipment are shown in ***Table 3-15***. A summary of equipment emissions is shown in ***Table 3-16***.

Table 3-16 – Operating Equipment Emissions

Scenario	ROG	CO	NOx	SO2	PM10	PM2.5	CO2
	tons per year						
Current Actual	3.708	12.726	30.651	0.036	1.189	1.189	3,959
Current Permitted	3.708	12.726	30.651	0.036	1.189	1.189	3,959
Project	3.708	12.726	30.651	0.036	1.189	1.189	3,959

On-site equipment emissions will be quantified and included in the emission calculations from the site. Forward projects that no additional equipment will be required if the Site were to receive the maximum permitted quantity of waste. This conclusion is consistent with the fact that the operating face of the landfill will not increase in size as the result of the project. Consequently, operations associated with the landfill face, such as soil transportation and cover operations will not increase. The Forward Joint Technical Document (JTD) does not project that any additional pieces of equipment will be required when operating at maximum capacity as compared to the baseline (current actual) conditions. Finally, equipment use does not correlate well with truck trips, disposal volumes, or other parameters that are scalable with the amount of refuse disposed. For example, 2010 and 2011 equipment use from the site show a decrease in the amount of waste accepted but an increase in the number of equipment hours and diesel use. Therefore, the Project does not create any impacts related to emissions from on-site equipment because the use of these equipment will not increase with the project nor will it increase simply by moving from current actual to maximum permitted conditions.

MODELING RESULTS

To determine whether Project emissions would exceed the National or California Ambient Air Quality Standards (NAAQS or CAAQS), emissions were modeled, added to background concentrations, and compared to the standards. Results of the modeling are shown in ***Table 3-17***. The SJVAPCD does not have a CEQA threshold for ground level concentrations for CAPs. The modeled concentration includes CAP emissions from sources that do not require an air permit to operate, including haul vehicles. No pollutant specific modeling (e.g. particle deposition or reaction of NOx) was modeled, which would result in lower modeled concentrations.

SUMMARY

CAP Emissions

Using the methodology described in this section, CAP emissions for two baseline options (Current Actual and Current Permitted) and two Post-Project options (Future Potential – Flares and Future Potential – LFG Engines) were calculated. Comparison summaries of emissions attributable to the project using various points of comparison were prepared and are presented on the tables listed below and provided at the end of this Section.

- Table 3-6A. Current Actual Emissions vs Future Potential to Emit (Flare Option)
- Table 3-6B. Current Permitted Emissions vs Future Potential to Emit (Flare Option)
- Table 3-7A. Current Actual Emissions vs Future Potential to Emit (LFG Engine Option)
- Table 3-7B. Current Permitted Emissions vs Future Potential to Emit (LFG Engine Option)

The summary tables include analyses of the effects of Project emissions in determining Major Source, Major Modification, and emission offset requirement status per District Rule 2201.

Significant increases in CAP emissions attributable to the Project are primarily the result of emissions from increased flare and/or LFG engine emissions, with the exception that the increase in PM_{10} emissions is primarily due to increased vehicle dust emissions. The emission estimate summaries also indicate the Project LFG Engine option results in significantly higher emissions of NOx, CO, and VOCs compared to the Project Flare option.

Project CAP emissions attributed to a new landfill gas to energy plant (Future Potential - IC Engine Scenario) may qualify to be offset through the District's Community Bank, as specified in California Health and Safety Code Section 42314 (Resource Recovery Project Exemption). However offsets are required for the emission increases.

TAC Emissions

TACs emission estimates for LFG-derived emissions and vehicle-derived emissions are included in the CAP emission tables previously listed and provided at the end of this Section. These TAC results were carried over and modified as needed for use in performing an HRA. The HRA is presented in Section 4.

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TABLE 3-1A. LFG GENERATION MODELING - BASELINE (PRE-PROJECT)
FORWARD LANDFILL - MANTECA, CA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	(m^3/min)	(Million ft^3/yr)
1954	52,403	0	47,539	0	0	0.0	0
1955	53,747	52,403	48,758	47,539	13	0.4	7
1956	55,125	106,150	50,009	96,298	25	0.7	13
1957	56,538	161,275	51,291	146,306	38	1.1	20
1958	57,988	217,813	52,606	197,597	51	1.5	27
1959	59,475	275,802	53,955	250,203	64	1.8	34
1960	61,000	335,277	55,338	304,158	77	2.2	41
1961	0	396,277	0	359,496	91	2.6	48
1962	0	396,277	0	359,496	89	2.5	47
1963	0	396,277	0	359,496	87	2.5	46
1964	62,525	396,277	56,722	359,496	85	2.4	45
1965	64,088	458,802	58,140	416,218	99	2.8	52
1966	65,690	522,890	59,593	474,357	112	3.2	59
1967	67,333	588,580	61,083	533,951	126	3.6	66
1968	69,016	655,913	62,610	595,034	140	4.0	74
1969	70,741	724,928	64,175	657,644	154	4.4	81
1970	72,510	795,670	65,780	721,819	168	4.8	88
1971	75,338	868,180	68,345	787,599	182	5.2	96
1972	78,276	943,517	71,011	855,944	197	5.6	103
1973	81,329	1,021,793	73,780	926,955	212	6.0	111
1974	84,500	1,103,122	76,658	1,000,735	227	6.4	119
1975	87,796	1,187,622	79,647	1,077,393	243	6.9	128
1976	91,220	1,275,418	82,753	1,157,040	260	7.4	137
1977	94,778	1,366,638	85,981	1,239,793	277	7.8	145
1978	224,556	1,461,416	203,714	1,325,774	294	8.3	155
1979	228,397	1,685,972	207,198	1,529,488	343	9.7	180
1980	232,387	1,914,369	210,818	1,736,686	391	11.1	206
1981	236,746	2,146,756	214,772	1,947,504	440	12.5	231
1982	241,283	2,383,502	218,888	2,162,276	488	13.8	257
1983	246,006	2,624,784	223,173	2,381,164	537	15.2	282
1984	184,256	2,870,790	167,154	2,604,337	586	16.6	308
1985	189,375	3,055,046	171,798	2,771,491	619	17.5	325
1986	194,703	3,244,421	176,631	2,943,289	653	18.5	343
1987	200,250	3,439,124	181,663	3,119,921	687	19.4	361
1988	206,024	3,639,374	186,902	3,301,584	722	20.4	379
1989	212,035	3,845,397	192,355	3,488,486	757	21.4	398
1990	204,404	4,057,432	185,432	3,680,840	794	22.5	417
1991	269,535	4,261,836	244,518	3,866,272	827	23.4	435
1992	209,754	4,531,371	190,285	4,110,790	876	24.8	461
1993	244,037	4,741,125	221,387	4,301,076	910	25.8	478
1994	230,094	4,985,162	208,738	4,522,463	951	26.9	500
1995	340,137	5,215,256	308,567	4,731,200	988	28.0	519
1996	305,018	5,555,393	276,708	5,039,767	1,051	29.7	552
1997	367,518	5,860,411	333,407	5,316,475	1,104	31.3	580
1998	768,117	6,227,929	696,824	5,649,882	1,171	33.2	615
1999	708,180	6,996,046	642,450	6,346,706	1,334	37.8	701
2000	965,068	7,704,225	875,495	6,989,155	1,479	41.9	777
2001	1,143,848	8,669,293	1,037,681	7,864,650	1,683	47.7	885

TABLE 3-1A. LFG GENERATION MODELING - BASELINE (PRE-PROJECT)
FORWARD LANDFILL - MANTECA, CA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	LFG Generation (m^3/min)	LFG Generation (Million ft^3/yr)
2002	1,602,312	9,813,141	1,453,593	8,902,332	1,927	54.6	1,013
2003	1,443,445	11,415,453	1,309,471	10,355,925	2,277	64.5	1,197
2004	1,931,155	12,858,898	1,751,914	11,665,396	2,581	73.1	1,357
2005	1,207,586	14,790,053	1,095,504	13,417,310	2,997	84.9	1,575
2006	1,411,255	15,997,639	1,280,269	14,512,814	3,231	91.5	1,698
2007	1,342,961	17,408,894	1,218,314	15,793,083	3,508	99.3	1,844
2008	1,213,984	18,751,855	1,101,308	17,011,396	3,764	106.6	1,978
2009	975,742	19,965,839	885,178	18,112,704	3,983	112.8	2,094
2010	1,107,594	20,941,581	1,004,792	18,997,882	4,141	117.3	2,176
2011	1,050,000	22,049,175	952,544	20,002,675	4,327	122.5	2,274
2012	993,106	23,099,175	900,931	20,955,218	4,496	127.3	2,363
2013	908,381	24,092,281	824,069	21,856,149	4,647	131.6	2,442
2014	907,535	25,000,662	823,302	22,680,218	4,775	135.2	2,510
2015	1,006,343	25,908,197	912,939	23,503,520	4,900	138.8	2,576
2016	1,046,571	26,914,541	949,433	24,416,460	5,047	142.9	2,653
2017	1,014,000	27,961,112	919,885	25,365,893	5,200	147.3	2,733
2018	1,028,196	28,975,112	932,764	26,285,778	5,343	151.3	2,808
2019	1,042,591	30,003,308	945,822	27,218,542	5,486	155.3	2,883
2020	1,057,187	31,045,898	959,064	28,164,364	5,630	159.4	2,959
2021	1,071,988	32,103,085	972,491	29,123,428	5,774	163.5	3,035
2022	1,086,995	33,175,073	986,106	30,095,919	5,920	167.6	3,111
2023	1,102,213	34,262,069	999,911	31,082,024	6,066	171.8	3,188
2024	1,117,644	35,364,282	1,013,910	32,081,935	6,212	175.9	3,265
2025	1,133,291	36,481,926	1,028,105	33,095,845	6,360	180.1	3,343
2026	1,149,157	37,615,218	1,042,498	34,123,950	6,508	184.3	3,421
2027	1,165,246	38,764,375	1,057,093	35,166,448	6,658	188.5	3,499
2028	1,181,559	39,929,621	1,071,892	36,223,541	6,808	192.8	3,578
2029	1,198,101	41,111,180	1,086,899	37,295,434	6,959	197.1	3,658
2030	991,381	42,309,281	899,366	38,382,332	7,112	201.4	3,738
2031	0	43,300,662	0	39,281,698	7,211	204.2	3,790
2032	0	43,300,662	0	39,281,698	7,068	200.1	3,715
2033	0	43,300,662	0	39,281,698	6,928	196.2	3,641
2034	0	43,300,662	0	39,281,698	6,791	192.3	3,569
2035	0	43,300,662	0	39,281,698	6,657	188.5	3,499
2036	0	43,300,662	0	39,281,698	6,525	184.8	3,429
2037	0	43,300,662	0	39,281,698	6,396	181.1	3,362
2038	0	43,300,662	0	39,281,698	6,269	177.5	3,295
2039	0	43,300,662	0	39,281,698	6,145	174.0	3,230
2040	0	43,300,662	0	39,281,698	6,023	170.6	3,166
2041	0	43,300,662	0	39,281,698	5,904	167.2	3,103
2042	0	43,300,662	0	39,281,698	5,787	163.9	3,042
2043	0	43,300,662	0	39,281,698	5,672	160.6	2,981
2044	0	43,300,662	0	39,281,698	5,560	157.4	2,922
2045	0	43,300,662	0	39,281,698	5,450	154.3	2,864
2046	0	43,300,662	0	39,281,698	5,342	151.3	2,808
2047	0	43,300,662	0	39,281,698	5,236	148.3	2,752
2048	0	43,300,662	0	39,281,698	5,133	145.3	2,698
2049	0	43,300,662	0	39,281,698	5,031	142.5	2,644

TABLE 3-1A. LFG GENERATION MODELING - BASELINE (PRE-PROJECT)
FORWARD LANDFILL - MANTECA, CA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	LFG Generation (m^3/min)	LFG Generation (Million ft^3/yr)
2050	0	43,300,662	0	39,281,698	4,931	139.6	2,592
2051	0	43,300,662	0	39,281,698	4,834	136.9	2,541
2052	0	43,300,662	0	39,281,698	4,738	134.2	2,490
2053	0	43,300,662	0	39,281,698	4,644	131.5	2,441
2054	0	43,300,662	0	39,281,698	0	0.0	0

Methane Content of LFG Adjusted to: 50%
Selected Decay Rate Constant (k): 0.020
Selected Ultimate Methane Recovery Rate (Lo): 100 m^3/Mg = 3,204 cu ft/ton

TABLE 3-1B. LFG GENERATION MODELING - FUTURE POTENTIAL (POST PROJECT)
FORWARD LANDFILL - MANTECA, CA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	LFG Generation (m^3/min)	LFG Generation (Million ft^3/yr)
1954	52,403	0	47,539	0	0	0.0	0
1955	53,747	52,403	48,758	47,539	13	0.4	7
1956	55,125	106,150	50,009	96,298	25	0.7	13
1957	56,538	161,275	51,291	146,306	38	1.1	20
1958	57,988	217,813	52,606	197,597	51	1.5	27
1959	59,475	275,802	53,955	250,203	64	1.8	34
1960	61,000	335,277	55,338	304,158	77	2.2	41
1961	0	396,277	0	359,496	91	2.6	48
1962	0	396,277	0	359,496	89	2.5	47
1963	0	396,277	0	359,496	87	2.5	46
1964	62,525	396,277	56,722	359,496	85	2.4	45
1965	64,088	458,802	58,140	416,218	99	2.8	52
1966	65,690	522,890	59,593	474,357	112	3.2	59
1967	67,333	588,580	61,083	533,951	126	3.6	66
1968	69,016	655,913	62,610	595,034	140	4.0	74
1969	70,741	724,928	64,175	657,644	154	4.4	81
1970	72,510	795,670	65,780	721,819	168	4.8	88
1971	75,338	868,180	68,345	787,599	182	5.2	96
1972	78,276	943,517	71,011	855,944	197	5.6	103
1973	81,329	1,021,793	73,780	926,955	212	6.0	111
1974	84,500	1,103,122	76,658	1,000,735	227	6.4	119
1975	87,796	1,187,622	79,647	1,077,393	243	6.9	128
1976	91,220	1,275,418	82,753	1,157,040	260	7.4	137
1977	94,778	1,366,638	85,981	1,239,793	277	7.8	145
1978	224,556	1,461,416	203,714	1,325,774	294	8.3	155
1979	228,397	1,685,972	207,198	1,529,488	343	9.7	180
1980	232,387	1,914,369	210,818	1,736,686	391	11.1	206
1981	236,746	2,146,756	214,772	1,947,504	440	12.5	231
1982	241,283	2,383,502	218,888	2,162,276	488	13.8	257
1983	246,006	2,624,784	223,173	2,381,164	537	15.2	282
1984	184,256	2,870,790	167,154	2,604,337	586	16.6	308
1985	189,375	3,055,046	171,798	2,771,491	619	17.5	325
1986	194,703	3,244,421	176,631	2,943,289	653	18.5	343
1987	200,250	3,439,124	181,663	3,119,921	687	19.4	361
1988	206,024	3,639,374	186,902	3,301,584	722	20.4	379
1989	212,035	3,845,397	192,355	3,488,486	757	21.4	398
1990	204,404	4,057,432	185,432	3,680,840	794	22.5	417
1991	269,535	4,261,836	244,518	3,866,272	827	23.4	435
1992	209,754	4,531,371	190,285	4,110,790	876	24.8	461
1993	244,037	4,741,125	221,387	4,301,076	910	25.8	478
1994	230,094	4,985,162	208,738	4,522,463	951	26.9	500
1995	340,137	5,215,256	308,567	4,731,200	988	28.0	519

TABLE 3-1B. LFG GENERATION MODELING - FUTURE POTENTIAL (POST PROJECT)
FORWARD LANDFILL - MANTECA, CA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	(m^3/min)	(Million ft^3/yr)
1996	305,018	5,555,393	276,708	5,039,767	1,051	29.7	552
1997	367,518	5,860,411	333,407	5,316,475	1,104	31.3	580
1998	768,117	6,227,929	696,824	5,649,882	1,171	33.2	615
1999	708,180	6,996,046	642,450	6,346,706	1,334	37.8	701
2000	965,068	7,704,225	875,495	6,989,155	1,479	41.9	777
2001	1,143,848	8,669,293	1,037,681	7,864,650	1,683	47.7	885
2002	1,602,312	9,813,141	1,453,593	8,902,332	1,927	54.6	1,013
2003	1,443,445	11,415,453	1,309,471	10,355,925	2,277	64.5	1,197
2004	1,931,155	12,858,898	1,751,914	11,665,396	2,581	73.1	1,357
2005	1,207,586	14,790,053	1,095,504	13,417,310	2,997	84.9	1,575
2006	1,411,255	15,997,639	1,280,269	14,512,814	3,231	91.5	1,698
2007	1,342,961	17,408,894	1,218,314	15,793,083	3,508	99.3	1,844
2008	1,213,984	18,751,855	1,101,308	17,011,396	3,764	106.6	1,978
2009	975,742	19,965,839	885,178	18,112,704	3,983	112.8	2,094
2010	1,107,594	20,941,581	1,004,792	18,997,882	4,141	117.3	2,176
2011	1,050,000	22,049,175	952,544	20,002,675	4,327	122.5	2,274
2012	993,106	23,099,175	900,931	20,955,218	4,496	127.3	2,363
2013	908,381	24,092,281	824,069	21,856,149	4,647	131.6	2,442
2014	907,535	25,000,662	823,302	22,680,218	4,775	135.2	2,510
2015	1,006,343	25,908,197	912,939	23,503,520	4,900	138.8	2,576
2016	1,046,571	26,914,541	949,433	24,416,460	5,047	142.9	2,653
2017	1,014,000	27,961,112	919,885	25,365,893	5,200	147.3	2,733
2018	1,028,196	28,975,112	932,764	26,285,778	5,343	151.3	2,808
2019	1,042,591	30,003,308	945,822	27,218,542	5,486	155.3	2,883
2020	1,057,187	31,045,898	959,064	28,164,364	5,630	159.4	2,959
2021	1,071,988	32,103,085	972,491	29,123,428	5,774	163.5	3,035
2022	1,086,995	33,175,073	986,106	30,095,919	5,920	167.6	3,111
2023	1,102,213	34,262,069	999,911	31,082,024	6,066	171.8	3,188
2024	1,117,644	35,364,282	1,013,910	32,081,935	6,212	175.9	3,265
2025	1,133,291	36,481,926	1,028,105	33,095,845	6,360	180.1	3,343
2026	1,149,157	37,615,218	1,042,498	34,123,950	6,508	184.3	3,421
2027	1,165,246	38,764,375	1,057,093	35,166,448	6,658	188.5	3,499
2028	1,181,559	39,929,621	1,071,892	36,223,541	6,808	192.8	3,578
2029	1,198,101	41,111,180	1,086,899	37,295,434	6,959	197.1	3,658
2030	1,214,874	42,309,281	1,102,115	38,382,332	7,112	201.4	3,738
2031	1,231,883	43,524,155	1,117,545	39,484,448	7,265	205.7	3,819
2032	1,249,129	44,756,038	1,133,191	40,601,993	7,420	210.1	3,900
2033	1,266,617	46,005,167	1,149,055	41,735,184	7,575	214.5	3,981
2034	1,284,349	47,271,784	1,165,142	42,884,239	7,732	218.9	4,064
2035	1,302,330	48,556,133	1,181,454	44,049,381	7,890	223.4	4,147
2036	1,320,563	49,858,463	1,197,994	45,230,835	8,049	227.9	4,230
2037	0	51,179,026	0	46,428,830	8,209	232.5	4,315

TABLE 3-1B. LFG GENERATION MODELING - FUTURE POTENTIAL (POST PROJECT)
FORWARD LANDFILL - MANTECA, CA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	LFG Generation (scfm)	LFG Generation (m^3/min)	LFG Generation (Million ft^3/yr)
2038	0	51,179,026	0	46,428,830	8,047	227.9	4,229
2039	0	51,179,026	0	46,428,830	7,887	223.3	4,146
2040	0	51,179,026	0	46,428,830	7,731	218.9	4,063
2041	0	51,179,026	0	46,428,830	7,578	214.6	3,983
2042	0	51,179,026	0	46,428,830	7,428	210.3	3,904
2043	0	51,179,026	0	46,428,830	7,281	206.2	3,827
2044	0	51,179,026	0	46,428,830	7,137	202.1	3,751
2045	0	51,179,026	0	46,428,830	6,995	198.1	3,677
2046	0	51,179,026	0	46,428,830	6,857	194.2	3,604
2047	0	51,179,026	0	46,428,830	6,721	190.3	3,533
2048	0	51,179,026	0	46,428,830	6,588	186.6	3,463
2049	0	51,179,026	0	46,428,830	6,458	182.9	3,394
2050	0	51,179,026	0	46,428,830	6,330	179.2	3,327
2051	0	51,179,026	0	46,428,830	6,204	175.7	3,261
2052	0	51,179,026	0	46,428,830	6,082	172.2	3,196
2053	0	51,179,026	0	46,428,830	5,961	168.8	3,133
2054	0	51,179,026	0	46,428,830	5,843	165.5	3,071
2055	0	51,179,026	0	46,428,830	5,727	162.2	3,010
2056	0	51,179,026	0	46,428,830	5,614	159.0	2,951
2057	0	51,179,026	0	46,428,830	5,503	155.8	2,892
2058	0	51,179,026	0	46,428,830	5,394	152.7	2,835
2059	0	51,179,026	0	46,428,830	5,287	149.7	2,779

Methane Content of LFG Adjusted to: 50%
Selected Decay Rate Constant (k): 0.020
Selected Ultimate Methane Recovery Rate (Lo): 100 m^3/Mg = 3,204 cu ft/ton

Note: For the Project LFG generation projection, waste acceptance was assumed to grow at a rate of 4.5% per year until the landfill capacity was reached in 2013.

Table 3-2A. BASELINE CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS - CURRENT ACTUAL

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.08	95.31%	3.68E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.04	95.31%	1.93E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.26	95.31%	1.20E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	95.31%	1.46E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	95.31%	1.95E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	4.26E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	3.13E-04
71-43-2	Benzene	78.11	0.9720	0.27	95.31%	1.25E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.09	95.31%	4.00E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	95.31%	1.77E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	95.31%	1.80E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.09	95.31%	4.19E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.05	95.31%	2.53E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	4.11E-04
74-87-3	Chloromethane	50.49	0.2490	0.04	95.31%	2.06E-03
106-46-7	Dichlorobenzene	147.00	1.6070	0.83	95.31%	3.87E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.008	95.31%	4.73E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.52	95.31%	1.18E-01
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	95.31%	3.08E-05
110-54-3	Hexane	86.17	2.3240	0.70	95.31%	3.28E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	9.61E-06
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.66	95.31%	1.25E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.26	95.31%	1.23E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.69	95.31%	3.25E-02
108-88-3	Toluene	92.13	25.4050	8.18	95.31%	3.84E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.31	95.31%	1.47E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.24	95.31%	1.10E-02
1330-20-7	Xylenes	106.16	16.5820	6.15	95.31%	2.89E-01
TOTALS	**HAPs**			9.03		1.15
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	179.27	95.31%	8.41

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations shown and estimated average LFG generation rate for the landfill for 2016 & 2017 derived from LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1A for model output).

(4) Collection efficiency of 95.31% from Solid Waste Industry for Climate Solutions (SWICS) collection efficiency evalutaion based on current cover.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds; also Precursor Organic Compounds (POCs)

MODEL VARIABLES

Estimated landfill gas total flow from landfill:	5124	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	SWICS collection efficiency

Table 3-2B. BASELINE CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS - CURRENT PERMITTED

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.11	95.31%	5.17E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.06	95.31%	2.71E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.36	95.31%	1.69E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.04	95.31%	2.06E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.06	95.31%	2.74E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	6.00E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	4.41E-04
71-43-2	Benzene	78.11	0.9720	0.37	95.31%	1.75E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.12	95.31%	5.62E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.01	95.31%	2.49E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.05	95.31%	2.54E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.13	95.31%	5.90E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.08	95.31%	3.56E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	5.79E-04
74-87-3	Chloromethane	50.49	0.2490	0.06	95.31%	2.90E-03
106-46-7	Dichlorobenzene	147.00	1.6070	1.16	95.31%	5.45E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.42	95.31%	6.66E-02
100-41-4	Ethylbenzene	106.16	6.7890	3.55	95.31%	1.66E-01
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	95.31%	4.34E-05
110-54-3	Hexane	86.17	2.3240	0.99	95.31%	4.62E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	1.35E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	3.75	95.31%	1.76E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.37	95.31%	1.73E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.97	95.31%	4.57E-02
108-88-3	Toluene	92.13	25.4050	11.52	95.31%	5.40E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.44	95.31%	2.07E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.33	95.31%	1.55E-02
1330-20-7	Xylenes	106.16	16.5820	8.66	95.31%	4.06E-01
TOTALS	**HAPs**			12.71		1.63
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	252.30	95.31%	11.84

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations shown and estimated average LFG generation rate for the landfill for 2016 & 2017 derived from LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1A for model output).

(4) Collection efficiency of 95.31% from Solid Waste Industry for Climate Solutions (SWICS) collection efficiency evaluation based on current cover.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
CFCs = Chlorofluorohydrocarbons
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill:	7211	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	

Table 3-2C. POST PROJECT (FUTURE POTENTIAL) CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.13	95.31%	5.89E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.07	95.31%	3.09E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.41	95.31%	1.93E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.05	95.31%	2.34E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.07	95.31%	3.12E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	6.83E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	5.02E-04
71-43-2	Benzene	78.11	0.9720	0.43	95.31%	2.00E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.14	95.31%	6.40E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.01	95.31%	2.83E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.06	95.31%	2.89E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.14	95.31%	6.72E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.09	95.31%	4.05E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	6.59E-04
74-87-3	Chloromethane	50.49	0.2490	0.07	95.31%	3.30E-03
106-46-7	Dichlorobenzene	147.00	1.6070	1.32	95.31%	6.21E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.62	95.31%	7.58E-02
100-41-4	Ethylbenzene	106.16	6.7890	4.04	95.31%	1.89E-01
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	95.31%	4.94E-05
110-54-3	Hexane	86.17	2.3240	1.12	95.31%	5.26E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	1.54E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	4.26	95.31%	2.00E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.42	95.31%	1.97E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	1.11	95.31%	5.20E-02
108-88-3	Toluene	92.13	25.4050	13.11	95.31%	6.15E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.50	95.31%	2.35E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.38	95.31%	1.77E-02
1330-20-7	Xylenes	106.16	16.5820	9.86	95.31%	4.63E-01
TOTALS	**HAPs**			14.47		1.85
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	287.23	95.31%	13.48

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations shown and estimated average LFG generation rate for the landfill for 2016 & 2017 derived from LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1B for model output).

(4) Collection efficiency of 95.31% from Solid Waste Industry for Climate Solutions (SWICS) collection efficiency evaluation based on current cover.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
CFCs = Chlorofluorohydrocarbons
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill:	8209	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	

TABLE 3-3A. BASELINE EMISSIONS FROM LANDFILL GAS FLARES - CURRENT ACTUAL

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.03	98.00%	1.46E-04	6.39E-04
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.02	98.00%	7.65E-05	3.35E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.10	98.00%	4.77E-04	2.09E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.01	98.00%	5.80E-05	2.54E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.02	98.00%	7.73E-05	3.39E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	98.00%	1.69E-05	7.41E-05
107-13-1	Acrylonitrile	53.06	0.0360	0.00	99.70%	1.86E-06	8.17E-06
71-43-2	Benzene	78.11	0.9720	0.11	99.70%	7.41E-05	3.25E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.03	99.70%	2.38E-05	1.04E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	7.01E-06	3.07E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.02	99.70%	1.07E-05	4.70E-05
108-90-7	Chlorobenzene	112.56	0.2270	0.04	98.00%	1.66E-04	7.28E-04
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.02	98.00%	1.00E-04	4.40E-04
67-66-3	Chloroform	119.39	0.0210	0.00	98.00%	1.63E-05	7.15E-05
74-87-3	Chloromethane	50.49	0.2490	0.02	98.00%	8.18E-05	3.58E-04
106-46-7	Dichlorobenzene	147.00	1.6070	0.34	98.00%	1.54E-03	6.73E-03
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.41	98.00%	1.88E-03	8.22E-03
100-41-4	Ethylbenzene	106.16	6.7890	1.03	99.70%	7.04E-04	3.08E-03
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	98.00%	1.22E-06	5.36E-06
110-54-3	Hexane	86.17	2.3240	0.29	99.70%	1.95E-04	8.56E-04
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	1.91E-05	8.35E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	1.09	99.70%	7.43E-04	3.26E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.11	99.70%	7.33E-05	3.21E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.28	98.00%	1.29E-03	5.64E-03
108-88-3	Toluene	92.13	25.4050	3.34	99.70%	2.28E-03	1.00E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.13	98.00%	5.82E-04	2.55E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.10	98.00%	4.38E-04	1.92E-03
1330-20-7	Xylenes	106.16	16.5820	2.51	99.70%	1.72E-03	7.53E-03
TOTALS	**HAPs**						**5.60E-02**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.01130		0.704	3.08
Nitrogen oxides (NOx)			0.050		3.114	13.64
Sulfur oxides (as SO2) (7)			0.0215		1.339	5.86
Carbon monoxide (CO)			0.200		12.455	54.55
Particulates (PM10)			0.034		2.117	9.27
TOTAL CRITERIA POLLUTANTS						**86.41**

TABLE 3-3A. BASELINE EMISSIONS FROM LANDFILL GAS FLARES - CURRENT ACTUAL

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare throughput data used in federal greenhouse gas reporting.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x   (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Average heat input to flares:	62.3	MMBtu/hr
Estimated methane content of LFG:	50.0%	
LFG to Flare, Average (actual data):	2,089	cfm

Year	scf
2016	885,211,567
2017	1,310,314,602
Average	**1,097,763,085**

TABLE 3-3B. BASELINE EMISSIONS FROM LANDFILL GAS FLARES - CURRENT PERMITTED

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.08	98.00%	3.72E-04	1.63E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.04	98.00%	1.95E-04	8.55E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.27	98.00%	1.22E-03	5.33E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	98.00%	1.48E-04	6.49E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	98.00%	1.97E-04	8.64E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	98.00%	4.32E-05	1.89E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	99.70%	4.76E-06	2.08E-05
71-43-2	Benzene	78.11	0.9720	0.28	99.70%	1.89E-04	8.29E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.09	99.70%	6.07E-05	2.66E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	1.79E-05	7.83E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	99.70%	2.74E-05	1.20E-04
108-90-7	Chlorobenzene	112.56	0.2270	0.09	98.00%	4.24E-04	1.86E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.06	98.00%	2.56E-04	1.12E-03
67-66-3	Chloroform	119.39	0.0210	0.01	98.00%	4.16E-05	1.82E-04
74-87-3	Chloromethane	50.49	0.2490	0.05	98.00%	2.09E-04	9.15E-04
106-46-7	Dichlorobenzene	147.00	1.6070	0.86	98.00%	3.92E-03	1.72E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.05	98.00%	4.79E-03	2.10E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.62	99.70%	1.80E-03	7.87E-03
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	98.00%	3.12E-06	1.37E-05
110-54-3	Hexane	86.17	2.3240	0.73	99.70%	4.99E-04	2.19E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	4.87E-05	2.13E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.77	99.70%	1.90E-03	8.31E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.27	99.70%	1.87E-04	8.20E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.72	98.00%	3.29E-03	1.44E-02
108-88-3	Toluene	92.13	25.4050	8.51	99.70%	5.83E-03	2.55E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.33	98.00%	1.49E-03	6.51E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.24	98.00%	1.12E-03	4.90E-03
1330-20-7	Xylenes	106.16	16.5820	6.40	99.70%	4.39E-03	1.92E-02
TOTALS	**HAPs**						**1.43E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.01130		1.831	8.018
Nitrogen oxides (NOx)			0.050		8.100	35.48
Sulfur oxides (as SO2) (7)			0.0215		3.483	15.256
Carbon monoxide (CO)			0.200		32.400	141.91
Particulates (PM10)			0.034		5.508	24.13
TOTAL CRITERIA POLLUTANTS						**224.79**

TABLE 3-3B. BASELINE EMISSIONS FROM LANDFILL GAS FLARES - CURRENT PERMITTED

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D, increase in LFG flow, and permitted flare capacity.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds; also Precursor Organic Compounds (POCs)

MODEL VARIABLES

Maximum Permitted Flare Capacity:	162	MMBtu/hr
Estimated methane content of LFG:	50.0%	
Total flare maximum capacity:	5,331	cfm

TABLE 3-3C. POST-PROJECT FLARE EMISSIONS INCREASE FROM LANDFILL GAS - FUTURE POTENTIAL (EXCESS PROJECT GAS TO FLARES)

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.13	98.00%	5.73E-04	2.51E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.07	98.00%	3.01E-04	1.32E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.41	98.00%	1.88E-03	8.22E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.05	98.00%	2.28E-04	9.99E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.07	98.00%	3.04E-04	1.33E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	98.00%	6.65E-05	2.91E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	99.70%	7.33E-06	3.21E-05
71-43-2	Benzene	78.11	0.9720	0.43	99.70%	2.91E-04	1.28E-03
75-15-0	Carbon disulfide	76.13	0.3200	0.14	99.70%	9.35E-05	4.09E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.01	98.00%	2.75E-05	1.21E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.06	99.70%	4.22E-05	1.85E-04
108-90-7	Chlorobenzene	112.56	0.2270	0.14	98.00%	6.54E-04	2.86E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.09	98.00%	3.94E-04	1.73E-03
67-66-3	Chloroform	119.39	0.0210	0.01	98.00%	6.41E-05	2.81E-04
74-87-3	Chloromethane	50.49	0.2490	0.07	98.00%	3.22E-04	1.41E-03
106-46-7	Dichlorobenzene	147.00	1.6070	1.32	98.00%	6.04E-03	2.65E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.62	98.00%	7.38E-03	3.23E-02
100-41-4	Ethylbenzene	106.16	6.7890	4.04	99.70%	2.77E-03	1.21E-02
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	98.00%	4.81E-06	2.11E-05
110-54-3	Hexane	86.17	2.3240	1.12	99.70%	7.68E-04	3.37E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	7.49E-05	3.28E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	4.26	99.70%	2.92E-03	1.28E-02
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.42	99.70%	2.88E-04	1.26E-03
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	1.11	98.00%	5.06E-03	2.22E-02
108-88-3	Toluene	92.13	25.4050	13.11	99.70%	8.98E-03	3.93E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.50	98.00%	2.29E-03	1.00E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.38	98.00%	1.72E-03	7.54E-03
1330-20-7	Xylenes	106.16	16.5820	9.86	99.70%	6.75E-03	2.96E-02
TOTALS	**HAPs**						**2.20E-01**

Criteria Air Pollutants	**Molecular Weight (g/Mol)**	**Concentration of Compound (ppmv)**	**Emission Factor (lb/MMBtu) (6)**	**Emission Factor (lb/hr/scfm)**	**Maximum Emissions from Flare (lbs/hr)**	**Maximum Emissions from Flare (tons/yr)**
Volatile Organic Compounds (VOCs)			0.0113		0.368	1.613
Nitrogen oxides (NOx)			0.0500		1.630	7.14
Sulfur oxides (as SO2) (7)			0.0215		0.701	3.069
Carbon monoxide (CO)			0.2000		6.519	28.55
Particulates (PM10)			0.034		1.108	4.85
TOTAL CRITERIA POLLUTANTS						**45.22**

TABLE 3-3C. POST-PROJECT FLARE EMISSIONS INCREASE FROM LANDFILL GAS - FUTURE POTENTIAL
(EXCESS PROJECT GAS TO FLARES)

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow assumption of all increased gas flow collected going to flare(s).

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds; also Precursor Organic Compounds (POCs)

MODEL VARIABLES

Maximum Estimated Heat Input to Flare:	32.59	MMBtu/hr
Estimated methane content of LFG:	50.0%	
Maximum LFG Generation (from Table 1)	8,209	cfm
Maximum LFG to Flare (LFG Model minus LFG to engines):	1,093	cfm

TABLE 3-4A. POST-PROJECT EMISSIONS FROM AMERESCO LANDFILL GAS-FIRED ENGINES - CURRENT ACTUAL

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Engine Destruction Efficiency (4)	Controlled LFG Emissions After Engine Destruction (lbs/hr)	Controlled LFG Emissions After Engine Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.02	93.00%	3.42E-04	1.50E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.01	93.00%	1.79E-04	7.86E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.07	93.00%	1.12E-03	4.90E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.01	93.00%	1.36E-04	5.97E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.01	93.00%	1.81E-04	7.94E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	93.00%	3.97E-05	1.74E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.00	86.10%	5.79E-05	2.54E-04
71-43-2	Benzene	78.11	0.9720	0.07	86.10%	2.30E-03	1.01E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.02	86.10%	7.39E-04	3.24E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	93.00%	1.64E-05	7.20E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.01	86.10%	3.33E-04	1.46E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.02	93.00%	3.90E-04	1.71E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.01	93.00%	2.35E-04	1.03E-03
67-66-3	Chloroform	119.39	0.0210	0.00	93.00%	3.83E-05	1.68E-04
74-87-3	Chloromethane	50.49	0.2490	0.01	93.00%	1.92E-04	8.41E-04
106-46-7	Dichlorobenzene	147.00	1.6070	0.23	93.00%	3.61E-03	1.58E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.28	93.00%	4.40E-03	1.93E-02
100-41-4	Ethylbenzene	106.16	6.7890	0.69	86.10%	2.19E-02	9.57E-02
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	93.00%	2.87E-06	1.26E-05
110-54-3	Hexane	86.17	2.3240	0.19	86.10%	6.07E-03	2.66E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	1.28E-05	5.60E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	0.73	86.10%	2.31E-02	1.01E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.07	86.10%	2.28E-03	9.98E-03
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.19	93.00%	3.02E-03	1.32E-02
108-88-3	Toluene	92.13	25.4050	2.24	86.10%	7.10E-02	3.11E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.09	93.00%	1.37E-03	5.98E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.06	93.00%	1.03E-03	4.50E-03
1330-20-7	Xylenes	106.16	16.5820	1.68	86.10%	5.34E-02	2.34E-01
TOTALS	**HAPs**						**8.65E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (g/bhp-hr) (6)	Emission Factor (lb/MMBtus)	Maximum Emissions from Engines (lbs/hr)	Maximum Emissions from Engines (tons/yr)
Volatile Organic Compounds (VOCs)	86.18	20.00			1.820	8.0
Nitrogen oxides (NOx)			0.15		1.481	6.5
Sulfur oxides (as SO2) (7)	64.06	150.00			2.820	12.4
Carbon monoxide (CO)			1.8		17.767	77.8
Particulates (PM10)			0.05		0.494	2.2
TOTAL CRITERIA POLLUTANTS						**106.8**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG destruction in engines as reported to under the EPA GHG reporting regulation

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, CO, PM10, and VOC were taken from Ameresco's permit.
SOx emissions based on Permit limit of 150 ppmv of H2S in LFG.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds; also Precursor Organic Compounds (POCs)

MODEL VARIABLES

Average Heat Input to Engines:	42	MMBtu/hr
Estimated methane content of LFG:	50.0%	
Total flow to engines	1,400	scfm
Engine Rating (Caterpillar G3520C engine data used to complete some calculations on this sheet)	3,012	bhp
Maximum flow to each engine	942	scfm
Number of engines needed	1	

Year	scf
2016	730,926,610
2017	741,042,845
Average	**735,984,728**

TABLE 3-4B. POST-PROJECT EMISSIONS FROM AMERESCO LANDFILL GAS-FIRED ENGINES - CURRENT PERMITTED

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Engine Destruction Efficiency (4)	Controlled LFG Emissions After Engine Destruction (lbs/hr)	Controlled LFG Emissions After Engine Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.03	93.00%	4.61E-04	2.02E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.02	93.00%	2.41E-04	1.06E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.09	93.00%	1.51E-03	6.60E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.01	93.00%	1.83E-04	8.03E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.02	93.00%	2.44E-04	1.07E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	93.00%	5.34E-05	2.34E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.00	86.10%	7.79E-05	3.41E-04
71-43-2	Benzene	78.11	0.9720	0.10	86.10%	3.10E-03	1.36E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.03	86.10%	9.94E-04	4.35E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	93.00%	2.21E-05	9.69E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.01	86.10%	4.49E-04	1.96E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.03	93.00%	5.25E-04	2.30E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.02	93.00%	3.17E-04	1.39E-03
67-66-3	Chloroform	119.39	0.0210	0.00	93.00%	5.15E-05	2.26E-04
74-87-3	Chloromethane	50.49	0.2490	0.02	93.00%	2.58E-04	1.13E-03
106-46-7	Dichlorobenzene	147.00	1.6070	0.30	93.00%	4.85E-03	2.13E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.37	93.00%	5.93E-03	2.60E-02
100-41-4	Ethylbenzene	106.16	6.7890	0.93	86.10%	2.94E-02	1.29E-01
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	93.00%	3.86E-06	1.69E-05
110-54-3	Hexane	86.17	2.3240	0.26	86.10%	8.17E-03	3.58E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	1.72E-05	7.53E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	0.98	86.10%	3.11E-02	1.36E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.10	86.10%	3.06E-03	1.34E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.25	93.00%	4.06E-03	1.78E-02
108-88-3	Toluene	92.13	25.4050	3.01	86.10%	9.55E-02	4.18E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.12	93.00%	1.84E-03	8.05E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.09	93.00%	1.38E-03	6.06E-03
1330-20-7	Xylenes	106.16	16.5820	2.26	86.10%	7.18E-02	3.15E-01
TOTALS	**HAPs**						**1.16E+00**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (g/bhp-hr) (6)	Emission Factor (lb/MMBtus)	Maximum Emissions from Engines (lbs/hr)	Maximum Emissions from Engines (tons/yr)
Volatile Organic Compounds (VOCs)	86.18	20.00			1.820	8.0
Nitrogen oxides (NOx)			0.15		1.992	8.7
Sulfur oxides (as SO2) (7)	64.06	150.00			2.820	12.4
Carbon monoxide (CO)			1.8		23.905	104.7
Particulates (PM10)			0.05		0.664	2.9
TOTAL CRITERIA POLLUTANTS						**136.7**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and maximum permitted heat input capacity

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, CO, PM10, and VOC were taken from Ameresco's permit.
SOx emissions based on Permit limit of 150 ppmv of H2S in LFG.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds; also Precursor Organic Compounds (POCs)

MODEL VARIABLES

Maximum Estimated Heat Input to Engines:	56	MMBtu/hr
Estimated methane content of LFG:	50.0%	
Total flow to engines	1,884	scfm
Engine Rating (Caterpillar G3520C engine data used to complete some calculations on this sheet)	3,012	bhp
Maximum flow to each engine	942	scfm
Number of engines needed	2	

TABLE 3-4C. POST-PROJECT EMISSIONS FROM NEW LANDFILL GAS-FIRED ENGINES - FUTURE POTENTIAL EXCESS PROJECT GAS TO LFG ENGINES

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Engine Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.07	93.00%	1.06E-03	4.64E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.03	93.00%	5.56E-04	2.43E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.22	93.00%	3.47E-03	1.52E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	93.00%	4.22E-04	1.85E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	93.00%	5.61E-04	2.46E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	93.00%	1.23E-04	5.38E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	86.10%	1.79E-04	7.86E-04
71-43-2	Benzene	78.11	0.9720	0.22	86.10%	7.13E-03	3.12E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.07	86.10%	2.29E-03	1.00E-02
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	93.00%	5.09E-05	2.23E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.03	86.10%	1.03E-03	4.52E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.08	93.00%	1.21E-03	5.29E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.05	93.00%	7.29E-04	3.19E-03
67-66-3	Chloroform	119.39	0.0210	0.01	93.00%	1.19E-04	5.19E-04
74-87-3	Chloromethane	50.49	0.2490	0.04	93.00%	5.94E-04	2.60E-03
106-46-7	Dichlorobenzene	147.00	1.6070	0.70	93.00%	1.12E-02	4.89E-02
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.85	93.00%	1.36E-02	5.97E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.13	86.10%	6.77E-02	2.96E-01
106-93-4	Ethylene dibromide	187.88	0.0010	0.00	93.00%	8.88E-06	3.89E-05
110-54-3	Hexane	86.17	2.3240	0.59	86.10%	1.88E-02	8.24E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	3.96E-05	1.73E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.25	86.10%	7.15E-02	3.13E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.22	86.10%	7.05E-03	3.09E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.59	93.00%	9.35E-03	4.10E-02
108-88-3	Toluene	92.13	25.4050	6.92	86.10%	2.20E-01	9.62E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.26	93.00%	4.23E-03	1.85E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.20	93.00%	3.18E-03	1.39E-02
1330-20-7	Xylenes	106.16	16.5820	5.21	86.10%	1.65E-01	7.24E-01
TOTALS	**HAPs**						**2.68E+00**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (g/bhp-hr) (6)	Emission Factor (lb/MMBtus)	Maximum Emissions from Engines (lbs/hr)	Maximum Emissions from Engines (tons/yr)
Volatile Organic Compounds (VOCs)	86.18	20.00			5.635	24.7
Nitrogen oxides (NOx)			0.15		4.584	20.1
Sulfur oxides (as SO2) (7)	64.06	150.00			8.731	38.2
Carbon monoxide (CO)			1.8		55.007	240.9
Particulates (PM10)			0.05		1.528	6.7
TOTAL CRITERIA POLLUTANTS						**330.6**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Compound concentration values from June 2007 source test results. If concentration could not be obtained from source test, average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare throughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, CO, PM10, and VOC were taken from Ameresco permit.
SOx emissions based on Permit limit of 150 ppmv of H2S in LFG.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds; also Precursor Organic Compounds (POCs)

MODEL VARIABLES

Maximum Estimated Heat Input to Engines:	129	MMBtu/hr
Estimated methane content of LFG:	50.0%	
Total maximum flow to engines	4,335	scfm
Engine Rating (engines assumed to be equivalent to engines used by Ameresco)	3,012	bhp
Maximum flow to each engine	942	scfm
Number of engines needed	5	

TABLE 3-5A. VEHICLE DUST EMISSIONS - ALL SCENARIOS

Truck Activity	Unpaved Annual Distance (VMT/year)	Unpaved Road Emissions (tons)	Paved Annual Truck Miles (VMT/year)	Paved Road Emissions (tons)	Total Annual Emissions (tons)
Landfill [a]	123,543	123.6	52,506	7.3	130.9
Vehicle Fugitive Particulate Emissions - Current Actual [a]					**130.9**
Landfill - Maximum Current Permitted Disposal Rate [b]	308,512	308.6	131,118	18.2	326.8
Vehicle Fugitive Particulate Emissions - Current Permitted [b]					**326.8**
Post-Project Maximum Permitted [c]	308,512	308.6	131,118	18.2	326.8
Vehicle Fugitive Particulate Emissions - Post-Project [c]					**326.8**

Truck Activity	Unpaved Road PM10 Emission Factor (lb/VMT)	Unpaved Road PM2.5 Emission Factor (lb/VMT)	Unpaved Road Control Efficiency (%)	Paved Road PM10 Emission Factor (lb/VMT)	Paved Road PM2.5 Emission Factor (lb/VMT)	Paved Road Control Efficiency (%)	Distance per Trip on Unpaved Road [a] miles	Distance per Trip on Paved Road [b] miles
Baseline	2.00	0.20	75	0.28	0.07	0	0.8	0.34
Current Permitted	2.00	0.20	75	0.28	0.07	0	0.8	0.34
Post-Project	2.00	0.20	75	0.28	0.07	0	0.8	0.34

	Current Actual Truck Trips trip/year	Current Actual Quantity Hauled tons/year	Current Permitted Truck Trips trips/day	Current Permitted Truck Trips trips/year	Current Permitted Quantity Hauled tons/year	Post-Project Average Daily Truck Trips trips/day	Post-Project Maximum Permitted Truck Trips trips/year
Hauling Data	154,429	1,030,286	1,240	385,640	1,320,563	1,240	385,640

[a] Current Actual (Baseline) values are from data provided by Landfill. Trips count is for one-way trips (from gate to face or face to gate).

[b] Current Permitted scenario (CP) is based on maximum annual disposal tonnage (refuse + ADC) under revised site life projection for current LF capacity. CP vehicle trips is based on maximum permitted daily traffic volume of 620 vehicles. Trips count is for one-way trips (from gate to face or back to the gate).

[c] Post Project (Project) assumes maximum permitted annual refuse tonnage plus ADC (per revised site life projection). Post Project scenario includes an average daily traffic volume of 620 vehicle trips per day (maximum daily traffic volume = 620 trips per day). Trips count is for one-way trips (from gate to face, or back to the gate).

TABLE 3-5A. VEHICLE DUST EMISSIONS - ALL SCENARIOS

Unpaved Road Emission Factor Algorithm[1]		
$E = k * (s/12)^a * (W/3)^b$		
k = empirical constant	1.5	lb/VMT for PM10[2]
a = empirical constant	0.9	for PM10 and PM2.5
b = empirical constant	0.45	for PM10 and PM2.5
k = empirical constant	0.15	lb/VMT for PM2.5[2]
s = typical surface silt content	6.4	%
W = mean vehicle weight	20	tons

[1] Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 13.2.2

[2] ibid, Table 13.2.2-2

[3] ibid, Table 13.2.2-1

Paved Road Emission Factor Algorithm[1]	
$E = k * (sL/2)^{0.91} * (W/3)^{1.02}$	
Where:	
E = emissions factor in pounds per vehicle mile	
k = empirical constant (lb/VMT for PM10[2])	0.0022
k = empirical constant (lb/VMT for PM2.5[2])	0.00054
sL = typical surface silt content (g/m^2)	7.4
W = mean vehicle weight (tons)	20

[1] Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Chapter 13.2.1

[2] ibid, Table 13.2.1-1

[3] ibid, Table 13.2.1-4

TABLE 3-5A. VEHICLE DUST EMISSIONS - ALL SCENARIOS (CONTINUED)

Pollutant	Weight Fraction of PM10	Scenario		
		Current Actual	Current Permitted	Project
PM10		261,717	653,561	653,561
Aluminum	1.26E-01	32,867	82,075	82,075
Antimony	6.23E-04	163	407	407
Barium	1.76E-03	461	1,150	1,150
Molybdenum	4.10E-05	11	27	27
Phosphorus	2.70E-03	705	1,761	1,761
Silver	1.24E-04	32	81	81
Thallium	1.90E-05	5	12	12
Zinc	3.70E-03	967	2,416	2,416

Emission rates shown in lb/year

TABLE 3-5B. VEHICLE CAP EMISSIONS - ALL SCENARIOS

Haul Vehicle Activity	Emission Factor VOCs	CO	NOx	SOx	PM10
	g/mile or g/idle hour	g/mile or g/idle hour	g/mile or g/idle hour	g/mile or g/idle hour	g/mile or g/idle hour
Idle	2.94	29.32	45.12	0.06	0.13
Traveling	2.99	5.79	18.44	0.03	0.40

Truck Activity	Truck Trips	Distance Per Trip	Moving Emissions				
			VOCs	CO	NOx	SOx	PM10
	per year	mi	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Baseline [a]	154,429	1.14	0.58	1.12	3.58	0.007	0.08
Current Permitted [b]	385,640	1.14	1.45	2.80	8.93	0.017	0.19
Post-Project [c]	385,640	1.14	1.45	2.80	8.93	0.017	0.19

Truck Activity	Truck Trips	Idle time	Idle Emissions				
			VOCs	CO	NOx	SOx	PM10
	per year	minutes per trip	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Baseline [a]	154,429	5	0.04	0.42	0.64	0.001	0.00
Current Permitted [b]	385,640	5	0.10	1.04	1.60	0.002	0.00
Post-Project [c]	385,640	5	0.10	1.04	1.60	0.002	0.00

Truck Activity	Total Haul Vehicle Emissions				
	VOCs	CO	NOx	SOx	PM10
	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Baseline [a]	0.62	1.54	4.21	0.008	0.08
Current Permitted [b]	1.55	3.84	10.52	0.019	0.20
Post-Project [c]	1.55	3.84	10.52	0.019	0.20

[a] Current Actual (Baseline) Truck Trips are from data provided by Landfill.

[b] Current Permitted scenario (CP) Truck Trips based on maximum permitted daily traffic volume of 620 vehicles. Trips count is for round trips (from gate to face, and back to the gate).

[c] Post Project (Project) Truck Trips based on an increase in the daily traffic volume to 620 trips per day (maximum daily traffic volume would be 620 trips per day). Trips count is for one-way trips (from gate to face or back to the gate).

TABLE 3-6A. PROJECT EMISSIONS - CURRENT ACTUAL VS FUTURE POTENTIAL (EXCESS PROJECT GAS TO FLARES)

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Baseline (Current Actual) Emissions						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (CA)	0.00	0.00	0.00	0.00	0.00	8.41
Landfill Gas Flare (CA)	13.64	54.55	9.27	9.27	5.86	3.08
Mobile Sources (CA)	4.21	1.54	0.08	0.08	0.01	0.62
Fugitive Dust (CA)			*130.86*	130.86		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
Total Baseline (Current Actual) Emissions	***24.34***	***133.91***	***142.37***	***142.37***	***18.22***	***20.08***
Post Project (Future Potential) Emissions						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (Project)	0.00	0.00	0.00	0.00	0.00	13.48
Landfill Gas Flare (CP)	35.48	141.91	24.13	24.13	15.26	8.02
Mobile Sources (Project)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (Project)			*326.78*	*326.78*		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
New Flare (Project-flares)	7.14	28.55	4.85	4.85	3.07	1.61
Total Post Project Potential Emissions	***59.63***	***252.12***	***358.12***	***358.12***	***30.70***	***32.63***
Major Source Threshold (Rule 2201,Table 3-3)	*10.00*	*100.00*	*70.00*	*100.00*	*70.00*	*10.00*
Major Source [a,b]	*YES*	*YES*	*NO*	*NO*	*NO*	*YES*
Offset Threshold (Rule 2201, Table 4-1)	*10.00*	*100.00*	*14.60*	*NA*	*27.38*	*10.00*
Offsets Requirements Triggered [b]	*YES*	*YES*	*YES*	*NA*	*NO*	*YES*
Change in Emissions	***35.29***	***118.21***	***215.75***	***215.75***	***12.47***	***12.54***
Major Modification Threshold (Rule 2201 Table 3-1) [a]	*0.00*	*NA*	*15.00*	*10.00*	*70.00*	*0.00*
Major Modification [a]	*YES*	*NA*	*YES*	*YES*	*NO*	*YES*

[a] Fugitive emissions not included per District Rule (Fugitive emissions in table indicated by italics)
[b] The engine facilities are permitted separately and are not included for purposes of determining offsets or major source status. However, they are included when determining CEQA significance.

NOx = Nitrogen Oxides
CO = Carbon Monoxide
PM10 = Particulate Matter less than 10 microns
SOx = Sulfur Oxides
VOCs = Volatile Organic Compounds

TABLE 3-6B. PROJECT EMISSIONS - CURRENT PERMITTED VS FUTURE POTENTIAL (EXCESS PROJECT GAS TO FLARES)

Source	Criteria Pollutant Emissions					
	NOx	CO	PM10	PM2.5	SOx	VOCs
	(tons per year)					
Baseline (Current Permitted) Emissions						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (CP)	0.00	0.00	0.00	0.00	0.00	11.84
Landfill Gas Flare (CP)	35.48	141.91	24.13	24.13	15.26	8.02
Mobile Sources (CP)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (CP)			*326.78*	*326.78*		
Ameresco Plant (LFG Engines) (CP)	8.73	104.70	2.91	2.91	12.35	7.97
Total Baseline (Current Permitted) Emissions	***54.73***	***250.46***	***354.01***	***354.01***	***27.63***	***29.38***
Post Project Potential To Emit						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (Project)	0.00	0.00	0.00	0.00	0.00	13.48
Landfill Gas Flare (CP)	35.48	141.91	24.13	24.13	15.26	8.02
Mobile Sources (Project)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (Project)			*326.78*	*326.78*		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
New Flare (Project flare)	7.14	28.55	4.85	4.85	3.07	1.61
Total Post Project Potential Emissions	***59.63***	***252.12***	***358.12***	***358.12***	***30.70***	***32.63***
Major Source Threshold (Rule 2201,Table 3-3)	*10.00*	*100.00*	*70.00*	*100.00*	*70.00*	*10.00*
Major Source [a,b]	*YES*	*YES*	*NO*	*NO*	*NO*	*YES*
Offset Threshold (Rule 2201, Table 4-1)	*10.00*	*100.00*	*14.60*	*NA*	*27.38*	*10.00*
Offsets Requirements Triggered [b]	*YES*	*YES*	*YES*	*NA*	*NO*	*YES*
Change in Emissions	***4.90***	***1.67***	***4.11***	***4.11***	***3.07***	***3.25***
Major Modification Threshold (Rule 2201 Table 3-1) [a]	*0.00*	*NA*	*15.00*	*10.00*	*70.00*	*0.00*
Major Modification [a]	*YES*	*NA*	*NO*	*YES*	*NO*	*YES*

[a] Fugitive emissions not included per District Rule (Fugitive emissions in table indicated by italics)

[b] The engine facilities are permitted separately and are not included for purposes of determining offsets or major source status. However, they are included when determining CEQA significance.

NOx = Nitrogen Oxides
CO = Carbon Monoxide
PM10 = Particulate Matter less than 10 microns
SOx = Sulfur Oxides
VOCs = Volatile Organic Compounds

TABLE 3-7A. PROJECT EMISSIONS - CURRENT ACTUAL VS FUTURE POTENTIAL

(EXCESS PROJECT GAS TO NEW LFG ENGINES)

Source	Criteria Pollutant Emissions					
	NOx	**CO**	**PM10**	**PM2.5**	**SOx**	**VOCs**
	(tons per year)					
Baseline (Current Actual) Emissions						
Forward Landfill (Facility # N-339)				0		
Landfill Fugitive Emissions (CA)	0.00	0.00	0.00	0.00	0.00	8.41
Landfill Gas Flares (CA)	13.64	54.55	9.27	9.27	5.86	3.08
Mobile Sources (CA)	4.21	1.54	0.08	0.08	0.01	0.62
Fugitive Dust (CA)			130.86	130.86		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
Total Baseline (Current Actual) Emissions	***24.34***	***133.91***	***142.37***	***142.37***	***18.22***	***20.08***
Post Project Potential To Emit						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (Project	0	0	0	0	0	13.48
Landfill Gas Flare (CA)	13.64	54.55	9.27	9.27	5.86	3.08
Mobile Sources (Project)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (Project)			326.78	326.78		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
New LFGTE (Project-engines)	20.08	240.93	6.69	6.69	38.24	24.68
Total Post Project Emissions	***50.73***	***377.15***	***345.11***	***345.11***	***56.48***	***50.76***
Major Source Threshold (Rule 2201-3.24.1)	*10.00*	*100.00*	*70.00*	*100.00*	*70.00*	*10.00*
Major Source [a,b]	*YES*	*YES*	*NO*	*NO*	*NO*	*YES*
Offset Threshold (Rule 2201, Table 3-5)	*10.00*	*100.00*	*14.60*	*NA*	*27.375*	*10.00*
Offsets Requirements Triggered [b]	*YES*	*YES*	*YES*	*NA*	*NO*	*YES*
Change in Emissions	**26.39**	**243.23**	**202.73**	**202.73**	**38.25**	**30.67**
Major Modification Threshold (Rule 2201 Table 3-5) [a]	*25.00*	*NA*	*15.00*	*NA*	*40.00*	*25.00*
Major Modification [a]	*YES*	*NA*	*YES*	*NA*	*NO*	*YES*

[a] Fugitive emissions not included per District Rule (Fugitive emissions in table indicated by italics)

[b] Major source, modification, or offsets requirement may apply to Ameresco LFGTE facility.

NOx = Nitrogen Oxides
CO = Carbon Monoxide
PM10 = Particulate Matter less than 10 microns
SOx = Sulfur Oxides
VOCs = Volatile Organic Compounds

TABLE 3-7B. PROJECT EMISSIONS - CURRENT PERMITTED VS FUTURE POTENTIAL

(EXCESS PROJECT GAS TO NEW LFG ENGINES)

Source	Criteria Pollutant Emissions					
	NOx	**CO**	**PM10**	**PM2.5**	**SOx**	**VOCs**
	(tons per year)					
Baseline (Current Permitted) Emissions						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions (CP)	0.00	0.00	0.00	0.00	0.00	11.84
Landfill Gas Flares (CP)	35.48	141.91	24.13	24.13	15.26	8.02
Mobile Sources (CP)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (CP)			326.78	326.78		
Ameresco Plant (LFG Engines) (CP)	8.73	104.70	2.91	2.91	12.35	7.97
Total Baseline (Current Permitted) Emissions	***54.73***	***250.46***	***354.01***	***354.01***	***27.63***	***29.38***
Post Project Potential To Emit						
Forward Landfill (Facility # N-339)						
Landfill Fugitive Emissions	0	0	0	0	0	13.48
Landfill Gas Flare (CA)	13.64	54.55	9.27	9.27	5.86	3.08
Mobile Sources (Project)	10.52	3.84	0.20	0.20	0.02	1.55
Fugitive Dust (Project)			326.78	326.78		
Ameresco Plant (LFG Engines) (CA)	6.49	77.82	2.16	2.16	12.35	7.97
New LFGTE (Project-engines)	20.08	240.93	6.69	6.69	38.24	24.68
Total Post Project Emissions	***50.73***	***377.15***	***345.11***	***345.11***	***56.48***	***50.76***
Major Source Threshold (Rule 2201-3.24.1)	*10.00*	*100.00*	*70.00*	*100.00*	*70.00*	*10.00*
Major Source [a,b]	*YES*	*YES*	*NO*	*NO*	*NO*	*YES*
Offset Threshold (Rule 2201, Table 3-5)	*10.00*	*100.00*	*14.60*	*NA*	*27.375*	*10.00*
Offsets Requirements Triggered [b]	*YES*	*YES*	*YES*	*NA*	*NO*	*YES*
Change in Emissions	**-4.00**	**126.69**	**-8.91**	**-8.91**	**28.85**	**21.38**
Major Modification Threshold (Rule 2201 Table 3-5) [a,b]	*25.00*	*NA*	*15.00*	*NA*	*40.00*	*25.00*
Major Modification [a]	*YES*	*NA*	*NO*	*NO*	*YES*	*YES*

[a] Fugitive emissions not included per District Rule (Fugitive emissions in table indicated by italics)

[b] Major source, modification, or offsets requirement may apply to Ameresco LFGTE facility.

NOx = Nitrogen Oxides
CO = Carbon Monoxide
PM10 = Particulate Matter less than 10 microns
SOx = Sulfur Oxides
VOCs = Volatile Organic Compounds

TABLE 3-9. ENERGY PRODUCTION AND OFFSETS

2011-2050

Scenario	LFG Sent to Engines (mmscf)	Energy Generation from LFG (MWh)	GHG Offset from LFG Derived Energy (MTCO2E)
Current Actual	26,495	1,270,394	305,298
Current Permitted	35,648	1,709,251	410,763
Project (flare)	35,648	1,709,251	410,763
Project (engine)	124,965	5,991,763	1,439,925

The energy production before 2008 from the existing LFGTE facility are not shown. The energy production for those years is assumed to be the same in all scenarios and therefore does not result in a change from the baseline.

TABLE 3-10. GHG EMISSIONS FROM FORWARD LANDFILL

Methodology	Scenario	Methane Emissions	Biogenic Carbon Dioxide Emissions	Carbon Storage	Energy Offsets	Total	Change in GHG Emissions from Current Permitted	Change in GHG Emissions from Current Actual
SWICS	Current Actual	1,388,824	3,600,429	13,524,055	305,298	-12,440,529		
SWICS	Current Permitted	2,723,096	7,461,782	19,688,811	410,763	-17,376,478		
SWICS	Project (flare)	3,093,666	8,596,942	23,271,103	410,763	-20,588,200	-3,211,722	-8,147,671
SWICS	Project (engines)	3,918,904	8,920,474	23,271,103	1,439,925	-20,792,124	-3,415,647	-8,351,596

Biogenic emissions from LFG derived carbon dioxide are not included in the total

All units in MTCO2E

4 HEALTH RISK ASSESSMENT

INTRODUCTION

The HRA presented in this section follows the scope of work typically utilized for the completion of HRAs of this nature. In general, it followed the outline and protocols presented in the following guidance documents:

- Office of Environmental Health Hazard Assessment (OEHHA), 2015, *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*, February 2015.

- (SJVAPCD) 2015, *SJVAPCD Planning Commission Guide for Assessing and Mitigating Air Quality Impacts*, March 2015.

These and other applicable HRA methodologies were utilized to reasonably assess human health risks associated with air toxic emissions from current conditions as well as the Project scenario for the Forward Landfill.

Background

In accordance with the CEQA Guidelines (SJVAPCD, 2015), this section of the AQIA evaluates the human health risks associated with LFG derived and vehicle emissions for the current conditions as well as the Project scenario, which includes expansion of Forward.

Objectives of the HRA

The primary objective of this HRA is to provide upper-bound, health-conservative estimates of the potential human health impacts that may be attributable to chemicals present in LFG emissions from the landfill surface and LFG control devices at Forward, where emissions will be increased with the proposed project. The upper bound estimate of the human health impact is provided per CARB, SJVAPCD, and EPA guidance and methodology.

In accordance with CEQA, this air toxics HRA evaluated potential human health risks under current conditions and the Project scenario, including:

- Baseline risks associated with the current conditions of the project site defined as the current actual emissions. This scenario represents health risks associated with average emissions from 2016-2017, which SJVAPCD considers “current actual.”
- Baseline risks associated with the currently permitted sources.
- The Project risks associated with the expansion of Forward.

Methodology

This HRA estimated health risks assuming that potential human receptors were exposed under a Reasonable Maximum Exposure (RME) scenario. The RME scenario is the methodology recommended by the EPA and Department of Toxic Substances Control (DTSC) (EPA, 1989; DTSC, 1996) for preparation of HRAs for hazardous substance sites and permitted facilities. The RME is defined as the maximum exposure (i.e., chemical intake) that is reasonably expected to occur due to chemicals of concern at a site.

Because of the health conservative nature of the RME methodology, it is highly unlikely that actual human health risks posed by chemicals of potential concern at the Project site will exceed the estimates calculated in this HRA. RME methodology uses conservative exposure factors, such as exposure time, exposure frequency, and average body weight.

HRA Organization

Section 4.1 presents introductory material and statements of the objective and methodology for the HRA; Section 4.2 describes the process through which chemicals of potential concern were identified. The exposure assessment is provided in Section 4.3, including identification of potentially exposed populations and exposure pathways. Section 4.4 describes the estimation of exposure point concentrations (EPCs). Section 4.5 describes the procedures through which chronic daily intakes (CDIs) of the chemicals of concern were estimated. Toxicity information for carcinogens and non-carcinogens is discussed in Section 4.6. Risk characterization is summarized in Section 4.7. Conclusions of the HRA are discussed in Section 4.8, which includes comparison to CEQA significance levels. Section 4.9 describes the uncertainties inherent in the HRA process while Section 4.10 describes the limitations of a baseline HRA of this type.

IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

This section summarizes and evaluates analytical data for the Project site and provides background information used in the overall characterization of the Project site with respect to this HRA. Based on an analysis of the analytical data collected for the Project site, chemicals of potential concern (COPC) to be included and evaluated in the HRA were selected from an overall list of potential site contaminants.

Summary of Previous Site Investigations

The following chemical categories were considered potential contaminants at the Project site due to the presence of LFG. These chemical categories were the focus of previous investigative and monitoring efforts at the project sites:

- Toxic VOCs present in LFG, such as benzene, vinyl chloride, etc.
- Heavy Metals and other inorganic constituents, including mercury, hydrochloric acid, etc., which can be derived from LFG surface emissions or combustion.

- Diesel particulate from diesel combustion

The following investigative activities have been conducted at the Landfill to date and were reviewed and evaluated in the completion of this HRA:

LFG Sampling

Where available, SCS reviewed and compiled data collected from site-specific LFG sampling conducted at the Landfill site. These data were used preferentially over any regulatory default values.

List of Chemicals of Potential Concern

A total of 27 separate VOCs were identified or were expected to be present in LFG surface emissions or LFG combustion products at the Project landfill per AP-42. These chemicals included:

- 1,1,1-Trichloroethane (methyl chloroform)
- 1,1,2,2-Tetrachloroethane
- 1,1-Dichloroethane
- 1,1-Dichloroethene
- 1,2-Dichloroethane
- 1,2-Dichloropropane
- Acrylonitrile
- Benzene
- Carbon disulfide
- Carbon tetrachloride
- Carbonyl sulfide
- Chlorobenzene
- Chloroethane (ethyl chloride)
- Chloroform
- Chloromethane
- Dichlorobenzene
- Dichloromethane (methylene chloride)
- Ethylbenzene
- Ethylene dibromide
- Hexane
- Methyl ethyl ketone
- Methyl isobutyl ketone
- Perchloroethylene (tetrachloroethylene)
- Toluene
- Trichloroethylene (trichloroethene)
- Vinyl chloride
- Xylenes

Mercury, a metal, was also included in the HRA.

Since each of the above compounds was detected or expected to be present in LFG, they became the focus of the various analyses completed for this HRA. These chemicals have been included in the HRA.

EXPOSURE ASSESSMENT

Identification of Potentially Exposed Populations

In this HRA, each source of COPCs was entered into the EPA approved AERMOD model. AERMOD is a refined air dispersion modeling program and can compute emission concentrations from many sources at many locations based on actual meteorological data. The meteorological data used in this HRA was obtained from the SJVAPCD web site and had already been reviewed for use in AERMOD. A Cartesian grid of receptors was placed from the edge of the site boundary out to five kilometers from the sources. No receptors are located within the facility boundaries. The facility, as defined by the property line, is not considered to be “ambient air” and is not evaluated in this HRA.

Identification of Exposure Pathways

To determine the extent and magnitude of exposures to human populations, the pathways of exposure to those populations were analyzed. This analysis took into account the sources of contaminants, release mechanisms, fate and transport in different media, receiving media, exposure points, exposure routes, and targeted populations.

EPA describes an exposure pathway as generally consisting of four necessary elements (EPA, 1989):

1. A source and mechanism of chemical release.
2. A retention or transport medium (or media).
3. A point of potential human contact with the contaminated medium (exposure point).
4. An exposure route at the exposure point.

Each of these four elements exists for the exposure scenarios, which include LFG emissions and inhalation exposure.

OEHHA requires that the HRA also include the soil ingestion, dermal contact, and mother’s milk exposure pathways. These pathways were also included in this HRA.

Choice of Receptors

The "off-site residential population" receptor scenario was based on the fact that there are currently residences within 1-mile of the current landfill site. The off-site residential population is exposed to contaminants through inhalation of contaminants in LFG. A correctional facility is located approximately 1,900 feet north of the facility. For purposes of this HRA, the correctional facility is considered a residential receptor. The residential risk was calculated for all receptors, even though many of the receptor locations are currently unoccupied. The risk at both the maximally exposed receptor and the maximally exposed occupied receptor are included in this report.

Rationale for Exclusion of Exposure Pathways

Several exposure pathways were not considered complete for the purposes of this human HRA. The HRA only evaluated exposure pathways that were expected to be complete, such that they could cause significant exposure to human receptors. The rationale for exclusion of certain incomplete exposure pathways is described below.

Groundwater

Since any Project expansion scenario for the Project landfill sites will have to be performed in compliance with Resource, Conservation, and Recovery Act (RCRA) Subtitle D and the California equivalent regulations under Title 27 of the California Code of Regulations (27 CCR), for purposes of this HRA, potential impacts to groundwater were assumed not to occur or would be mitigated by the regulatory requirements for installation of a groundwater monitoring network. No groundwater impacts are expected with the expansion of Forward.

Based on this information, the exposure pathways associated with the potable uses of groundwater were considered incomplete for the purposes of this HRA, including: (1) ingestion as a drinking water source; (2) incidental ingestion during showering or bathing; (3) dermal contact with impacted groundwater during showering or bathing; and (4) inhalation of VOCs in groundwater during showering, bathing, and cooking. No further evaluation of these pathways was conducted or is necessary for current or Project scenario receptors.

Surface Water

Since any Project expansion scenarios for the Project landfill site will have to be performed in compliance with RCRA Subtitle D, 27 CCR, as well as National Pollutant Discharge Elimination System (NPDES) regulations, for purposes of this HRA, impacts to surface water were not expected to occur due to future landfill expansion and operations.

Based on this information, the exposure pathways associated with the potential uses of surface water were considered incomplete for the purposes of this HRA, including: (1) ingestion as a drinking water source; (2) incidental ingestion during showering, bathing, or swimming; (3) dermal contact with impacted surface water during showering, bathing, or swimming; and (4) inhalation of VOCs in surface water during showering, bathing, cooking; or swimming. No further evaluation of these pathways was conducted or is necessary for existing or future receptor scenarios.

General

With the elimination of the above exposure pathways, the remaining pathway that were considered complete as part of this HRA included the inhalation of chemicals present in LFG and emissions from vehicles, the dermal absorption, soil ingestion, and mother's milk. Exposure pathways other than inhalation are not expected to contribute significantly, as demonstrated in the 2012 and 2014 AQIA for Forward. Mercury is the only COPC which can be deposited and lead to exposure by these pathways, and it accounted for less than one percent of the hazard in the previous AQIA.

Note that the hazard indices/carcinogenic risks for current and proposed Project scenario off-site residents were utilized to evaluate the potential human health risks to sensitive populations since children are considered a sensitive population. No specific sensitive populations, other than an off-site child resident, were assumed to exist near the Project site in the future.

ESTIMATION OF EXPOSURE POINT CONCENTRATIONS (EPCS)

Exposure point concentrations (EPCs) are the chemical concentrations at the specific points of potential human contact used to estimate exposures for both on- and off-site populations of concern. The HRA utilized health conservative methods for determining EPCs that tend to overestimate environmental concentrations at the points of exposure.

Air EPCs

Exposures in air were estimated for a pathway, which includes volatilization and emission of chemicals into the breathing zone through the landfill surface, from LFG control devices, and vehicle exhaust. The airborne pathway included landfill surface emissions from the current permitted landfill along with its existing permitted LFG control equipment, where applicable. Emissions from the proposed Project scenario included emissions from the expanded Project landfill in accordance with the Project scenario, as well as future LFG control devices if necessary, plus vehicle exhaust emissions.

For the purposes of this HRA, a list of "regulated toxic compounds" was developed from the current list of TACs regulated by the EPA under the federal CAA and chemicals regulated by the CARB under the AB 2588 air toxic "hot spots" program. These lists were cross-referenced against the list of toxic substances expected to be present in LFG, as identified in the EPA's AP-42 section on landfills.

Concentrations of the regulated toxic compounds in LFG were determined in one of two ways. If analytical data were available for a particular compound, the site-specific concentrations were used in lieu of any regulatory default value. If actual measured concentrations were not available, default concentrations were derived from WAIC and AP-42 for those compounds that are expected to be present in LFG.

Current actual emissions from LFG were calculated based on the emissions from 2016-2017, the SJVAPCD definition of “current actual.” LFG generation was modeled in EPA’s LandGEM. A collection efficiency of 95.31% was assumed for the LFG. Any collected gas not sent to the LFGTE plant was assumed to be sent to the flare and/or engines, as described in Section 3 of this report. All uncollected gas was assumed to escape through the landfill cover. For the purposes of the carcinogenic and chronic risk calculations, the current actual emissions were assumed to be constant throughout the 30 year averaging period. Acute exposure was calculated based on the peak annual emission rate from 2016-2017.

For the Future Potential scenario, LFG generation was modeled in LandGEM assuming the landfill stops accepting waste when the Project permitted capacity is reached. The Future Potential scenario assumes all additional LFG generated was combusted in a flare.

For the Future Potential scenario, mobile source emissions were assumed to increase to the levels described in Section 3 of this report. Conservatively, the emission factor over this period was assumed to be constant, despite model predictions that the PM_{10} emission factor for diesel trucks will decrease over time.

For the purposes of the carcinogenic and chronic risk calculations, LFG derived emission rates were averaged for the 30 year period with the highest average LFG generation rate. Acute exposure was calculated based on the peak annual emission rate during those 30 years.

Tables 4-1 through 4-15 show the calculated emission rates for LFG derived sources for each scenario, and are provided at the end of this section. Complete details are in Section 3.

Non-LFG-derived sources of TACs (i.e. sources of diesel particulate) are not time-dependent as LFG-derived emissions are. To calculate health risk from diesel particulate matter, the diesel particulate emission rates from Section 3 were used for on-site mobile sources.

Dispersion Modeling for Airborne Concentrations of COPC

To calculate off-site atmospheric concentrations of COPCs, the EPA-approved AERMOD air dispersion model was utilized. AERMOD was used to calculate EPCs for the COPCs at receptor locations from the site boundary up to three kilometers away from the site. Site-specific meteorological conditions were taken into consideration during AERMOD modeling. Meteorological data files were downloaded from the SJVAPCD website. The Gaussian plume model used in AERMOD assumes no pollutant undergoes any chemical reactions and that no removal processes act on the plume during transport from the source, which is also health conservative.

Receptor locations are inclusive of various locations representing pertinent off-site populations, including the nearest residential and commercial/industrial worker populations under the current conditions and Project exposure scenarios.

All modeling was done using unit emission rates so modeling results could be adapted to analyze each scenario and risk type without multiple modeling runs. All acute risk was calculated using the peak 1-hour concentration of each COPC, though some acute toxicity criteria require longer periods of exposure. This results in a slightly conservative analysis of the acute risk because modeled concentrations with longer averaging times are always lower than modeled concentrations with shorter averaging times.

The flare height is from the specifications for one of the existing flares at Forward. The current actual heat release rate for the flare is based on the heat content of the LFG at current flow rates. The Current Permitted stack parameters use a scaled up stack velocity based on the increase of LFG flow to permitted flow rates. For the Future Permitted scenario, it is assumed that any additional flares required for the control of LFG will have similar stack parameters to the existing flares and that the flares will operate at or near their maximum capacity.

The landfill surface area is modeled using a polygon that approximates the area of the landfill surface.

The engine stack parameters are derived from stack drawings provided by Forward and Ameresco. It is assumed that additional engines in Project scenario in which additional LFG is sent to engines will have similar stack parameters.

Complete modeling files will be provided upon request.

ESTIMATION OF CHRONIC DAILY INTAKE (CDI)

The chronic daily intake (CDI) is a measure of the human intake of EPCs for the COPC. AERMOD results and COPC emission rates were imported into the Hotspots Analysis and Reporting Program (HARP), which was then used to calculate the GLC and the CDI for each receptor and exposure scenario. All OEHHA/HARP HRA default parameters were used for all pathways.

TOXICITY ASSESSMENT

For risk assessment purposes, chemicals are separated in two categories of toxicity, depending on whether they exhibit non-carcinogenic or carcinogenic effects. This distinction reflects the current scientific opinion that the mechanisms of action for each category are different. For purposes of assessing risks associated with potential carcinogens, the general risk assessment approach used by EPA is conservative, and assumes that a small number of molecular events can cause changes in a single cell or a small number of cells that can lead to tumor formation. This is known as a no-threshold mechanism since there is essentially no level of exposure (i.e., threshold) to a carcinogen, which will not result in some finite possibility of causing a disease. In the case of chemicals exhibiting non-carcinogenic effects, however, it is believed that organisms have protective mechanisms that must be overcome before toxic endpoints are manifested. Toxicity criteria are integrated into the HARP database.

RISK CHARACTERIZATION

Risk characterization was performed in HARP using OEHHA/HARP default values.

SJVAPCD CEQA guidelines specify that a project has significant increased cancer risk if the project increases cancer risk by 20 in a million ($2x10^{-5}$). This $2x10^{-5}$ level was used in the HRA as the threshold of significance for the proposed Project. SJVPACD CEQA guidelines consider non-carcinogenic risk to be significant if the hazard index exceeds one (1).

Risk Characterization Results

Risk characterization results for the current conditions and the Project scenarios are summarized in ***Table 4-18***. The table shows the risk at the maximally exposed receptor. The maximally exposed receptor is at the fenceline for the facility and is currently unoccupied. Maps showing risk isopleths are shown in ***Figures 4-1 through 4-12***.

HRA CONCLUSIONS

Hazard Indices

The increase in both the chronic and acute Hazard Index for the Project scenario is less than 1. The total hazard index in the future potential scenario is less than 1 for both chronic and acute hazard. The FP acute hazard index is 0.0015, which indicates acute health effects resulting from the project are negligible under SJVAPCD guidelines. The chronic hazard index is 0.0001, which indicates chronic health effects resulting from the project are negligible under SJVAPCD guidelines. Non-carcinogenic risk levels would not be considered significant under CEQA for the proposed Project scenarios.

Carcinogenic Risks

The increase in the carcinogenic risk for the Project scenario is calculated to be less than 10^{-5} at occupied receptors. The increase from the CA baseline to the Project scenario at an occupied receptor is $4x10^{-6}$, and the increase from the CP baseline to the Project at an occupied receptor is $2x10^{-9}$. The reason the increase from the CA baseline is so much more than the CP baseline is primarily due to the fact that cancer risk is driven by DPM, which is proportional to the trip count. The actual number of trips is much smaller than the number of trips in the Project scenario because the Project scenario includes trips at the permitted level. It should be noted that the Project does not seek an increase in the permitted number of trips. Even with this conservative approach, the increase in the cancer risk is less than the SJVAPCD CEQA threshold of significance for cancer risk.

The cumulative cancer risk for the Project scenario is $3.52x10^{-5}$ at that unoccupied maximally exposed fenceline receptor. However, SJVAPCD guidance calls for risk to be evaluated at occupied receptors. The cumulative cancer risk for the Project at the maximally exposed individual receptor (MEIR) is $7x10^{-6}$. Cancer risks at the MEIR are not cumulatively significant.

Due to the health-conservative methodologies used in this baseline HRA, the actual probabilities of cancer formation in the populations of concern due to exposure to chemicals in LFG are likely to be lower than the risks derived using the above methodology. In fact, the RME risk assessment has been designed to overestimate risks and err on the side of health protection. The health conservative assumptions also impact the non-carcinogenic analysis indicating that the estimated HQs are likely to be overestimated when compared to the actual non-carcinogenic hazards posed by the detected chemicals at the project site**.**

Conservative assumptions used in this HRA included: (1) overestimates of COPCs emissions due to conservative LFG modeling assumptions; (2) the use of regulatory default exposure factors when determining chronic daily intake; and (3) the use of regulatory derived to toxicity values. The combination of these conservative parameters provides a very conservative risk value.

Summary

Based on the above risk characterization results, SCS has the following conclusion:

- Carcinogenic risk increases for the Project scenario at human receptors are less than 20 in a million, which is the acceptable policy standard.
- Non-carcinogenic risk increases for the Project scenarios' human receptors are less than 1, which is the acceptable policy standard.

HRA UNCERTAINTIES

Due to limitations of available scientific data and the amount and type of data collected, every risk assessment will have uncertainties associated with it. The primary sources of uncertainty for the present risk assessment include:

- uncertainties in toxicity criteria;
- uncertainties in the calculated GLC.

Uncertainties in the toxicity criteria include (1) the complete absence of RfDs or CSFs for some chemicals and (2) the lack of adequate toxicological basis for some toxicity criteria. The general lack of toxicity criteria based on a solid database of underlying toxicological data results in a reduced ability to accurately quantify both non-cancer and cancer risks. This lack of criteria may result in both under- and overestimation of health risks.

Uncertainties in the calculated GLC are due to the estimation of concentrations of several compounds and the uncertainty inherent in dispersion modeling. The concentration of several compounds was estimated from default values rather than measures. These default values tend to overestimate concentrations. The uncertainty in dispersion modeling includes several conservative assumptions intended to overestimate the GLC. Because of these conservative assumptions, the uncertainty associated with the modeling is expected to overestimate health risk.

HRA LIMITATIONS AND CERTIFICATIONS

This air toxics HRA was prepared in accordance with risk assessment methodologies recommended at the present time by regulatory agencies having jurisdiction in the State of California. It should be recognized that an assessment of the human health risks associated with exposures to chemicals in the environment is a difficult and inexact science. Professional judgments leading to conclusions and recommendations are generally made with an incomplete knowledge of the surface and subsurface conditions. Additional studies may help reduce the uncertainties regarding estimation of potential human health risks. No other warranty, either expressed or implied, is made as to the information presented in this document.

Some of the analytical data used in the HRA were developed by others. SCS cannot speak for the adequacy or accuracy of the site investigations or monitoring events through which these data were developed. For this reason, we have attempted to use health-conservative assumptions wherever data or information was limited or uncertain. Also, the final recommendations presented in this document are meant to reduce the uncertainties associated with past site investigative work and minimize any potential health risks.

SECTION 4. INDEX OF TABLES

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Table 4-18	Risk Summary

All Section 4 tables are provided at the end of the section, beginning on the following page, with the exception of those indicated with an asterisk (*), which are provide in the section text.

Table 4-1. BASELINE CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS FOR CHRONIC RISK CALCULATION

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.06	95.31%	3.04E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.03	95.31%	1.59E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.21	95.31%	9.94E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	95.31%	1.21E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.03	95.31%	1.61E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	3.52E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	2.59E-04
71-43-2	Benzene	78.11	0.9720	0.22	95.31%	1.03E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.07	95.31%	3.30E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	95.31%	1.46E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.03	95.31%	1.49E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.07	95.31%	3.46E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.04	95.31%	2.09E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	3.40E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	95.31%	1.44E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	95.31%	4.18E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.833	95.31%	3.91E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.08	95.31%	9.77E-02
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	95.31%	5.35E-04
110-54-3	Hexane	86.17	2.3240	0.58	95.31%	2.71E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	7.94E-06
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.20	95.31%	1.03E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.22	95.31%	1.02E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.57	95.31%	2.68E-02
108-88-3	Toluene	92.13	25.4050	6.76	95.31%	3.17E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.26	95.31%	1.21E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.19	95.31%	9.12E-03
1330-20-7	Xylenes	106.16	16.5820	5.09	95.31%	2.39E-01
TOTALS	**HAPs**			6.77		0.32

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results.Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and estimated average LFG generation rate for the landfill for 2012 and 2013 derived from 2014 LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1A for model output).

(4) Collection efficiency of 95.37% from Solid Waste Industry for Climate Solutions (SWICS) report dated 2009.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill (5):	4234	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	SWICS collection efficiency

Table 4-2. BASELINE CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS FOR ACUTE RISK CALCULATION

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.07	95.31%	3.11E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.03	95.31%	1.63E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.22	95.31%	1.02E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	95.31%	1.24E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	95.31%	1.65E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	3.60E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	2.65E-04
71-43-2	Benzene	78.11	0.9720	0.22	95.31%	1.05E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.07	95.31%	3.37E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	95.31%	1.49E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.03	95.31%	1.52E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.08	95.31%	3.54E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.05	95.31%	2.14E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	3.47E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	95.31%	1.47E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	95.31%	4.28E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.852	95.31%	3.99E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.13	95.31%	9.98E-02
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	95.31%	5.47E-04
110-54-3	Hexane	86.17	2.3240	0.59	95.31%	2.77E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	8.11E-06
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.25	95.31%	1.05E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.22	95.31%	1.04E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.58	95.31%	2.74E-02
108-88-3	Toluene	92.13	25.4050	6.91	95.31%	3.24E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.26	95.31%	1.24E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.20	95.31%	9.32E-03
1330-20-7	Xylenes	106.16	16.5820	5.20	95.31%	2.44E-01
TOTALS	**HAPs**			6.92		0.32
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	151.40	95.31%	7.10

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and estimated average LFG generation rate for the landfill for 2012 & 2013 derived from 2014 LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1A for model output).

(4) Collection efficiency of 95.37% from Solid Waste Industry for Climate Solutions (SWICS) report dated 2009.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill (5):	4327	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	SWICS collection efficiency

Table 4-3. CURRENT PERMITTED CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS FOR CHRONIC RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.09	95.31%	4.35E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.05	95.31%	2.28E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.30	95.31%	1.42E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.04	95.31%	1.73E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.05	95.31%	2.30E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	5.04E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	3.71E-04
71-43-2	Benzene	78.11	0.9720	0.31	95.31%	1.47E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.10	95.31%	4.73E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	95.31%	2.09E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.05	95.31%	2.13E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.11	95.31%	4.96E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.06	95.31%	2.99E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	4.86E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	95.31%	2.06E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	95.31%	5.99E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.193	95.31%	5.60E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.98	95.31%	1.40E-01
106-93-4	Ethylene dibromide	187.88	0.0210	0.02	95.31%	7.66E-04
110-54-3	Hexane	86.17	2.3240	0.83	95.31%	3.89E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	1.14E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	3.15	95.31%	1.48E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.31	95.31%	1.46E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.82	95.31%	3.84E-02
108-88-3	Toluene	92.13	25.4050	9.68	95.31%	4.54E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.37	95.31%	1.74E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.28	95.31%	1.31E-02
1330-20-7	Xylenes	106.16	16.5820	7.28	95.31%	3.42E-01
TOTALS	**HAPs**			9.69		0.45
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	212.05	95.31%	9.95

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and estimated LFG generation rate for the landfill for 2012-2041 derived from 2014 LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1A for model output).

(4) Collection efficiency of 95.37% from Solid Waste Industry for Climate Solutions (SWICS) report dated 2009.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
CFCs = Chlorofluorohydrocarbons
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill (5):	6061	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	

Table 4-4. CURRENT PERMITTED CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS FOR ACUTE RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.09	95.31%	4.25E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.05	95.31%	2.23E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.30	95.31%	1.39E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.04	95.31%	1.69E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.05	95.31%	2.25E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	4.92E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	3.62E-04
71-43-2	Benzene	78.11	0.9720	0.31	95.31%	1.44E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.10	95.31%	4.62E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	95.31%	2.04E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	95.31%	2.08E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.10	95.31%	4.84E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.06	95.31%	2.92E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	4.75E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	95.31%	2.01E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	95.31%	5.85E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.165	95.31%	5.47E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.91	95.31%	1.37E-01
106-93-4	Ethylene dibromide	187.88	0.0210	0.02	95.31%	7.48E-04
110-54-3	Hexane	86.17	2.3240	0.81	95.31%	3.80E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	1.11E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	3.08	95.31%	1.44E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.30	95.31%	1.42E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.80	95.31%	3.75E-02
108-88-3	Toluene	92.13	25.4050	9.46	95.31%	4.44E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.36	95.31%	1.70E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.27	95.31%	1.28E-02
1330-20-7	Xylenes	106.16	16.5820	7.11	95.31%	3.34E-01
TOTALS	**HAPs**			9.46		0.44
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	207.12	95.31%	9.72

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and estimated LFG generation rate for the landfill for 2028 derived from 2014 LandGEM (ver 3.01) Mimic Model using site-specific k and Lo parameters (see Table 3-1A for model output).

(4) Collection efficiency of 95.37% from Solid Waste Industry for Climate Solutions (SWICS) report dated 2009.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
CFCs = Chlorofluorohydrocarbons
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill (5):	5920	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	

Table 4-5. POST PROJECT CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS

FOR CHRONIC RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.11	95.31%	4.97E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.06	95.31%	2.60E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.35	95.31%	1.62E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.04	95.31%	1.98E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.06	95.31%	2.63E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	5.76E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	4.23E-04
71-43-2	Benzene	78.11	0.9720	0.36	95.31%	1.68E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.12	95.31%	5.40E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.01	95.31%	2.39E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.05	95.31%	2.44E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.12	95.31%	5.66E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.07	95.31%	3.42E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	5.55E-04
74-87-3	Chloromethane	50.49	0.0210	0.01	95.31%	2.35E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	95.31%	6.84E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.362	95.31%	6.39E-02
100-41-4	Ethylbenzene	106.16	6.7890	3.40	95.31%	1.60E-01
106-93-4	Ethylene dibromide	187.88	0.0210	0.02	95.31%	8.74E-04
110-54-3	Hexane	86.17	2.3240	0.95	95.31%	4.44E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	1.30E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	3.59	95.31%	1.69E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.35	95.31%	1.66E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.93	95.31%	4.38E-02
108-88-3	Toluene	92.13	25.4050	11.05	95.31%	5.18E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.42	95.31%	1.98E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.32	95.31%	1.49E-02
1330-20-7	Xylenes	106.16	16.5820	8.31	95.31%	3.90E-01
TOTALS	**HAPs**			11.06		0.52
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	242.09	95.31%	11.36

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and estimated MAXIMUM LFG generation rate for the landfill (2032) derived from 2014 LandGEM (ver 3.01) Mimic Model (see Table 3-1B for model output).

(4) Collection efficiency of 95.37% from Solid Waste Industry for Climate Solutions (SWICS) report dated 2009.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
CFCs = Chlorofluorohydrocarbons
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill (5):	6919	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	

Table 4-6. POST PROJECT CONTROLLED FUGITIVE LANDFILL GAS EMISSIONS

FOR ACUTE RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Avg. Conc. of Compounds Found in LFG (2) (ppmv)	Maximum Uncontrolled LFG Emissions (3) (tons/yr)	LFG Collection System Efficiency (4)	LFG Emissions from Landfill (tons/yr)
	HAZARDOUS AIR POLLUTANTS					
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.12	95.31%	5.55E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.06	95.31%	2.91E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.39	95.31%	1.81E-02
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.05	95.31%	2.21E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.06	95.31%	2.94E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	95.31%	6.43E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	95.31%	4.73E-04
71-43-2	Benzene	78.11	0.9720	0.40	95.31%	1.88E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.13	95.31%	6.03E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.01	95.31%	2.67E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.06	95.31%	2.72E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.13	95.31%	6.32E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.08	95.31%	3.82E-03
67-66-3	Chloroform	119.39	0.0210	0.01	95.31%	6.21E-04
74-87-3	Chloromethane	50.49	0.0210	0.01	95.31%	2.62E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.02	95.31%	7.64E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.521	95.31%	7.14E-02
100-41-4	Ethylbenzene	106.16	6.7890	3.80	95.31%	1.78E-01
106-93-4	Ethylene dibromide	187.88	0.0210	0.02	95.31%	9.77E-04
110-54-3	Hexane	86.17	2.3240	1.06	95.31%	4.96E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	95.31%	1.45E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	4.02	95.31%	1.88E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.40	95.31%	1.86E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	1.04	95.31%	4.90E-02
108-88-3	Toluene	92.13	25.4050	12.35	95.31%	5.79E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.47	95.31%	2.21E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.36	95.31%	1.67E-02
1330-20-7	Xylenes	106.16	16.5820	9.29	95.31%	4.36E-01
TOTALS	**HAPs**			12.36		0.58
Criteria Air Pollutants						
NMOCs (as hexane) (5)(6)		86.17	595	270.50	95.31%	12.69

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and estimated MAXIMUM LFG generation rate for the landfill (2031) derived from 2014 LandGEM (ver 3.01) Mimic Model (see Table 3-1B for model output).

(4) Collection efficiency of 95.37% from Solid Waste Industry for Climate Solutions (SWICS) report dated 2009.

(5) 595 ppmv = NSPS default value

(6) NMOCs assumed to be equivalent to VOCs.

HAPs = Hazardous Air Pollutants
CFCs = Chlorofluorohydrocarbons
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Estimated landfill gas total flow from landfill (5):	7731	cfm
Estimated methane content of LFG:	50.0%	
LFG Collection Efficiency	95.31%	

TABLE 4-7A. EMISSIONS FROM LANDFILL GAS FIRED ENGINE (LFGTE PLANT) FOR CHRONIC RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Engine Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.02	93.00%	3.42E-04	1.50E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.01	93.00%	1.79E-04	7.86E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.07	93.00%	1.12E-03	4.90E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.01	93.00%	1.36E-04	5.97E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.01	93.00%	1.81E-04	7.94E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	93.00%	3.97E-05	1.74E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.00	86.10%	5.79E-05	2.54E-04
71-43-2	Benzene	78.11	0.9720	0.07	86.10%	2.30E-03	1.01E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.02	86.10%	7.39E-04	3.24E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	93.00%	1.64E-05	7.20E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.01	86.10%	3.33E-04	1.46E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.02	93.00%	3.90E-04	1.71E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.01	93.00%	2.35E-04	1.03E-03
67-66-3	Chloroform	119.39	0.0210	0.00	93.00%	3.83E-05	1.68E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	93.00%	1.62E-05	7.09E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.00	93.00%	4.71E-05	2.06E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.28	93.00%	4.40E-03	1.93E-02
100-41-4	Ethylbenzene	106.16	6.7890	0.69	86.10%	2.19E-02	9.57E-02
106-93-4	Ethylene dibromide	187.88	0.0210	0.00	93.00%	6.03E-05	2.64E-04
110-54-3	Hexane	86.17	2.3240	0.19	86.10%	6.07E-03	2.66E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	1.28E-05	5.60E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	0.73	86.10%	2.31E-02	1.01E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.07	86.10%	2.28E-03	9.98E-03
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.19	93.00%	3.02E-03	1.32E-02
108-88-3	Toluene	92.13	25.4050	2.24	86.10%	7.10E-02	3.11E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.09	93.00%	1.37E-03	5.98E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.06	93.00%	1.03E-03	4.50E-03
1330-20-7	Xylenes	106.16	16.5820	1.68	86.10%	5.34E-02	2.34E-01
TOTALS	**HAPs**						**8.49E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (g/bhp-hr) (6)	Emission Factor (lb/mmBTU)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)	86.18	20.00			1.820	8.0
Nitrogen oxides (NOx)			0.15		1.481	6.5
Sulfur oxides (as SO2) (7)	64.06	150.00			2.820	12.4
Carbon monoxide (CO)			1.8		17.767	77.8
Particulates (PM10)			0.07		0.691	3.0
TOTAL CRITERIA POLLUTANTS						**99.7**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, CO, and VOC were calculated using CARB-recommended rates per BACT guidance document dated 11/15/01.
PM-10 emission factor from EPA AP-42, Table 2.4-5 (11/98); SOx emissions based on Permit limit of 46.9 ppmv of H2S in LFG.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Maximum Estimated Heat Input to Engines:	42	mmBtu/hr
Estimated methane content of LFG:	50.0%	
Total maximum flow to engines	1,400	scfm
Engine Rating (Caterpillar G3520C engine data used to complete some calculations on this sheet)	3,012	bhp
Maximum flow to each engine	942	scfm
Number of engines needed	1	

TABLE 4-7A. EMISSIONS FROM LANDFILL GAS FIRED ENGINE (LFGTE PLANT)
FOR ALL RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Engine Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.03	93.00%	4.61E-04	2.02E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.02	93.00%	2.41E-04	1.06E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.09	93.00%	1.51E-03	6.60E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.01	93.00%	1.83E-04	8.03E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.02	93.00%	2.44E-04	1.07E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	93.00%	5.34E-05	2.34E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.00	86.10%	7.79E-05	3.41E-04
71-43-2	Benzene	78.11	0.9720	0.10	86.10%	3.10E-03	1.36E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.03	86.10%	9.94E-04	4.35E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	93.00%	2.21E-05	9.69E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.01	86.10%	4.49E-04	1.96E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.03	93.00%	5.25E-04	2.30E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.02	93.00%	3.17E-04	1.39E-03
67-66-3	Chloroform	119.39	0.0210	0.00	93.00%	5.15E-05	2.26E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	93.00%	2.18E-05	9.54E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.00	93.00%	6.34E-05	2.78E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.37	93.00%	5.93E-03	2.60E-02
100-41-4	Ethylbenzene	106.16	6.7890	0.93	86.10%	2.94E-02	1.29E-01
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	93.00%	8.11E-05	3.55E-04
110-54-3	Hexane	86.17	2.3240	0.26	86.10%	8.17E-03	3.58E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	1.72E-05	7.53E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	0.98	86.10%	3.11E-02	1.36E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.10	86.10%	3.06E-03	1.34E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.25	93.00%	4.06E-03	1.78E-02
108-88-3	Toluene	92.13	25.4050	3.01	86.10%	9.55E-02	4.18E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.12	93.00%	1.84E-03	8.05E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.09	93.00%	1.38E-03	6.06E-03
1330-20-7	Xylenes	106.16	16.5820	2.26	86.10%	7.18E-02	3.15E-01
TOTALS	**HAPs**						**1.14E+00**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (g/bhp-hr) (6)	Emission Factor (lb/mmBTU)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)	86.18	20.00			1.820	8.0
Nitrogen oxides (NOx)			0.15		1.992	8.7
Sulfur oxides (as SO2) (7)	64.06	150.00			2.820	12.4
Carbon monoxide (CO)			1.8		23.905	104.7
Particulates (PM10)			0.07		0.930	4.1
TOTAL CRITERIA POLLUTANTS						**129.9**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, CO, and VOC were calculated using CARB-recommended rates per BACT guidance document dated 11/15/01.
PM-10 emission factor from EPA AP-42, Table 2.4-5 (11/98); SOx emissions based on Permit limit of 46.9 ppmv of H2S in LFG.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Maximum Estimated Heat Input to Engines:	56	mmBtu/hr
Estimated methane content of LFG:	50.0%	
Total maximum flow to engines	1,884	scfm
Engine Rating (Caterpillar G3520C engine data used to complete some calculations on this sheet)	3,012	bhp
Maximum flow to each engine	942	scfm
Number of engines needed	2	

TABLE 4-8. POST-PROJECT EMISSIONS FROM NEW LANDFILL GAS-FIRED ENGINES
(EXCESS PROJECT GAS TO IC ENGINES)
FOR CHRONIC RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Engine Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.04	93.00%	6.96E-04	3.05E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.02	93.00%	3.65E-04	1.60E-03
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.14	93.00%	2.28E-03	9.97E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.02	93.00%	2.77E-04	1.21E-03
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.02	93.00%	3.69E-04	1.61E-03
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	93.00%	8.07E-05	3.53E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.00	86.10%	1.18E-04	5.16E-04
71-43-2	Benzene	78.11	0.9720	0.15	86.10%	4.68E-03	2.05E-02
75-15-0	Carbon disulfide	76.13	0.3200	0.05	86.10%	1.50E-03	6.58E-03
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	93.00%	3.34E-05	1.46E-04
463-58-1	Carbonyl sulfide	60.07	0.1830	0.02	86.10%	6.78E-04	2.97E-03
108-90-7	Chlorobenzene	112.56	0.2270	0.05	93.00%	7.93E-04	3.47E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.03	93.00%	4.79E-04	2.10E-03
67-66-3	Chloroform	119.39	0.0210	0.00	93.00%	7.78E-05	3.41E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	93.00%	3.29E-05	1.44E-04
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	93.00%	9.58E-05	4.20E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.56	93.00%	8.95E-03	3.92E-02
100-41-4	Ethylbenzene	106.16	6.7890	1.40	86.10%	4.44E-02	1.95E-01
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	93.00%	1.22E-04	5.36E-04
110-54-3	Hexane	86.17	2.3240	0.39	86.10%	1.23E-02	5.41E-02
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	2.60E-05	1.14E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	1.48	86.10%	4.69E-02	2.06E-01
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.15	86.10%	4.63E-03	2.03E-02
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.38	93.00%	6.14E-03	2.69E-02
108-88-3	Toluene	92.13	25.4050	4.55	86.10%	1.44E-01	6.32E-01
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.17	93.00%	2.78E-03	1.22E-02
75-01-4	Vinyl chloride	62.50	1.0770	0.13	93.00%	2.09E-03	9.15E-03
1330-20-7	Xylenes	106.16	16.5820	3.42	86.10%	1.09E-01	4.75E-01
TOTALS	**HAPs**						**1.72E+00**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (g/bhp-hr) (6)	Emission Factor (lb/mmBTU)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)	86.18	20.00			1.820	8.0
Nitrogen oxides (NOx)			0.15		3.010	13.2
Sulfur oxides (as SO2) (7)	64.06	150.00			2.820	12.4
Carbon monoxide (CO)			1.8		36.118	158.2
Particulates (PM10)			0.07		1.405	6.2
TOTAL CRITERIA POLLUTANTS						**189.9**

NOTES:
(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (Control Efficiencies for LFG Constituents, 11/98)
(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, CO, and VOC were calculated using CARB-recommended rates per BACT guidance document dated 11/15/01.
PM-10 emission factor from EPA AP-42, Table 2.4-5 (11/98); SOx emissions based on Permit limit of 46.9 ppmv of H2S in LFG.
(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Maximum Estimated Heat Input to Engines:	85	mmBtu/hr
Estimated methane content of LFG:	50.0%	
Total maximum flow to engines	2,847	scfm
Engine Rating (Caterpillar G3520C engine data used to complete some calculations on this sheet)	3,012	bhp
Maximum flow to each engine	942	scfm
Number of engines needed	3	

TABLE 4-10. BASELINE (CURRENT ACTUAL) EMISSIONS FROM LANDFILL GAS FLARES FOR CHRONIC RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.04	98.00%	1.74E-04	7.63E-04
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.02	98.00%	9.13E-05	4.00E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.12	98.00%	5.70E-04	2.49E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.02	98.00%	6.93E-05	3.03E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.02	98.00%	9.23E-05	4.04E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	98.00%	2.02E-05	8.84E-05
107-13-1	Acrylonitrile	53.06	0.0360	0.00	99.70%	2.23E-06	9.75E-06
71-43-2	Benzene	78.11	0.9720	0.13	99.70%	8.85E-05	3.87E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.04	99.70%	2.84E-05	1.24E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	8.37E-06	3.66E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.02	99.70%	1.28E-05	5.61E-05
108-90-7	Chlorobenzene	112.56	0.2270	0.04	98.00%	1.98E-04	8.69E-04
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.03	98.00%	1.20E-04	5.25E-04
67-66-3	Chloroform	119.39	0.0210	0.00	98.00%	1.95E-05	8.53E-05
74-87-3	Chloromethane	50.49	0.0210	0.00	98.00%	8.24E-06	3.61E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	98.00%	2.40E-05	1.05E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.49	98.00%	2.24E-03	9.81E-03
100-41-4	Ethylbenzene	106.16	6.7890	1.23	99.70%	8.40E-04	3.68E-03
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	98.00%	3.06E-05	1.34E-04
110-54-3	Hexane	86.17	2.3240	0.34	99.70%	2.33E-04	1.02E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	2.28E-05	9.97E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	1.30	99.70%	8.87E-04	3.89E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.13	99.70%	8.75E-05	3.83E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.34	98.00%	1.54E-03	6.73E-03
108-88-3	Toluene	92.13	25.4050	3.98	99.70%	2.73E-03	1.19E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.15	98.00%	6.95E-04	3.04E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.11	98.00%	5.23E-04	2.29E-03
1330-20-7	Xylenes	106.16	16.5820	2.99	99.70%	2.05E-03	8.98E-03
TOTALS	**HAPs**						**5.87E-02**

Criteria Air Pollutants	**Molecular Weight (g/Mol)**	**Concentration of Compound (ppmv)**	**Emission Factor (lb/MMBtu) (6)**	**Emission Factor (lb/hr/scfm)**	**Maximum Emissions from Flare (lbs/hr)**	**Maximum Emissions from Flare (tons/yr)**
Volatile Organic Compounds (VOCs)			0.01130		0.840	3.68
Nitrogen oxides (NOx)			0.050		3.717	16.28
Sulfur oxides (as SO2) (7)			0.0215		1.598	7.00
Carbon monoxide (CO)			0.200		14.866	65.12
Particulates (PM10)			0.034		2.527	11.07
TOTAL CRITERIA POLLUTANTS						**99.46**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (C0ntrol Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Average heat input to flares:	74.332 mmBtu/hr		
Estimated methane content of LFG:	50.0%		
LFG to Flare, Average:	2,493 cfm	1,310,314,602 cf/yr	

TABLE 4-11. BASELINE (CURRENT ACTUAL) EMISSIONS FROM LANDFILL GAS FLARES FOR ACUTE RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.04	98.00%	1.74E-04	7.63E-04
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.02	98.00%	9.13E-05	4.00E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.12	98.00%	5.70E-04	2.49E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.02	98.00%	6.93E-05	3.03E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.02	98.00%	9.23E-05	4.04E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.00	98.00%	2.02E-05	8.84E-05
107-13-1	Acrylonitrile	53.06	0.0360	0.00	99.70%	2.23E-06	9.75E-06
71-43-2	Benzene	78.11	0.9720	0.13	99.70%	8.85E-05	3.87E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.04	99.70%	2.84E-05	1.24E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	8.37E-06	3.66E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.02	99.70%	1.28E-05	5.61E-05
108-90-7	Chlorobenzene	112.56	0.2270	0.04	98.00%	1.98E-04	8.69E-04
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.03	98.00%	1.20E-04	5.25E-04
67-66-3	Chloroform	119.39	0.0210	0.00	98.00%	1.95E-05	8.53E-05
74-87-3	Chloromethane	50.49	0.0210	0.00	98.00%	8.24E-06	3.61E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	98.00%	2.40E-05	1.05E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.49	98.00%	2.24E-03	9.81E-03
100-41-4	Ethylbenzene	106.16	6.7890	1.23	99.70%	8.40E-04	3.68E-03
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	98.00%	3.06E-05	1.34E-04
110-54-3	Hexane	86.17	2.3240	0.34	99.70%	2.33E-04	1.02E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	2.28E-05	9.97E-05
78-93-3	Methyl ethyl ketone	72.11	10.5570	1.30	99.70%	8.87E-04	3.89E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.13	99.70%	8.75E-05	3.83E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.34	98.00%	1.54E-03	6.73E-03
108-88-3	Toluene	92.13	25.4050	3.98	99.70%	2.73E-03	1.19E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.15	98.00%	6.95E-04	3.04E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.11	98.00%	5.23E-04	2.29E-03
1330-20-7	Xylenes	106.16	16.5820	2.99	99.70%	2.05E-03	8.98E-03
TOTALS	**HAPs**						**5.87E-02**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.01130		0.840	3.68
Nitrogen oxides (NOx)			0.050		3.717	16.28
Sulfur oxides (as SO2) (7)			0.0215		1.598	7.00
Carbon monoxide (CO)			0.200		14.866	65.12
Particulates (PM10)			0.034		2.527	11.07
TOTAL CRITERIA POLLUTANTS						**99.46**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (C0ntrol Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Average heat input to flares:	74.332 mmBtu/hr	
Estimated methane content of LFG:	50.0%	
LFG to Flare, Average 2006 & 2007 (actual data):	2,493 cfm	1,310,314,602 cf/yr

TABLE 4-12. CURRENT PERMITTED EMISSIONS FROM LANDFILL GAS FLARES
FOR CHRONIC AND ACUTE RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.08	98.00%	3.72E-04	1.63E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.04	98.00%	1.95E-04	8.55E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.27	98.00%	1.22E-03	5.33E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	98.00%	1.48E-04	6.49E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	98.00%	1.97E-04	8.64E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	98.00%	4.32E-05	1.89E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	99.70%	4.76E-06	2.08E-05
71-43-2	Benzene	78.11	0.9720	0.28	99.70%	1.89E-04	8.29E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.09	99.70%	6.07E-05	2.66E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	1.79E-05	7.83E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	99.70%	2.74E-05	1.20E-04
108-90-7	Chlorobenzene	112.56	0.2270	0.09	98.00%	4.24E-04	1.86E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.06	98.00%	2.56E-04	1.12E-03
67-66-3	Chloroform	119.39	0.0210	0.01	98.00%	4.16E-05	1.82E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	98.00%	1.76E-05	7.71E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	98.00%	5.13E-05	2.25E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.05	98.00%	4.79E-03	2.10E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.62	99.70%	1.80E-03	7.87E-03
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	98.00%	6.55E-05	2.87E-04
110-54-3	Hexane	86.17	2.3240	0.73	99.70%	4.99E-04	2.19E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	4.87E-05	2.13E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.77	99.70%	1.90E-03	8.31E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.27	99.70%	1.87E-04	8.20E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.72	98.00%	3.29E-03	1.44E-02
108-88-3	Toluene	92.13	25.4050	8.51	99.70%	5.83E-03	2.55E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.33	98.00%	1.49E-03	6.51E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.24	98.00%	1.12E-03	4.90E-03
1330-20-7	Xylenes	106.16	16.5820	6.40	99.70%	4.39E-03	1.92E-02
TOTALS	**HAPs**						**1.26E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.01130		1.831	8.018
Nitrogen oxides (NOx)			0.050		8.100	35.48
Sulfur oxides (as SO2) (7)			0.0215		3.483	15.256
Carbon monoxide (CO)			0.200		32.400	141.91
Particulates (PM10)			0.034		5.508	24.13
TOTAL CRITERIA POLLUTANTS						**216.77**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (C0ntrol Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

SOx = 0.0215 (Permit limit); PM-10 = 0.001 lb/hr/dscfm (Permit limit & AP-42); VOC/NMOC = 0.0113 lb/MMBtu (Permit limit)

PM-10 = 0.001 lb/hr/dscfm (Permit limit & AP-42); VOC/NMOC = 0.0113 lb/MMBtu (Permit limit)

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds 3400
VOCs = Volatile Organic Compounds. 1530
4930

MODEL VARIABLES

Maximum Permitted Flare Capacity:	162	mmBtu/hr
Estimated methane content of LFG:	50.0%	
Maximum Permitted Flare Capacity:	5,331	cfm

TABLE 4-13. CURRENT PERMITTED EMISSIONS FROM LANDFILL GAS FLARES FOR ACUTE RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.08	98.00%	3.45E-04	1.51E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.04	98.00%	1.81E-04	7.92E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.25	98.00%	1.13E-03	4.94E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	98.00%	1.37E-04	6.01E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	98.00%	1.83E-04	8.00E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	98.00%	4.00E-05	1.75E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	99.70%	4.41E-06	1.93E-05
71-43-2	Benzene	78.11	0.9720	0.26	99.70%	1.75E-04	7.67E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.08	99.70%	5.62E-05	2.46E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	1.66E-05	7.25E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	99.70%	2.54E-05	1.11E-04
108-90-7	Chlorobenzene	112.56	0.2270	0.09	98.00%	3.93E-04	1.72E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.05	98.00%	2.37E-04	1.04E-03
67-66-3	Chloroform	119.39	0.0210	0.01	98.00%	3.86E-05	1.69E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	98.00%	1.63E-05	7.14E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	98.00%	4.75E-05	2.08E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.97	98.00%	4.44E-03	1.94E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.43	99.70%	1.66E-03	7.28E-03
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	98.00%	6.07E-05	2.66E-04
110-54-3	Hexane	86.17	2.3240	0.67	99.70%	4.62E-04	2.02E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	4.50E-05	1.97E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.56	99.70%	1.76E-03	7.69E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.25	99.70%	1.73E-04	7.59E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.67	98.00%	3.04E-03	1.33E-02
108-88-3	Toluene	92.13	25.4050	7.88	99.70%	5.40E-03	2.37E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.30	98.00%	1.38E-03	6.03E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.23	98.00%	1.04E-03	4.53E-03
1330-20-7	Xylenes	106.16	16.5820	5.93	99.70%	4.06E-03	1.78E-02
TOTALS	**HAPs**						**1.16E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.01130		1.695	7.424
Nitrogen oxides (NOx)			0.050		7.500	32.85
Sulfur oxides (as SO2) (7)			0.0215		3.225	14.126
Carbon monoxide (CO)			0.200		30.000	131.40
Particulates (PM10)			0.034		5.100	22.34
TOTAL CRITERIA POLLUTANTS						**200.71**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (C0ntrol Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

SOx = 0.0215 (Permit limit); PM-10 = 0.001 lb/hr/dscfm (Permit limit & AP-42); VOC/NMOC = 0.0113 lb/MMBtu (Permit limit)

PM-10 = 0.001 lb/hr/dscfm (Permit limit & AP-42); VOC/NMOC = 0.0113 lb/MMBtu (Permit limit)

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants

NMOCs = Non-Methane Organic Compounds 3400

VOCs = Volatile Organic Compounds. 1530

4930

MODEL VARIABLES

Maximum Permitted Flare Capacity:	150	mmBtu/hr
Estimated methane content of LFG:	50.0%	
Maximum Permitted Flare Capacity:	4,936	cfm

TABLE 4-14. POST PROJECT POTENTIAL EMISSIONS FROM LANDFILL GAS FLARES FOR CHRONIC RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.07	98.00%	3.39E-04	1.49E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.04	98.00%	1.78E-04	7.79E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.24	98.00%	1.11E-03	4.86E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.03	98.00%	1.35E-04	5.91E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.04	98.00%	1.80E-04	7.87E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	98.00%	3.93E-05	1.72E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	99.70%	4.34E-06	1.90E-05
71-43-2	Benzene	78.11	0.9720	0.25	99.70%	1.72E-04	7.55E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.08	99.70%	5.53E-05	2.42E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	1.63E-05	7.14E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	99.70%	2.49E-05	1.09E-04
108-90-7	Chlorobenzene	112.56	0.2270	0.08	98.00%	3.87E-04	1.69E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.05	98.00%	2.33E-04	1.02E-03
67-66-3	Chloroform	119.39	0.0210	0.01	98.00%	3.79E-05	1.66E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	98.00%	1.60E-05	7.03E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	98.00%	4.67E-05	2.05E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	0.96	98.00%	4.36E-03	1.91E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.39	99.70%	1.64E-03	7.16E-03
106-93-4	Ethylene dibromide	187.88	0.0210	0.01	98.00%	5.97E-05	2.61E-04
110-54-3	Hexane	86.17	2.3240	0.66	99.70%	4.55E-04	1.99E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	4.43E-05	1.94E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	2.52	99.70%	1.73E-03	7.57E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.25	99.70%	1.70E-04	7.47E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.66	98.00%	2.99E-03	1.31E-02
108-88-3	Toluene	92.13	25.4050	7.76	99.70%	5.31E-03	2.33E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.30	98.00%	1.35E-03	5.93E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.22	98.00%	1.02E-03	4.46E-03
1330-20-7	Xylenes	106.16	16.5820	5.83	99.70%	4.00E-03	1.75E-02
TOTALS	**HAPs**						**1.14E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.0113		1.636	7.166
Nitrogen oxides (NOx)			0.0500		7.239	31.71
Sulfur oxides (as SO2) (7)			0.0215		3.113	13.634
Carbon monoxide (CO)			0.2000		28.957	126.83
Particulates (PM10)			0.034		4.923	21.56
TOTAL CRITERIA POLLUTANTS						**193.73**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (C0ntrol Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Maximum Estimated Heat Input to Flare:	144.78 mmBtu/hr
Estimated methane content of LFG:	50.0%
LFG to Flare (30-year average)	4,856 cfm

TABLE 4-15. POST PROJECT POTENTIAL EMISSIONS FROM LANDFILL GAS FLARES FOR ACUTE RISK CALCULATIONS

CAS	COMPOUNDS (1)	Molecular Weight (g/Mol)	Concentration of Compounds Found In LFG (2) (ppmv)	Pollutant Flow Rate to Flare (3) (tons/yr)	Compound-Specific Flare Destruction Efficiency (4)	Controlled LFG Emissions After Flare Destruction (lbs/hr)	Controlled LFG Emissions After Flare Destruction (5) (tons/yr)
	HAZARDOUS AIR POLLUTANTS						
71-55-6	1,1,1-Trichloroethane (methyl chloroform)	133.42	0.1680	0.09	98.00%	4.15E-04	1.82E-03
79-34-5	1,1,2,2-Tetrachloroethane	167.85	0.0700	0.05	98.00%	2.17E-04	9.53E-04
107-06-2	1,1-Dichloroethane	98.95	0.7410	0.30	98.00%	1.36E-03	5.94E-03
75-35-4	1,1-Dichloroethene	96.94	0.0920	0.04	98.00%	1.65E-04	7.23E-04
107-06-2	1,2-Dichloroethane	98.96	0.1200	0.05	98.00%	2.20E-04	9.63E-04
78-87-5	1,2-Dichloropropane	112.98	0.0230	0.01	98.00%	4.81E-05	2.11E-04
107-13-1	Acrylonitrile	53.06	0.0360	0.01	99.70%	5.30E-06	2.32E-05
71-43-2	Benzene	78.11	0.9720	0.31	99.70%	2.11E-04	9.23E-04
75-15-0	Carbon disulfide	76.13	0.3200	0.10	99.70%	6.76E-05	2.96E-04
56-23-5	Carbon tetrachloride	153.84	0.0070	0.00	98.00%	1.99E-05	8.73E-05
463-58-1	Carbonyl sulfide	60.07	0.1830	0.04	99.70%	3.05E-05	1.34E-04
108-90-7	Chlorobenzene	112.56	0.2270	0.10	98.00%	4.73E-04	2.07E-03
75-00-3	Chloroethane (ethyl chloride)	64.52	0.2390	0.06	98.00%	2.85E-04	1.25E-03
67-66-3	Chloroform	119.39	0.0210	0.01	98.00%	4.64E-05	2.03E-04
74-87-3	Chloromethane	50.49	0.0210	0.00	98.00%	1.96E-05	8.60E-05
106-46-7	Dichlorobenzene	147.00	0.0210	0.01	98.00%	5.71E-05	2.50E-04
75-09-2	Dichloromethane (methylene chloride)	84.94	3.3950	1.17	98.00%	5.34E-03	2.34E-02
100-41-4	Ethylbenzene	106.16	6.7890	2.92	99.70%	2.00E-03	8.76E-03
106-93-4	Ethylene dibromide	187.88	0.0210	0.02	98.00%	7.30E-05	3.20E-04
110-54-3	Hexane	86.17	2.3240	0.81	99.70%	5.56E-04	2.44E-03
7439-97-6	Mercury (total)*	200.61	0.0003	0.00	0.00%	5.42E-05	2.37E-04
78-93-3	Methyl ethyl ketone	72.11	10.5570	3.09	99.70%	2.11E-03	9.26E-03
108-10-1	Methyl isobutyl ketone	100.16	0.7500	0.30	99.70%	2.09E-04	9.14E-04
127-18-4	Perchloroethylene (tetrachloroethylene)	165.83	1.1930	0.80	98.00%	3.66E-03	1.60E-02
108-88-3	Toluene	92.13	25.4050	9.49	99.70%	6.50E-03	2.85E-02
79-01-6	Trichloroethylene (trichloroethene)	131.38	0.6810	0.36	98.00%	1.66E-03	7.25E-03
75-01-4	Vinyl chloride	62.50	1.0770	0.27	98.00%	1.25E-03	5.46E-03
1330-20-7	Xylenes	106.16	16.5820	7.14	99.70%	4.89E-03	2.14E-02
TOTALS	**HAPs**						**1.40E-01**

Criteria Air Pollutants	Molecular Weight (g/Mol)	Concentration of Compound (ppmv)	Emission Factor (lb/MMBtu) (6)	Emission Factor (lb/hr/scfm)	Maximum Emissions from Flare (lbs/hr)	Maximum Emissions from Flare (tons/yr)
Volatile Organic Compounds (VOCs)			0.0113		2.001	8.766
Nitrogen oxides (NOx)			0.0500		8.856	38.79
Sulfur oxides (as SO2) (7)			0.0215		3.808	16.679
Carbon monoxide (CO)			0.2000		35.423	155.15
Particulates (PM10)			0.034		6.022	26.38
TOTAL CRITERIA POLLUTANTS						**236.99**

NOTES:

(1) Hazardous air pollutants (HAPs) found in landfill gas and listed in Title III of the 1990 Clean Air Acts Amendments (from US EPA AP-42, Tables 2.4-1 and 2.4-2).

(2) Average concentration of compounds found in LFG based on "Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values." Compounds with an asterisk (*) have concentration values from June 2007 source test results. Mercury concentrations are based on the Revised EPA AP-42 Section 2.4 Table 2.4-1 (11/98).

(3) Based on concentrations in Column D and LFG flow actual flare thorughput data provided by SCS Field Services.

(4) Compound-specific flare destruction efficiencies from AP-42 Table 2.4-3 (C0ntrol Efficiencies for LFG Constituents, 11/98)

(5) Controlled emissions of HAPs after destruction in flare equals uncontrolled emissions x (1- flare destruction efficiency).

(6) Emissions of NOx, SOx, CO, VOCs, and PM10 were estimated with the following emission limits, per current Title V permit: NOx = 0.05 lb/MMBtu; CO = 0.2 lb/MMBtu; SOx = 0.0215 lb/MMBtu; PM-10 = 0.034 lb/MMBtu; VOC/NMOC = 0.0113 lb/MMBtu.

(7) Destruction efficiency of reduced sulfur compounds assumed to be 100%; i.e., complete conversion to sulfur dioxide

HAPs = Hazardous Air Pollutants
NMOCs = Non-Methane Organic Compounds
VOCs = Volatile Organic Compounds.

MODEL VARIABLES

Maximum Estimated Heat Input to Flare:	177.11	mmBtu/hr
Estimated methane content of LFG:	50.0%	
LFG to Flare (acute)	5,940	cfm

TABLE 4-18. HEALTH RISK ASSESSMENT RESULTS AT PMI

Scenario	Receptor	Cancer Risk (Maximum Impact)	Cancer Risk (Occupied Receptor)	Increase in Cancer Risk due to Project	Chronic Hazard Index	Increase in Acute Hazard Index due to Project	Acute Hazard Index	Increase in Acute Hazard Index due to Project
Current Actual	Maximum	9.30E-06	9.70E-07	1.27E-05	0.0022	0.00340	0.0015	0.0115
Current Permitted	Maximum	2.10E-05	3.19E-06	1.00E-06	0.0043	0.00130	0.0100	0.0030
Project	Maximum	2.20E-05	3.30E-06		0.0056		0.013	

5 PROJECT IMPACTS AND RECOMMENDATIONS

SIGNIFICANCE CRITERIA

The SJVAPCD uses the "Thresholds of Significance" requirements contained within its *Guide for Assessing and Mitigating Air Quality Impacts* as a basis to establish air quality significance criteria for the SJVAB. According to the guidelines, a project may be deemed to have a significant adverse impact on the environment if it would "violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations."

A project would also have a significant impact to air quality if it would conflict with adopted environmental plans or goals of the community where it is located, or "create a potential public health hazard or involve the use, production or disposal of materials which pose a hazard to people or animal or plant populations in the area affected. The state CEQA Guidelines also indicates that a project could have a significant air quality impact if it would create "objectionable" odors.

Criteria Air Pollutant Standard

Based on the SJVAPCD's CEQA guidelines, operational impacts from a proposed project are considered significant under CEQA if the project resulted in a net emissions increase of the following:

- 10 tons per year of VOC,
- 10 tons per year of NOx,
- 15 tons per year of PM_{10},
- 15 tons per year of $PM_{2.5}$,
- 27 tons per year of oxides of sulfur (SOx),
- 100 tons per year of CO.

Based on the Project emission data as previously summarized in Table ES-8, Project impacts for all CAPs are predicted to be significant under some Project scenarios presented prior to the acquisition of offsets through the SJVAPCD permitting process.

Because compliance with offset requirements are required under SJVAPCD rules when Forward seeks an air permit for the landfill or associated destruction devices, Project emissions of CAPs determined to be significant would be considered not significant after compliance with the District offsetting rules. In the unlikely case that stationary source emissions would be permitted and the required Emission Reduction Credits (ERCs) would not be sufficient to reduce the increase in emissions below significance levels, additional ERCs would be obtained to reduce emissions to less than significant levels Recommended measures to reduce Project impacts that may be determined to be significant are identified herein are summarized later in this Section and discussed in more detail within Section 5 of this AQIA.

Toxic Air Contaminant Standard

Based on SJVAPCD guidelines, any project with the potential to expose sensitive receptors (including residential areas) or the general public to substantial levels of TACs would be deemed to have a potentially significant impact. This applies to receptors locating near existing sources of toxic air contaminants, as well as sources of toxic air contaminants locating near existing receptors.

The proposed project does not have the potential to expose the public to TACs in excess of 20 in one million cancer risk, which would be considered to have a significant air quality impact. These thresholds are based on the SJVAPCD's Risk Management Policy, and CEQA guidance. As such, TAC emissions under the proposed project are not likely to be considered significant under CEQA. The results of the HRA performed as part of this AQIA is presented in Section 4.

Greenhouse Gas Standard

There is no SJVAPCD threshold for significance for GHG emissions; however recent cases have concluded that any increase in GHG emissions could be considered significant. The Project results in a decrease in GHG emissions as a result of increased power displacement and increased carbon storage; therefore, the GHG emissions from the Project are not likely to be considered significant.

SJVAPCD guidance states that projects that comply with District Approved Best Performance Standards (BPS) are not significant. For landfills, the BPS may be compliance with CARB's Landfill Methane Rule (LMR), California Code of Regulation (CCR) Subchapter 10, Article 4, Subarticle 6, Sections 95460 to 95476. Forward is subject to the LMR and will comply with the requirements of the regulation. As such, it meets the BPS and the GHG emissions are not significant per SJVAPCD guidance.

As a conservative measure and for additional disclosure, GHG emissions were quantitatively evaluated. The Project would result in a reduction in GHG emissions over the time frame analyzed (1990-2050) due to increased carbon sequestration and potential electricity generation offsets.

Odor Standard

The SJVAPCD identifies a sanitary landfill as a type of facility that is a potential odor source. Because there are one or more sensitive receptors with the screening trigger distance of 1 mile from the landfill property, potential odor impacts from the Project must be considered. The District has established the following significance threshold for odor problems:

- More than one confirmed complaint per year averaged over a three-year period, or
- Three unconfirmed complaints per year averaged over a three-year period.

The facility has not received an average of one odor complaint for the past three years, so the odor impact is not expected to be significant. No additional measures to reduce odor impacts are recommended.

PROJECT IMPACTS

As previously discussed, Project impacts from VOCs, NOx, PM10/PM2.5, and CO may exceed the SJVAPCD's thresholds of significance for each of the pollutants. Therefore, measures to reduce Project impacts to less-than-significant are recommended.

Project VOC Emissions

Project VOC emissions are estimated to exceed the SJVAPCD's threshold of significance for all scenarios except Current Permitted to Project Flare scenario.

Recommendations Proposed as Part of the Project

Any Project VOC emissions from stationary sources in excess of the SJVAPCD threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during the permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. Mobile source VOC emissions are less than the VOC threshold of significance.

Results after Implementing Recommendations

Because all VOC emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by acquisition of emission offsets and VOC emissions from mobile sources are less than the threshold of significance, the Project impact from VOC emissions would be considered not significant after implementation of these recommendations.

Project NOx Emissions

Project NOx emissions are estimated to exceed the SJVAPCD's threshold of significance for all Baseline to Project scenarios considered for the AQIA except the Current Permitted to Project Engine scenario.

Recommendations Proposed as Part of the Project

Any Project NOx emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations.

Results after Implementing Recommendations

Because all NOx emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets, and NOx emissions from mobile sources are less than the SJVAPCD threshold of significance, the Project impact from NOx emissions would be considered not significant after implementation of these recommendations.

Project PM10 Emissions

Project PM_{10} emissions are estimated to exceed the SJVAPCD's threshold of significance for both Current Actual baseline scenarios.

Recommendations Proposed as Part of the Project

Any Project PM_{10} emissions from permitted stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. The Site is also subject to the District's Fugitive Dust Rules (Regulation VIII), which reduces dust emissions.

Results after Implementing Recommendations

Because all PM_{10} emissions from permitted stationary sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets, and PM_{10} emissions from mobile sources are less than the SJVAPCD threshold of significance, the Project impact from PM_{10} emissions would be considered significant due to dust emissions and only when the Current Actual Baseline is considered. However, the Project does not propose a change in any of the dust generating activities as part of the Project; therefore, it is reasonable to use the Current Permitted Baseline to determine the significance of PM_{10} resulting from dust emissions.

Project PM2.5 Emissions

Project $PM_{2.5}$ emissions are estimated to exceed the SJVAPCD's threshold of significance for both Current Actual baseline scenarios.

Recommendations Proposed as Part of the Project

Any Project $PM_{2.5}$ emissions from stationary permitted sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets during the air permitting process or have already been offset during permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. The Site is also subject to the District's Fugitive Dust Rules (Regulation VIII), which reduces dust emissions.

Results after Implementing Recommendations

Because all $PM_{2.5}$ emissions from stationary permitted sources in excess of the SJVAPCD offset threshold will be offset by the acquisition of emission offsets, and $PM_{2.5}$ emissions from mobile sources are less than the SJVAPCD threshold of significance, the Project impact from $PM_{2.5}$ emissions would be considered significant due to dust emissions and only when the Current Actual Baseline is considered. However, the Project does not propose a change in any of the dust generating activities as part of the Project; therefore, it is reasonable to use the Current Permitted Baseline to determine the significance of $PM_{2.5}$ resulting from dust emissions.

Project CO Emissions

Project CO emissions are estimated to exceed the SJVAPCD's threshold of significance for all scenarios except the Current Permitted to Project Flare scenario.

Recommendations Proposed as Part of the Project

Project CO emissions from stationary sources in excess of the SJVAPCD threshold will are likely to be offset by the acquisition of emission offsets during the air permitting process or have already been offset during the permitting of stationary sources, which are required by SJVAPCD Rule 2201 regulations. It is possible for stationary sources to avoid the need for CO offsets through a modeling of CO emissions and demonstrating that impacts will not conflict with SJVAPCD limits. If offsets are avoided this way by the Site, the Site has effectively demonstrated that ground level CO impacts are not significant even if the CO emission threshold is exceeded. Mobile source CO emissions are less than the CO threshold of significance.

Results after Implementing Recommendations

Because all CO emissions from stationary sources in excess of the SJVAPCD offset threshold will be offset by acquisition of emission offsets and CO emissions from mobile sources are less than the threshold of significance, the Project impact from CO emissions would be considered not significant after implementation of these recommendations.

PROJECT ODOR IMPACT

The SJVAPCD's Odor threshold of significance is based on the history of odor complaints received. A review of odor complaints received for the Forward Landfill indicates the Project odor impact is not expected to be significant.

Recommendations Proposed as Part of the Project

No odor impact reduction measures are required. Forward will continue to implement its current odor control practices.

INCREASED GHG EMISSIONS FROM LFG

As discussed above, the GHG emissions from the project are not significant. The site will comply with the landfill methane rule (LMR) and thus can be considered to be not significant and the project results in a net reduction in atmospheric emissions of carbon due to the long term storage of carbon in the landfilled waste.

CUMULATIVE IMPACTS

SJVAPCD's *Guide for Assessing and Mitigating Air Quality Impacts* indicates that any proposed project that would individually have a significant impact on air quality would also be considered to have a significant cumulative air quality impact. By reducing emissions from the Project to less than significant through offsets, the Project is not expected to have a significant cumulative impact except for the pollutants noted as having individual impacts.

SJVAPCD's GHG guidance document *Climate Change Action Plan: Addressing GHG Emissions Impacts under CEQA*, states that Projects meeting the BPS would not be cumulatively significant.

6 REFERENCES

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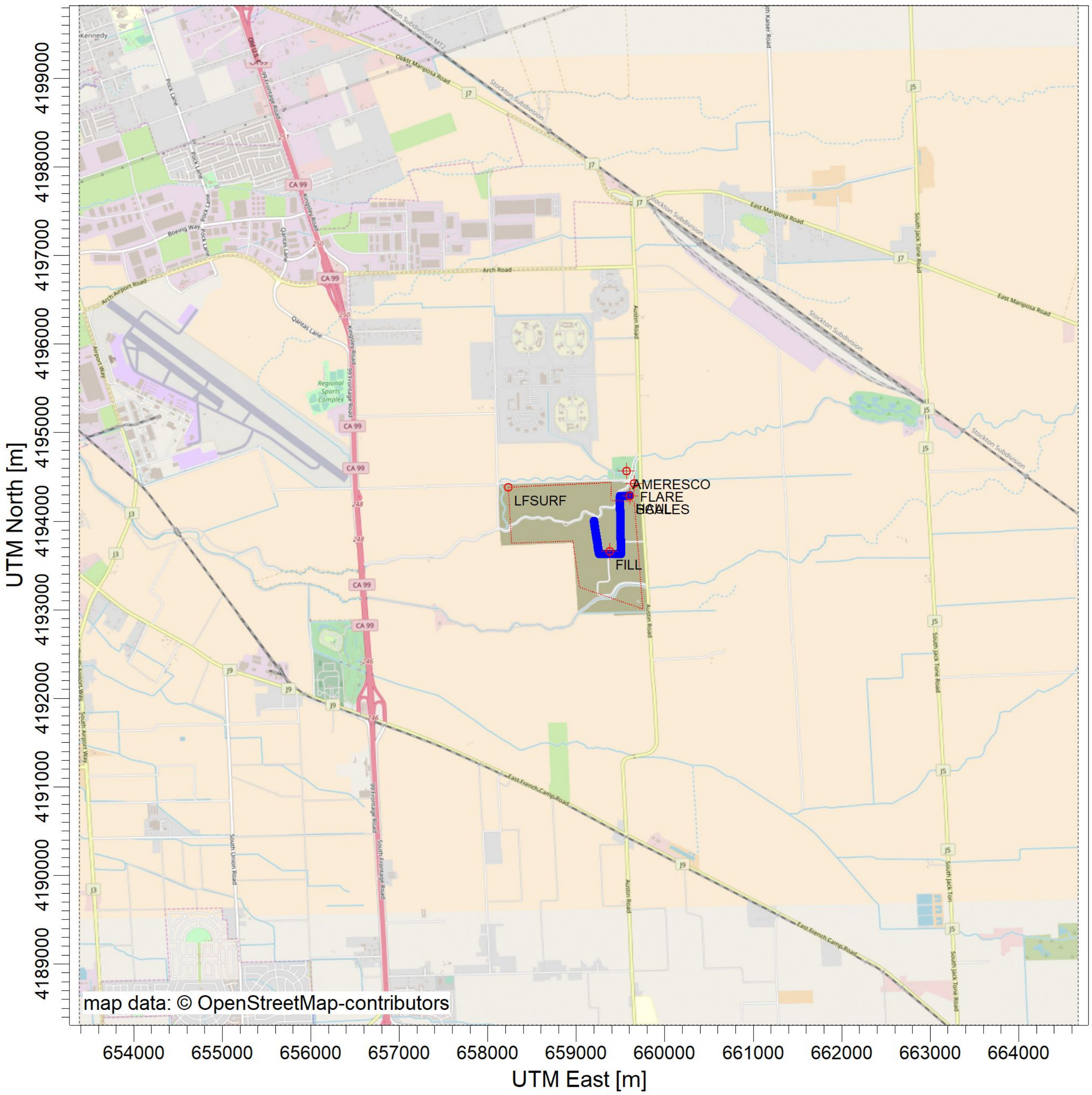
WIAC, 2001. *Waste Industry Air Coalition Comparison of Recent Landfill Gas Analyses with Historic AP-42 Values*, January 2001.

FIGURES

PROJECT TITLE:

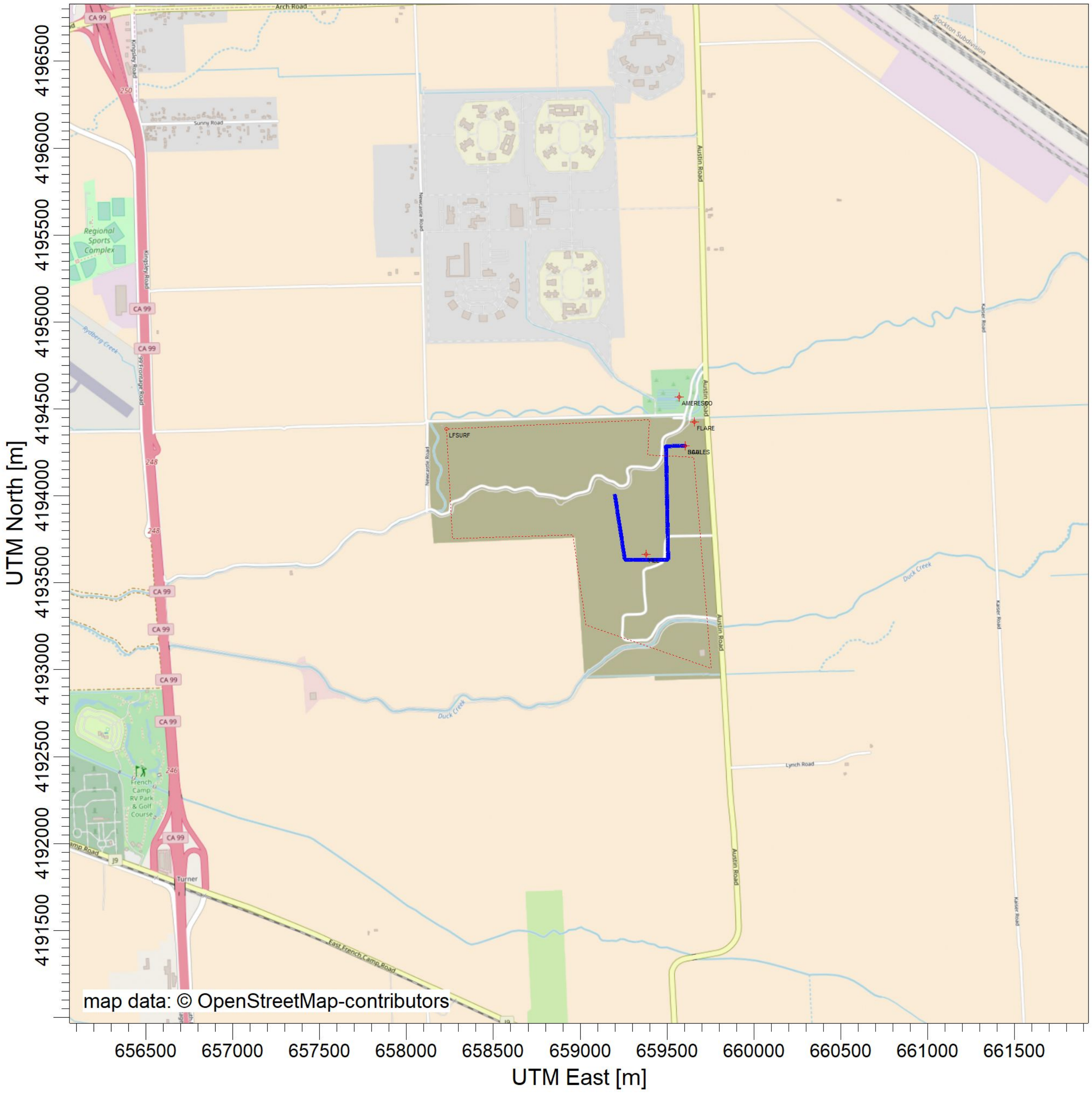
Figure 1-1 - Site Vicinity/Site Location Map



COMMENTS:	SOURCES: **6**	COMPANY NAME: **SCS Engineers**	
	RECEPTORS: **2670**		
		SCALE: 1:72,414 — 0 to 2 km	
		DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 1-2 - Landfill Site Map



COMMENTS:

SOURCES:

6

COMPANY NAME:

SCS Engineers

RECEPTORS:

2670

SCALE: 1:36,877

0 — 1 km

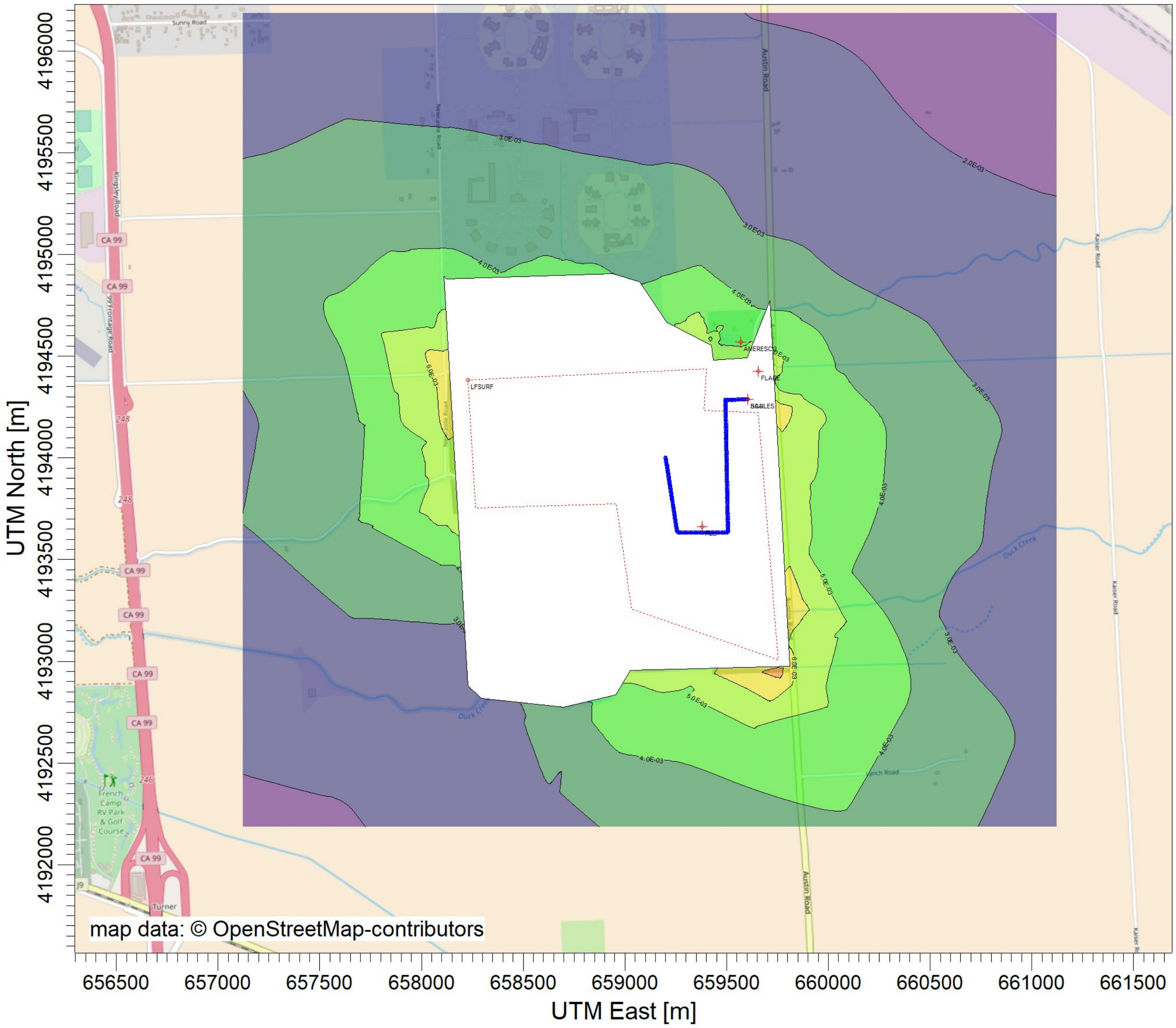
DATE:

2/5/2019

PROJECT NO.:

PROJECT TITLE:

Figure 4-1 - Current Actual Acute Hazard



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

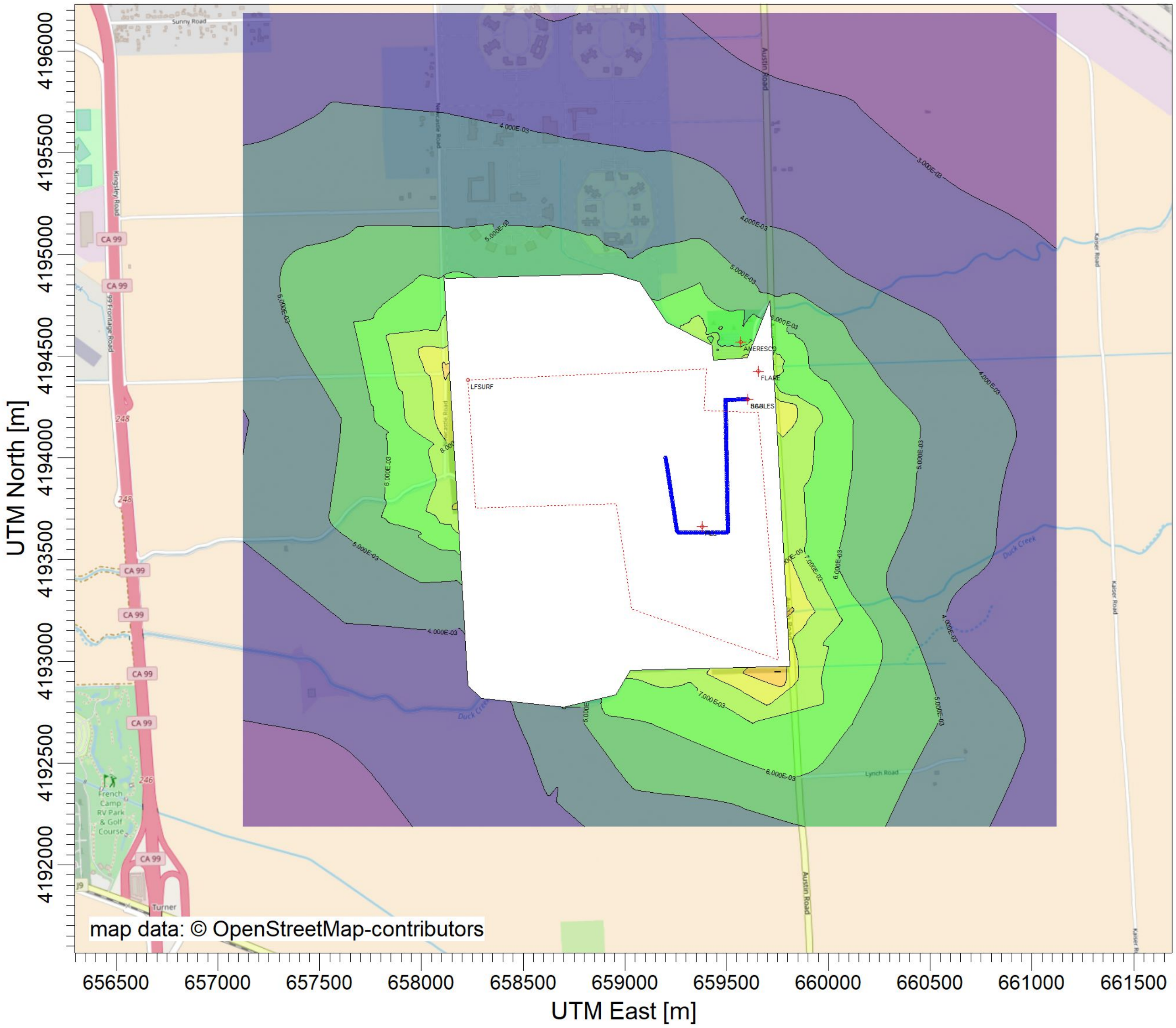
Max: 7.3E-03 [ug/m^3] at (659762.97, 4192949.52)

1.4E-03 2.0E-03 3.0E-03 4.0E-03 5.0E-03 6.0E-03 7.0E-03 7.3E-03

COMMENTS:	SOURCES: **6**	COMPANY NAME: **SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:33,914 (0 — 1 km)	
	MAX: **7.3E-03 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 4-2 - Current Permitted Acute Hazard



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

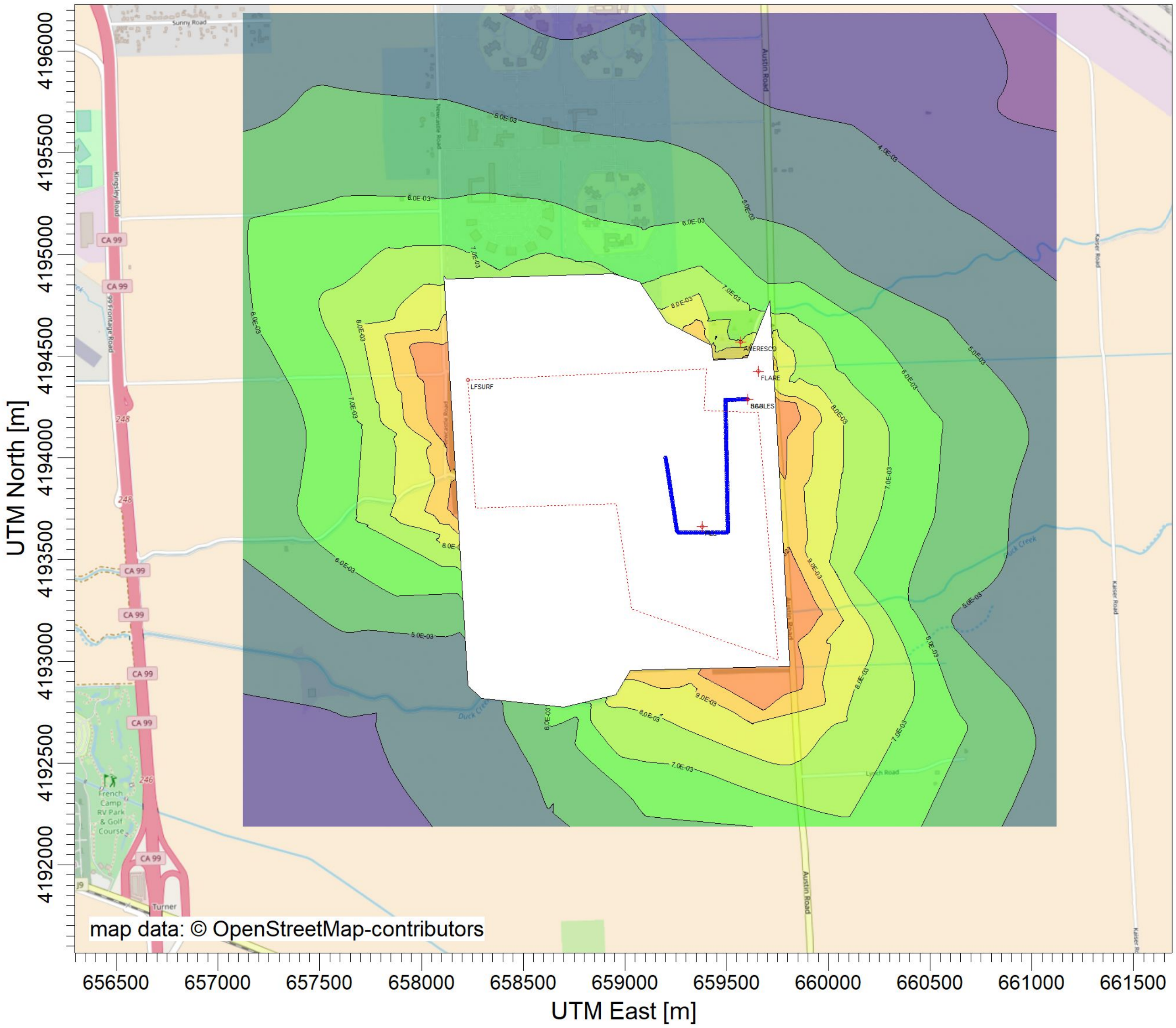
Max: 1.004E-02 [ug/m^3] at (659762.97, 4192949.52)

2.000E-03 3.000E-03 4.000E-03 5.000E-03 6.000E-03 7.000E-03 8.000E-03 9.000E-03 1.000E-02 1.004E-02

COMMENTS:	SOURCES: **6**	COMPANY NAME: **SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:33,910 (0 — 1 km)	
	MAX: **1.004E-02 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 4-3 - Project Flare Acute Hazard



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 1.3E-02 [ug/m^3] at (659762.97, 4192949.52)

2.5E-03 3.0E-03 4.0E-03 5.0E-03 6.0E-03 7.0E-03 8.0E-03 9.0E-03 1.0E-02 1.3E-02

COMMENTS:

SOURCES:

6

COMPANY NAME:

SCS Engineers

RECEPTORS:

2670

OUTPUT TYPE:

Concentration

SCALE:

1:33,914

0 1 km

MAX:

1.3E-02 ug/m^3

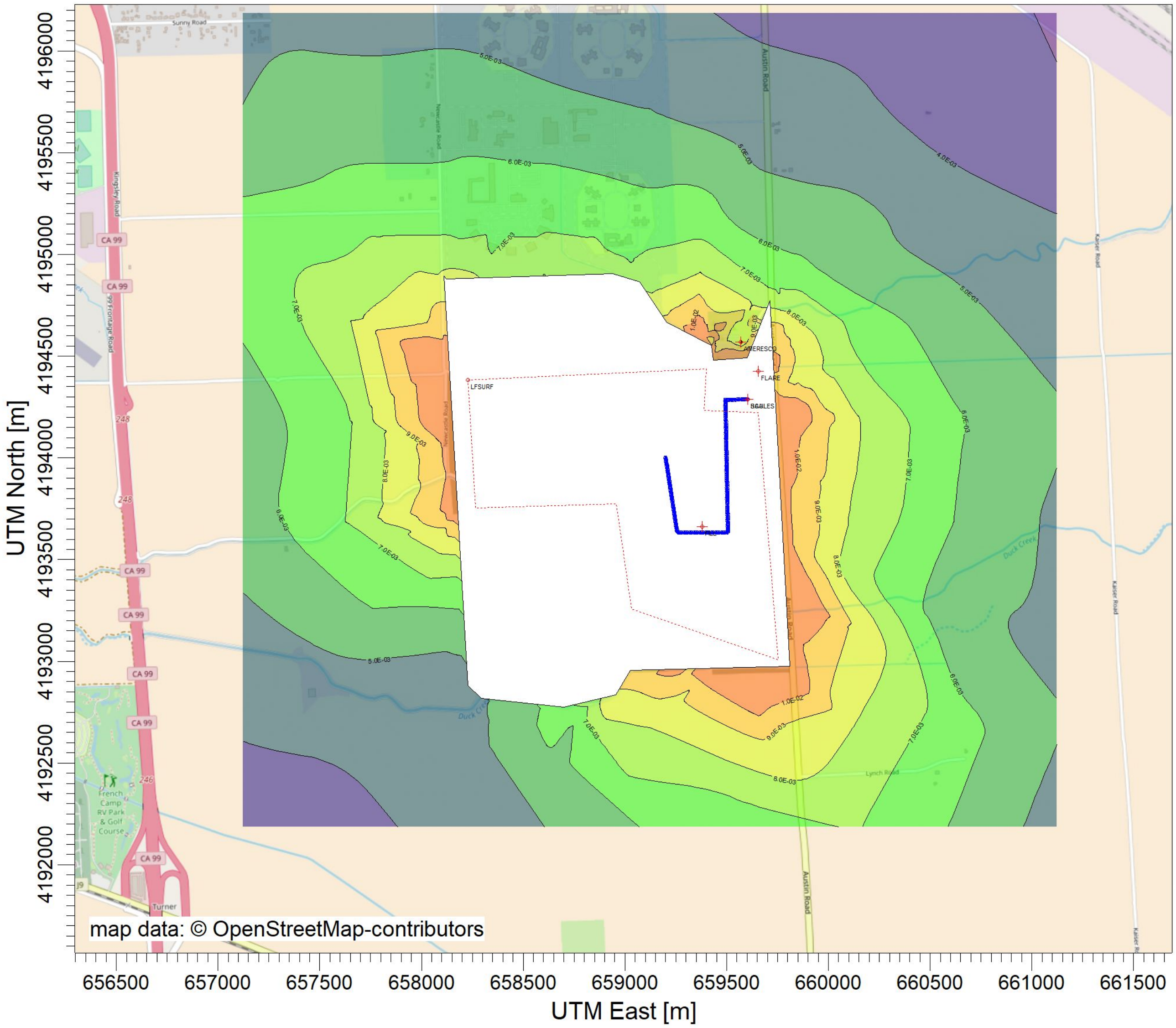
DATE:

2/5/2019

PROJECT NO.:

PROJECT TITLE:

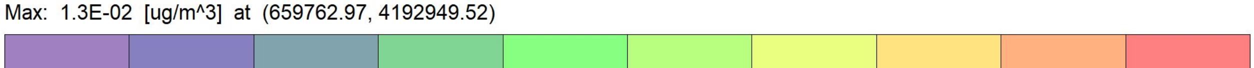
Figure 4-4 - Project EnginesAcute Hazard



PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

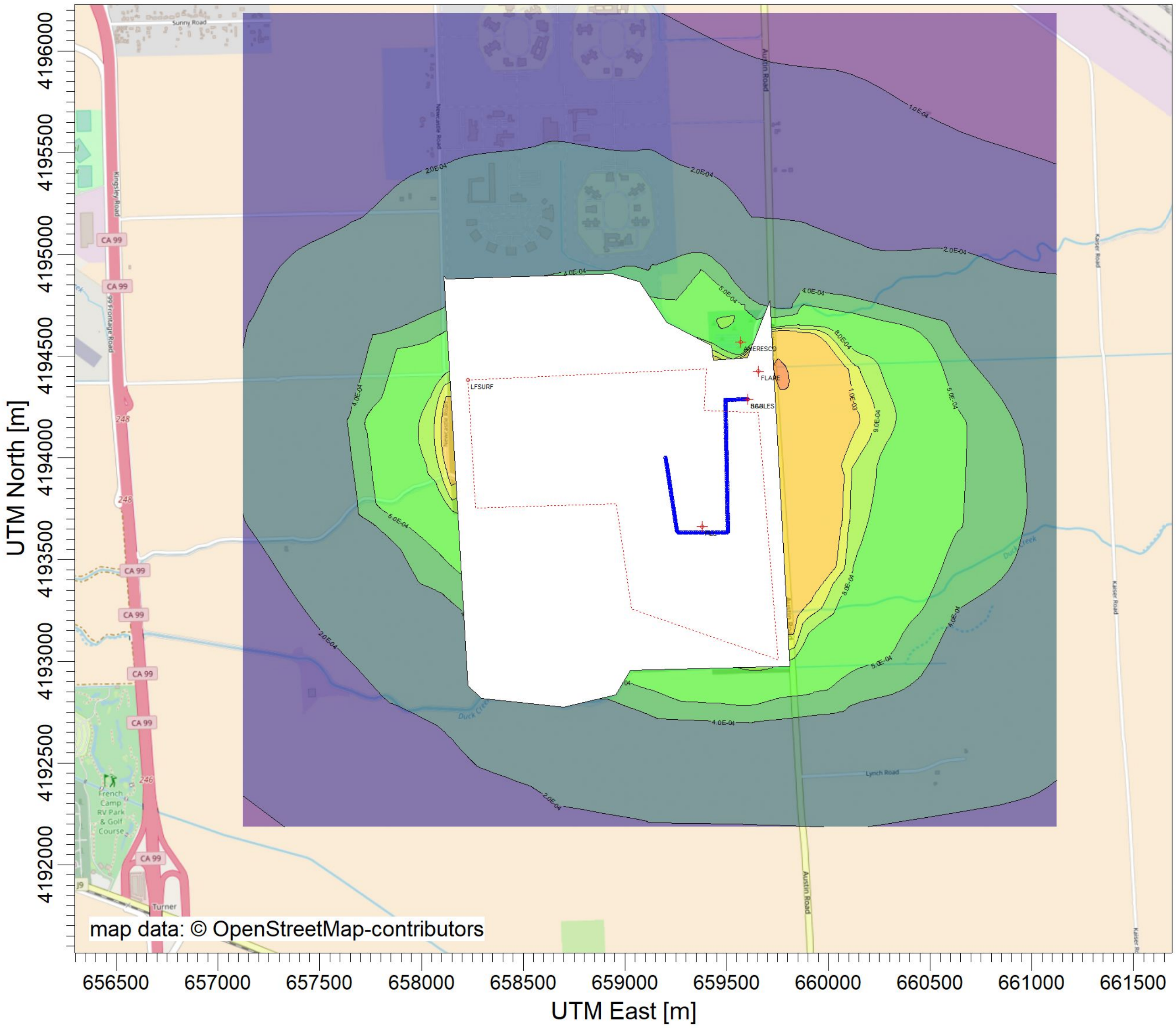
Max: 1.3E-02 [ug/m^3] at (659762.97, 4192949.52)



COMMENTS:	SOURCES:	COMPANY NAME:	
	6	**SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:33,914 0 — 1 km	
	MAX: **1.3E-02 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 4-5 - Current Actual Chronic Hazard



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL

ug/m^3

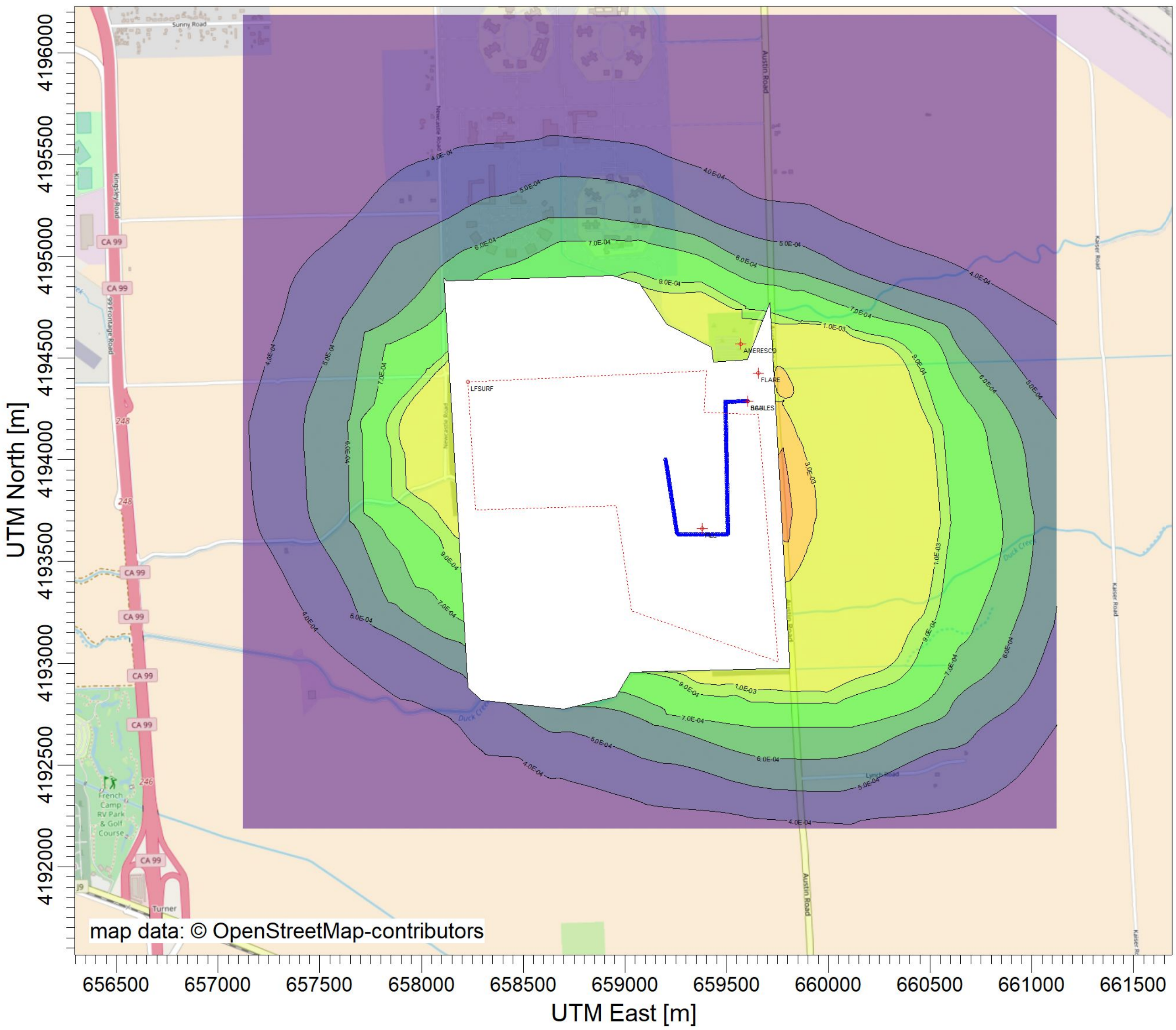
Max: 2.2E-03 [ug/m^3] at (659756.93, 4194424.17)

6.0E-05 | 1.0E-04 | 2.0E-04 | 4.0E-04 | 5.0E-04 | 8.0E-04 | 9.0E-04 | 1.0E-03 | 2.0E-03 | 2.2E-03

COMMENTS:	SOURCES:	COMPANY NAME:	
	6	**SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:33,914 (0 — 1 km)	
	MAX: **2.2E-03 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 4-6 - Current Permitted Chronic Hazard



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 4.4E-03 [ug/m^3] at (659793.92, 4193750.56)

1.3E-04 | 4.0E-04 | 5.0E-04 | 6.0E-04 | 7.0E-04 | 9.0E-04 | 1.0E-03 | 3.0E-03 | 4.0E-03 | 4.4E-03

COMMENTS:

SOURCES:

6

COMPANY NAME:

SCS Engineers

RECEPTORS:

2670

OUTPUT TYPE:

Concentration

SCALE:

1:33,914

0 — 1 km

MAX:

4.4E-03 ug/m^3

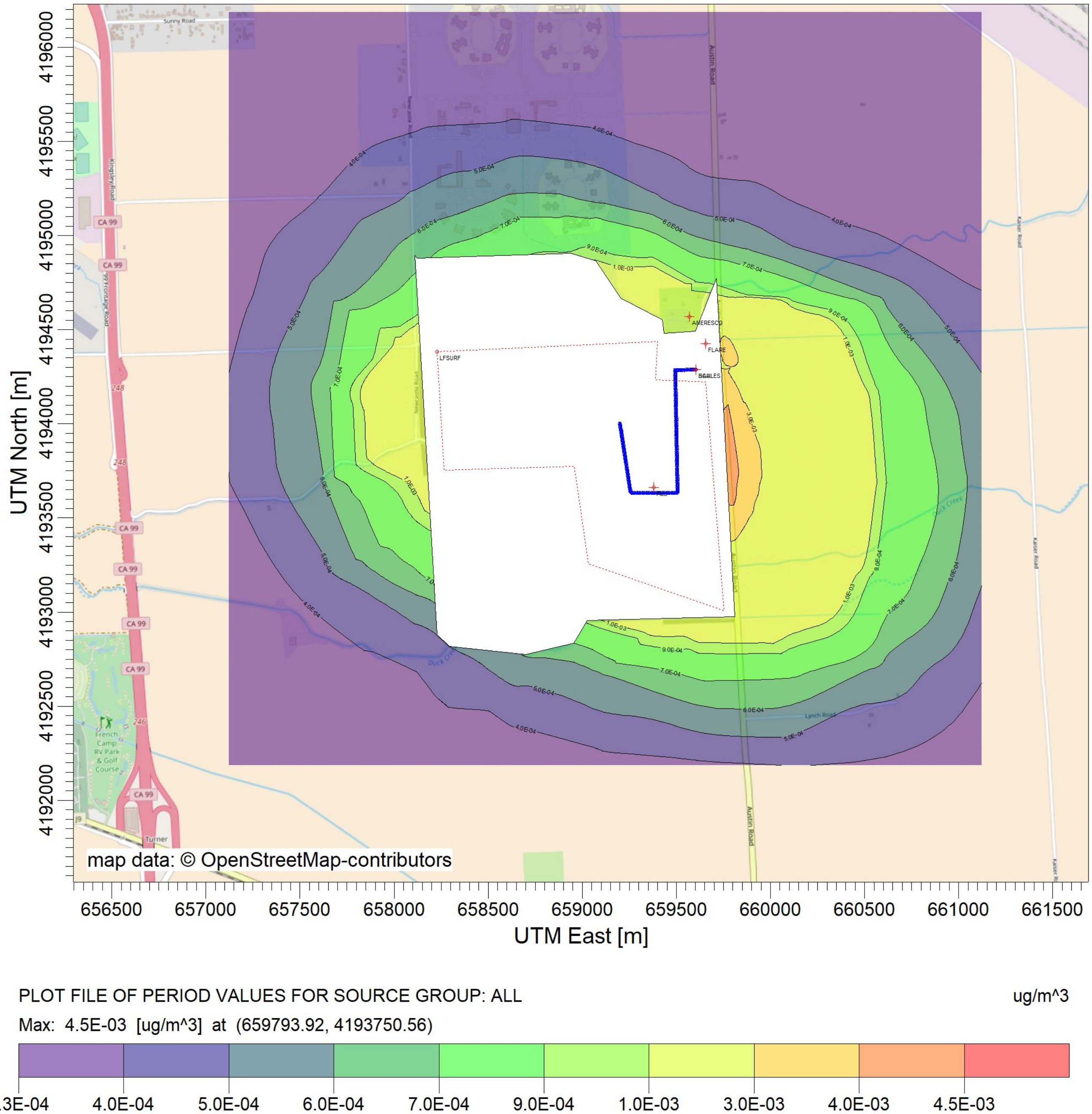
DATE:

2/5/2019

PROJECT NO.:

PROJECT TITLE:

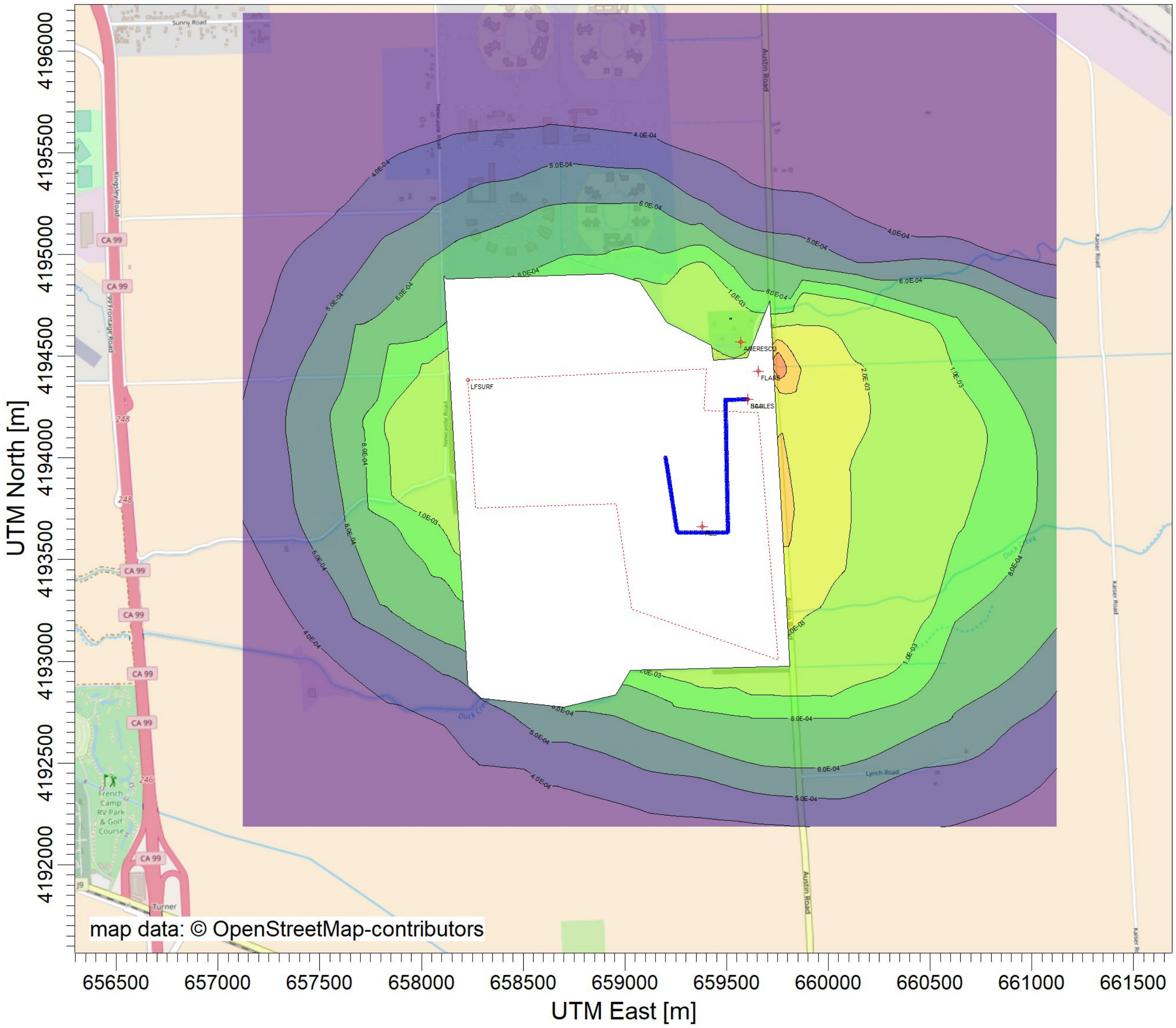
Figure 4-7 - Project Flare Chronic Hazard



COMMENTS:	SOURCES:	COMPANY NAME:	
	6	**SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:33,914 (0 — 1 km)	
	MAX: **4.5E-03 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

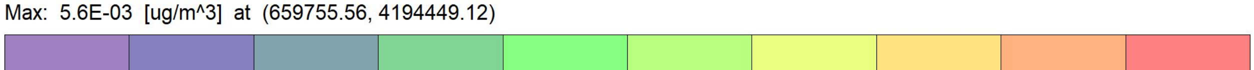
Figure 4-8 - Project Engines Chronic Hazard



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 5.6E-03 [ug/m^3] at (659755.56, 4194449.12)

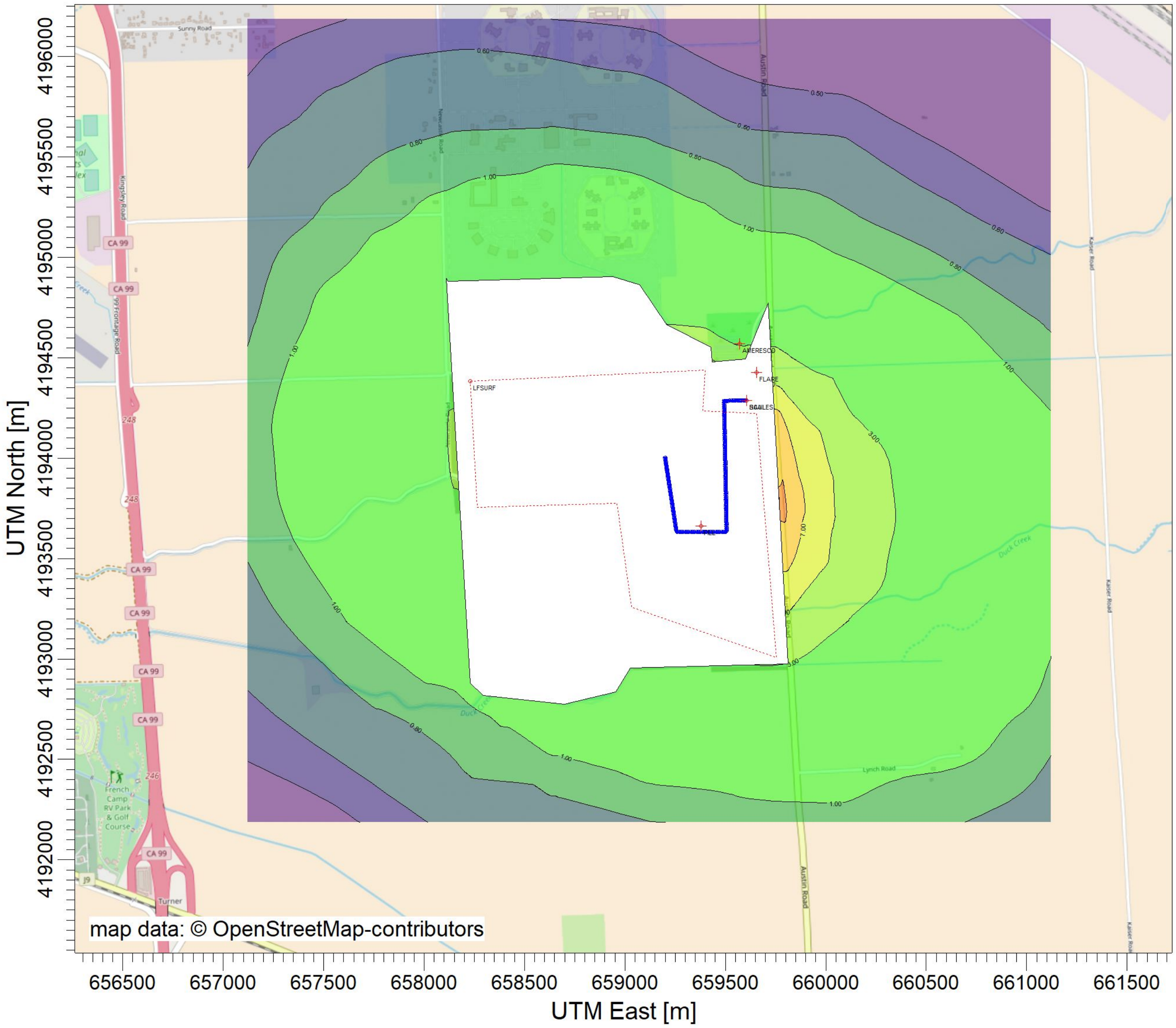


1.3E-04 4.0E-04 5.0E-04 6.0E-04 8.0E-04 1.0E-03 2.0E-03 4.0E-03 5.0E-03 5.6E-03

COMMENTS:	SOURCES:	COMPANY NAME:	
	6	**SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:33,914 (0 — 1 km)	
	MAX: **5.6E-03 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 4-9 - Current Actual Cancer Risk



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL — ug/m^3

Max: 9.31 [ug/m^3] at (659793.92, 4193750.56)

0.28	0.50	0.60	0.80	1.00	3.00	5.00	7.00	9.00	9.31

COMMENTS:

SOURCES: **6**

COMPANY NAME: **SCS Engineers**

RECEPTORS: **2670**

OUTPUT TYPE: **Concentration**

SCALE: 1:34,355 (0 — 1 km)

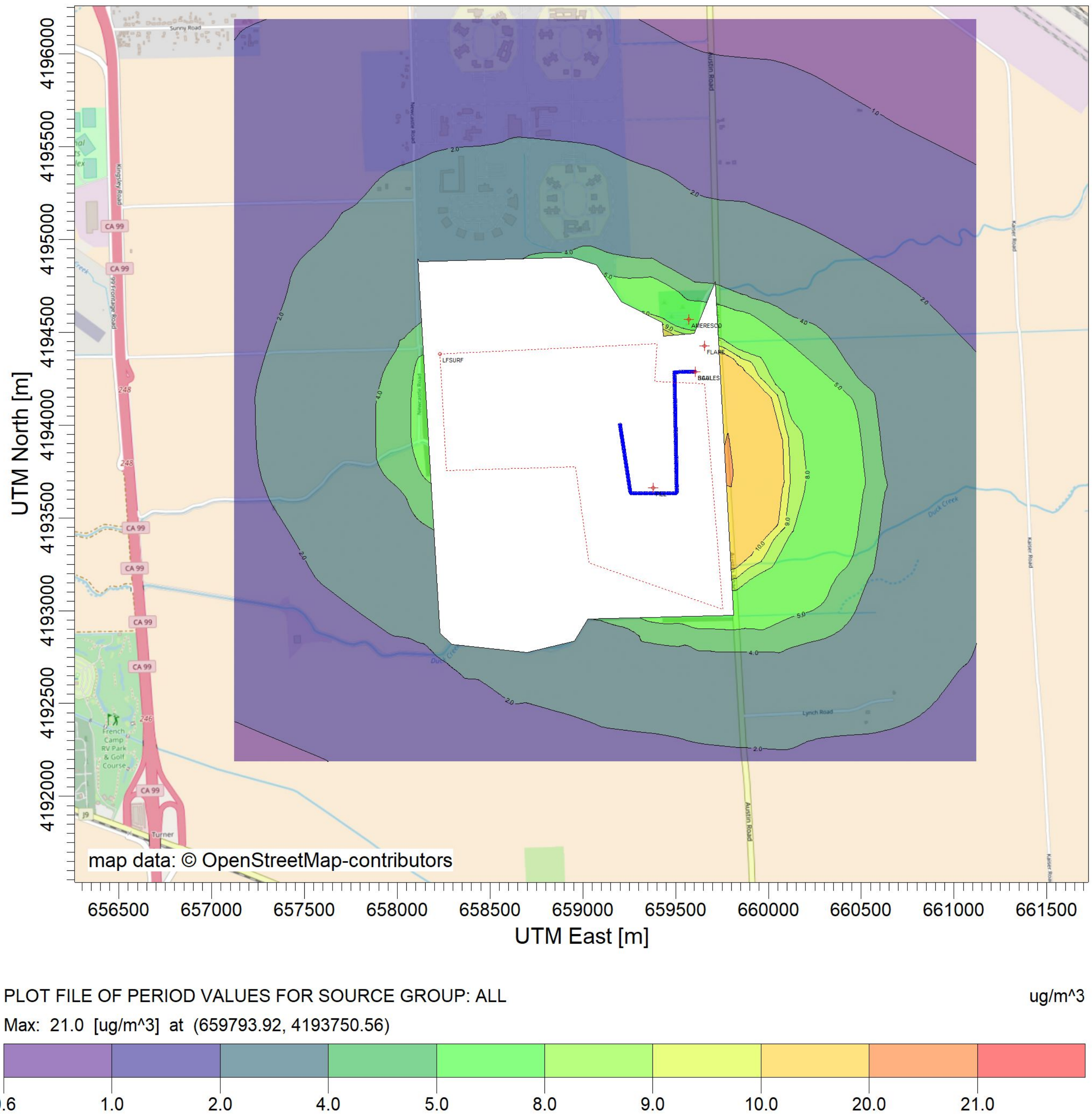
MAX: **9.31 ug/m^3**

DATE: **2/5/2019**

PROJECT NO.:

PROJECT TITLE:

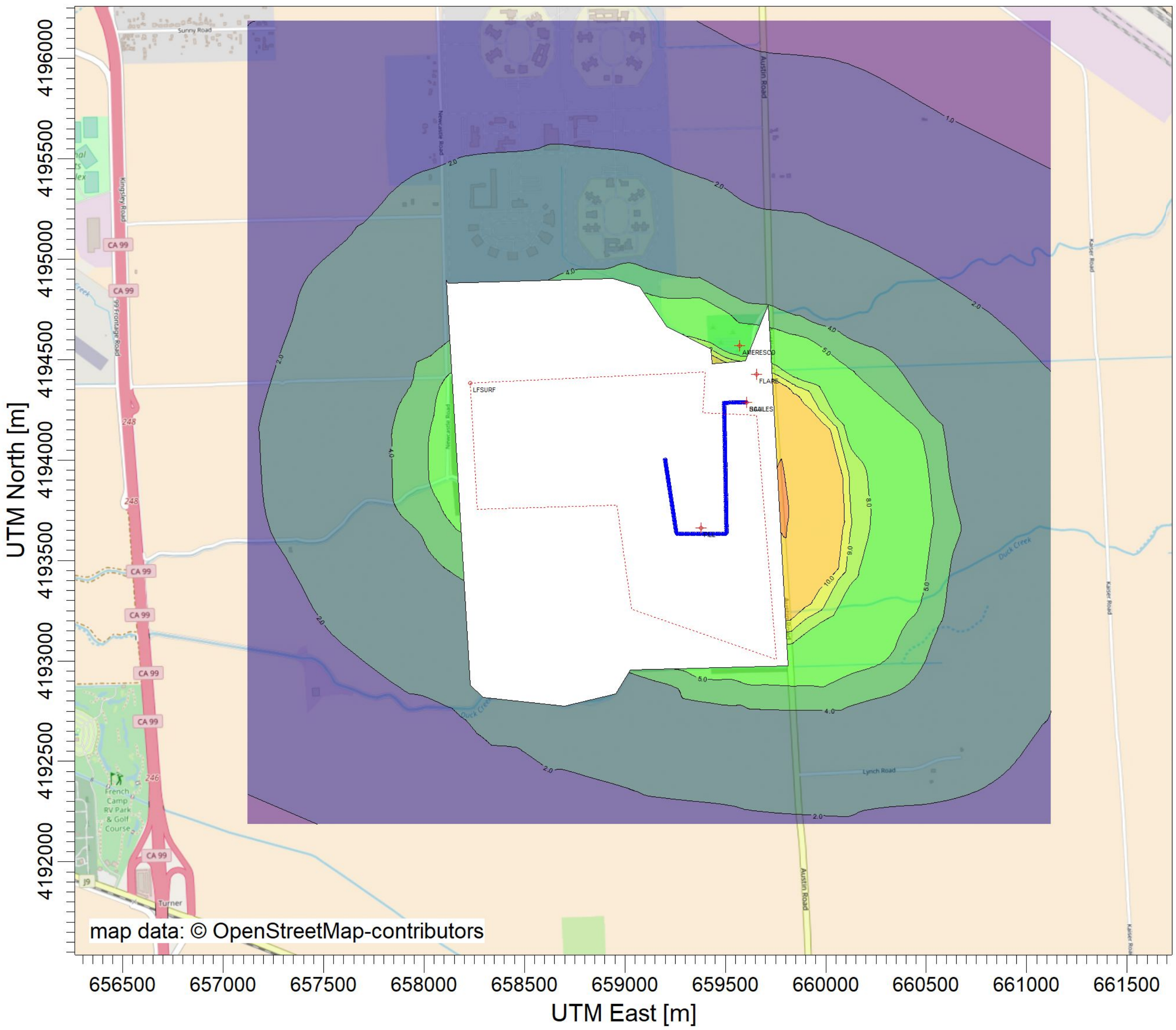
Figure 4-10 - Current PermittedCancer Risk



COMMENTS:	SOURCES: **6**	COMPANY NAME: **SCS Engineers**	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:34,355 0 — 1 km	
	MAX: **21.0 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

PROJECT TITLE:

Figure 4-11 - Project Flare Cancer Risk



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 21.5 [ug/m^3] at (659793.92, 4193750.56)

0.6	1.0	2.0	4.0	5.0	8.0	9.0	10.0	20.0	21.5

COMMENTS:

SOURCES:

6

COMPANY NAME:

SCS Engineers

RECEPTORS:

2670

OUTPUT TYPE:

Concentration

SCALE: 1:34,355

0 1 km

MAX:

21.5 ug/m^3

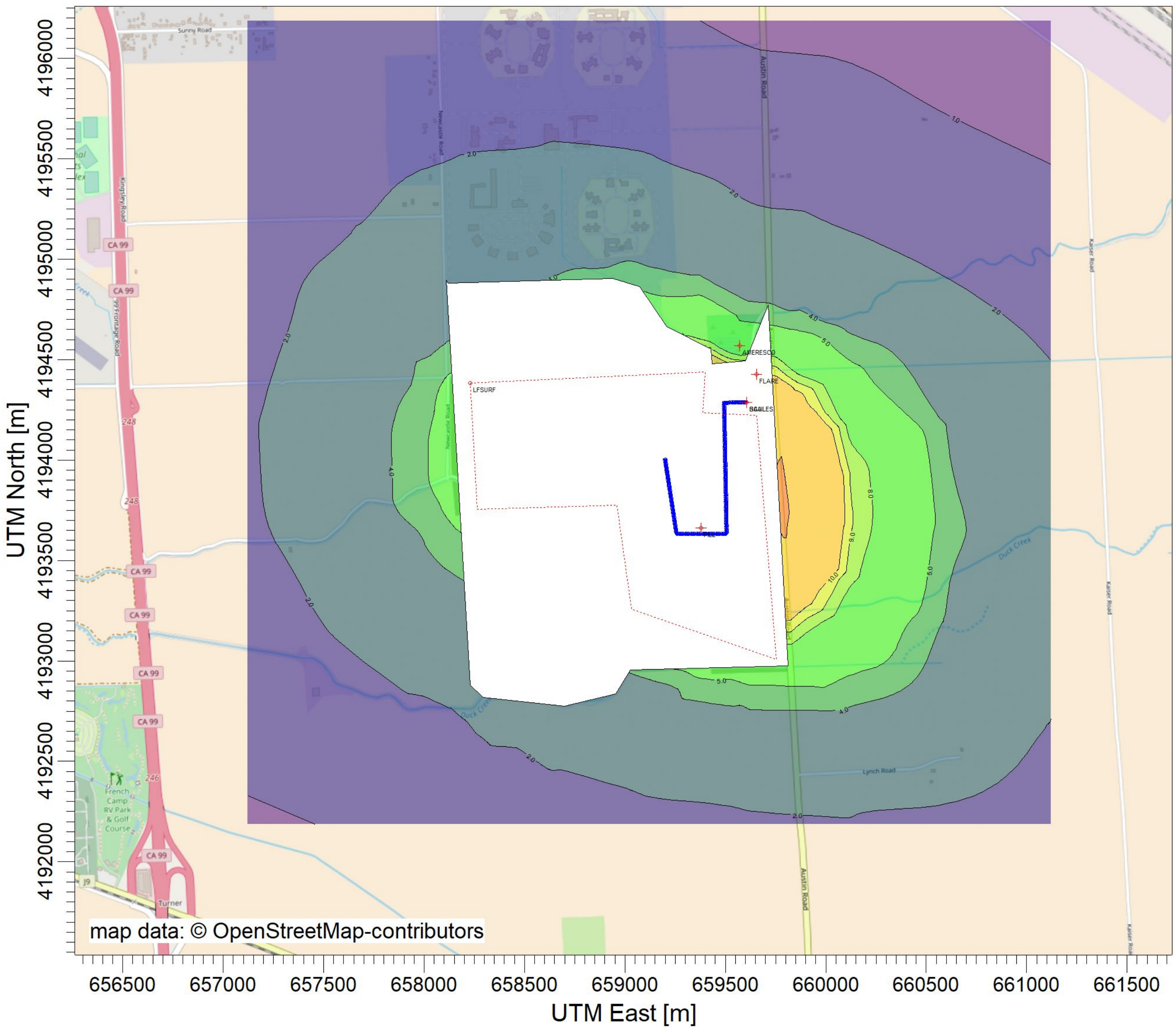
DATE:

2/5/2019

PROJECT NO.:

PROJECT TITLE:

Figure 4-12 - Project Engine Cancer Risk



PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: ALL ug/m^3

Max: 21.5 [ug/m^3] at (659793.92, 4193750.56)

0.7 1.0 2.0 4.0 5.0 8.0 9.0 10.0 20.0 21.5

COMMENTS:	SOURCES:	COMPANY NAME:	
	6	SCS Engineers	
	RECEPTORS: **2670**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:34,355 (0 — 1 km)	
	MAX: **21.5 ug/m^3**	DATE: **2/5/2019**	PROJECT NO.:

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Appendix E: Source Test Results and SJVAPCD Emission Factor Documentation

Appendix F: CalEEMod Output

APPENDIX A

LFG GENERATION MODELING AND EMISSION CALCULATION ASSUMPTIONS

LFG Generation Modeling Assumptions

All Scenarios:

- Historical annual disposal data used in all modeling was provided by Forward.
- Decay constant (*k*): 0.02/yr, NSPS and AP-42 value for dry sites, based on approximately 13 inches per year of precipitation in the landfill vicinity;
- Ultimate methane recovery rate (L_o): 3,204 ft^3/ton (100 m3/Mg), AP-42 default value;

Current Actual and Current Permitted scenarios:

- Future projected annual increase in disposal rate of 4.5% annually until current permitted landfill capacity is reached in 2021, with a total refuse tonnage-in-place of 42,816,355.

Future Potential scenario:

- Future projected annual increase in disposal rate of 4.5% annually until current permitted landfill capacity is reached in 2031, with approximately 50,346,162 cumulative tons of decomposable material in place.

Emission Calculation Assumptions

All Scenarios:

- NMOC concentration in LFG of 595 ppmv, per NSPS default value.
- CAP emissions calculated using actual permit limits for flares and engines. For Vehicle dust emissions, EPA AP-42 methodology was used to calculate PM10 emissions.
- TAC concentration in LFG obtained from site-specific source test data, when available, and WIAC Study and AP-42 values;

Current Actual Scenario:

- LFG generation rate – Average of 2016 and 2017 is used; TAC emissions for HRA uses 2017 rate);
- LFG to LFGTE engine – actual gas throughput data for 2016 and 2017 (provided by Forward);
- LFG to Flares – average of actual throughput data for 2016 and 2017 (provided by Forward)

Current Permitted Scenario:

- LFG generation rate – Peak year of 2031 is used (TAC emissions for HRA uses average of highest 30-yr period;
- LFG to LFGTE Ameresco at full capacity;
- LFG to Flares – assumes existing flares operating at full permitted capacity.

Future Potential Scenario:

- LFG generation rate – Peak year of 2037 is used (TAC emissions for HRA uses average of highest 30-yr period;
- LFG to LFGTE Ameresco at full capacity;
- LFG to Flares (Flare option) – assumes all collected LFG (per model) in excess of current LFGTE operation goes to new and existing flares;

- LFG to Flares (LFG-Engine option) – assumes all collected LFG (per model) in excess of current LFGTE operation and current permitted flare operation goes to new LFG to energy plant IC engines.

APPENDIX B

DEFAULT PARAMETERS AND PROCEDURES FOR AIR DISPERSION MODELING USING AERMOD

DEFAULT PARAMETERS AND
PROCEDURES FOR AIR DISPERSION MODELING
USING AERMOD

AERMOD was utilized in regulatory default mode for the purposes of the HRA portion of this AQIA. The rural terrain model was utilized since the project site is generally located in an rural area. For all sources, the terrain was considered “simple” (i.e., the majority of the receptors are located at a lower elevation than the sources).

Receptors were placed in two groups: fenceline receptors and a receptor grid. Fenceline receptors were placed at the facility boundary spaced 25 meters apart. A grid of receptors was placed outside the facility spaced 100 meters apart out to 500 meters, spaced 250 meters out to 1000 meters, spaced 500 meters out to 2000 meters. The receptor grid captured the peak impact from all sources. No individual receptors were placed because the grid was adequate coverage for occupied receptors. Receptors were assumed to be at ground level. No receptors were included within the property line. The property is not considered to be “ambient air.”

The flares were modeled under current actual conditions. The increase of LFG generation from the landfill expansion was assumed to be emitted from additional flare throughput. The engines were modeled using measured stack parameters that do not change from the current actual to current permitted to future potential scenarios. The property boundary and landfill surfaces are approximated as polygons. The difference in the shape of these polygons and the actual boundaries is not expected to impact modeling results.

One model run was performed using 5 years of meteorological data from the Stockton airport. Each scenario was then evaluated using emission rates for that scenario. Critical modeling parameters for each source are summarized in Table B-1.

Modeling files are provided on attached media.

Table B-1 - Critical Source Parameters

Source	Parameter	Value	Units
Flare	Height	40	ft
	Exit gas temperature	1500	F
	Exit gas velocity	12.9	ft/s
Moving Diesel Vehicles	Plume height	10.2	ft
	Plume width	31.7	m
Idling vehicles	Release height	12.6	ft
	Exit gas temperature	199	F
	Exit gas velocity	170	ft/s
Landfill Surface	Release height	0	ft
Engine	Height	35	ft
	Exit gas temperature	912	F
	Exit gas velocity	27.3	ft/s

APPENDIX C

AERMOD Modeling Output

(Data provided electronically)

APPENDIX D

LANDFILL AIR PERMITS

- **SJVAPCD/Title V Permit to Operate**
- **SJVAPCD ATC for Permit Unit N-339-17-15**

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING

JUL 14 2017

Mr. Kevin Basso
Forward INC Landfill
9999 S Austin Rd
Manteca, CA 95336

Re: Notice of Final Action - Title V Permit Renewal
District Facility # N-339
Project # N1162178

Dear Mr. Basso:

The District has issued the Final Renewed Title V Permit for Forward INC Landfill (see enclosure). The preliminary decision for this project was made on May 26, 2017. No comments were received subsequent to the District preliminary decision.

The public notice for issuance of the Final Title V Permit will be published approximately three days from the date of this letter.

Thank you for your cooperation in this matter. If you have any questions, please contact Mr. Nick Peirce, Permit Services Manager, at (209) 557-6400.

Sincerely,

Arnaud Marjollet
Director of Permit Services

Enclosures

cc: Tung Le, CARB (w/enclosure) via email
cc: Gerardo C. Rios, EPA (w/enclosure) via email

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING

Permit to Operate

FACILITY: N-339 **EXPIRATION DATE:** 07/31/2021

LEGAL OWNER OR OPERATOR:	FORWARD INC LANDFILL
MAILING ADDRESS:	9999 S AUSTIN RD MANTECA, CA 95336
FACILITY LOCATION:	9999 S AUSTIN RD MANTECA, CA 95336
FACILITY DESCRIPTION:	LANDFILL

The Facility's Permit to Operate may include Facility-wide Requirements as well as requirements that apply to specific permit units.

This Permit to Operate remains valid through the permit expiration date listed above, subject to payment of annual permit fees and compliance with permit conditions and all applicable local, state, and federal regulations. This permit is valid only at the location specified above, and becomes void upon any transfer of ownership or location. Any modification of the equipment or operation, as defined in District Rule 2201, will require prior District approval. This permit shall be posted as prescribed in District Rule 2010.

Seyed Sadredin
Executive Director / APCO

Arnaud Marjollet
Director of Permit Services

Jul 11 2017 9:56AM – HARADERJ

San Joaquin Valley
Air Pollution Control District

FACILITY: N-339-0-3 **EXPIRATION DATE:** 07/31/2021

FACILITY-WIDE REQUIREMENTS

1. The owner or operator shall notify the District of any breakdown condition as soon as reasonably possible, but no later than one hour after its detection, unless the owner or operator demonstrates to the District's satisfaction that the longer reporting period was necessary. [District Rule 1100, 6.1 and San Joaquin County Rule 110] Federally Enforceable Through Title V Permit

2. The District shall be notified in writing within ten days following the correction of any breakdown condition. The breakdown notification shall include a description of the equipment malfunction or failure, the date and cause of the initial failure, the estimated emissions in excess of those allowed, and the methods utilized to restore normal operations. [District Rule 1100, 7.0 and San Joaquin County Rule 110] Federally Enforceable Through Title V Permit

3. The owner or operator of any stationary source operation that emits more than 25 tons per year of nitrogen oxides or reactive organic compounds, shall provide the District annually with a written statement in such form and at such time as the District prescribes, showing actual emissions of nitrogen oxides and reactive organic compounds from that source. [District Rule 1160, 5.0] Federally Enforceable Through Title V Permit

4. Any person building, altering or replacing any operation, article, machine, equipment, or other contrivance, the use of which may cause the issuance of air contaminants or the use of which may eliminate, reduce, or control the issuance of air contaminants, shall first obtain an Authority to Construct (ATC) from the District unless exempted by District Rule 2020 (12/20/07). [District Rule 2010, 3.0 and 4.0; and 2020] Federally Enforceable Through Title V Permit

5. The permittee must comply with all conditions of the permit including permit revisions originated by the District. All terms and conditions of a permit that are required pursuant to the Clean Air Act (CAA), including provisions to limit potential to emit, are enforceable by the EPA and Citizens under the CAA. Any permit noncompliance constitutes a violation of the CAA and the District Rules and Regulations, and is grounds for enforcement action, for permit termination, revocation, reopening and reissuance, or modification; or for denial of a permit renewal application. [District Rules 2070, 7.0; 2080; and 2520, 9.8.1 and 9.13.1] Federally Enforceable Through Title V Permit

6. A Permit to Operate or an Authority to Construct shall not be transferred unless a new application is filed with and approved by the District. [District Rule 2031] Federally Enforceable Through Title V Permit

7. Every application for a permit required under Rule 2010 (12/17/92) shall be filed in a manner and form prescribed by the District. [District Rule 2040] Federally Enforceable Through Title V Permit

8. The operator shall maintain records of required monitoring that include: 1) the date, place, and time of sampling or measurement; 2) the date(s) analyses were performed; 3) the company or entity that performed the analysis; 4) the analytical techniques or methods used; 5) the results of such analysis; and 6) the operating conditions at the time of sampling or measurement. [District Rule 2520, 9.4.1] Federally Enforceable Through Title V Permit

9. The operator shall retain records of all required monitoring data and support information for a period of at least 5 years from the date of the monitoring sample, measurement, or report. Support information includes copies of all reports required by the permit and, for continuous monitoring instrumentation, all calibration and maintenance records and all original strip-chart recordings. [District Rule 2520, 9.4.2] Federally Enforceable Through Title V Permit

FACILITY-WIDE REQUIREMENTS CONTINUE ON NEXT PAGE

10. The operator shall submit reports of any required monitoring at least every six months unless a different frequency is required by an applicable requirement. All instances of deviations from permit requirements must be clearly identified in such reports. [District Rule 2520, 9.5.1] Federally Enforceable Through Title V Permit

11. Deviations from permit conditions must be promptly reported, including deviations attributable to upset conditions, as defined in the permit. For the purpose of this condition, promptly means as soon as reasonably possible, but no later than 10 days after detection. The report shall include the probable cause of such deviations, and any corrective actions or preventive measures taken. All required reports must be certified by a responsible official consistent with section 10.0 of District Rule 2520 (6/21/01). [District Rules 2520, 9.5.2 and 1100, 7.0] Federally Enforceable Through Title V Permit

12. If for any reason a permit requirement or condition is being challenged for its constitutionality or validity by a court of competent jurisdiction, the outcome of such challenge shall not affect or invalidate the remainder of the conditions or requirements in that permit. [District Rule 2520, 9.7] Federally Enforceable Through Title V Permit

13. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit. [District Rule 2520, 9.8.2] Federally Enforceable Through Title V Permit

14. The permit may be modified, revoked, reopened and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. [District Rule 2520, 9.8.3] Federally Enforceable Through Title V Permit

15. The permit does not convey any property rights of any sort, or any exclusive privilege. [District Rule 2520, 9.8.4] Federally Enforceable Through Title V Permit

16. The Permittee shall furnish to the District, within a reasonable time, any information that the District may request in writing to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit or to determine compliance with the permit. Upon request, the permittee shall also furnish to the District copies of records required to be kept by the permit or, for information claimed to be confidential, the permittee may furnish such records directly to EPA along with a claim of confidentiality. [District Rule 2520, 9.8.5] Federally Enforceable Through Title V Permit

17. The permittee shall pay annual permit fees and other applicable fees as prescribed in Regulation III of the District Rules and Regulations. [District Rule 2520, 9.9] Federally Enforceable Through Title V Permit

18. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to enter the permittee's premises where a permitted source is located or emissions related activity is conducted, or where records must be kept under condition of the permit. [District Rule 2520, 9.13.2.1] Federally Enforceable Through Title V Permit

19. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit. [District Rule 2520, 9.13.2.2] Federally Enforceable Through Title V Permit

20. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under the permit. [District Rule 2520, 9.13.2.3] Federally Enforceable Through Title V Permit

21. Upon presentation of appropriate credentials, a permittee shall allow an authorized representative of the District to sample or monitor, at reasonable times, substances or parameters for the purpose of assuring compliance with the permit or applicable requirements. [District Rule 2520, 9.13.2.4] Federally Enforceable Through Title V Permit

22. No air contaminants shall be discharged into the atmosphere for a period or periods aggregating more than 3 minutes in any one hour which is as dark or darker than Ringelmann #1 or equivalent to 20% opacity and greater, unless specifically exempted by District Rule 4101 (02/17/05). If the equipment or operation is subject to a more stringent visible emission standard as prescribed in a permit condition, the more stringent visible emission limit shall supersede this condition. [District Rule 4101, and County Rules 401 (in all eight counties in the San Joaquin Valley)] Federally Enforceable Through Title V Permit

FACILITY-WIDE REQUIREMENTS CONTINUE ON NEXT PAGE

23. No person shall manufacture, blend, repackage, supply, sell, solicit or apply any architectural coating with a VOC content in excess of the corresponding limit specified in Table of Standards 1 effective until 12/30/10 or Table of Standards 2 effective on and after 1/1/11 of District Rule 4601 (12/17/09) for use or sale within the District. [District Rule 4601, 5.1] Federally Enforceable Through Title V Permit

24. All VOC-containing materials subject to Rule 4601 (12/17/09) shall be stored in closed containers when not in use. [District Rule 4601, 5.4] Federally Enforceable Through Title V Permit

25. The permittee shall comply with all the Labeling and Test Methods requirements outlined in Rule 4601 sections 6.1 and 6.3 (12/17/09). [District Rule 4601, 6.1 and 6.3] Federally Enforceable Through Title V Permit

26. With each report or document submitted under a permit requirement or a request for information by the District or EPA, the permittee shall include a certification of truth, accuracy, and completeness by a responsible official. [District Rule 2520, 9.13.1 and 10.0] Federally Enforceable Through Title V Permit

27. If the permittee performs maintenance on, or services, repairs, or disposes of appliances, the permittee shall comply with the standards for Recycling and Emissions Reduction pursuant to 40 CFR Part 82, Subpart F. [40 CFR 82 Subpart F] Federally Enforceable Through Title V Permit

28. If the permittee performs service on motor vehicles when this service involves the ozone-depleting refrigerant in the motor vehicle air conditioner (MVAC), the permittee shall comply with the standards for Servicing of Motor Vehicle Air Conditioners pursuant to all the applicable requirements as specified in 40 CFR Part 82, Subpart B. [40 CFR Part 82, Subpart B] Federally Enforceable Through Title V Permit

29. Disturbances of soil related to any construction, demolition, excavation, extraction, or other earthmoving activities shall comply with the requirements for fugitive dust control in District Rule 8021 unless specifically exempted under Section 4.0 of Rule 8021 (8/19/2004) or Rule 8011 (8/19/2004). [District Rules 8011 and 8021] Federally Enforceable Through Title V Permit

30. Outdoor handling, storage and transport of any bulk material which emits dust shall comply with the requirements of District Rule 8031, unless specifically exempted under Section 4.0 of Rule 8031 (8/19/2004) or Rule 8011 (8/19/2004). [District Rules 8011 and 8031] Federally Enforceable Through Title V Permit

31. An owner/operator shall prevent or cleanup any carryout or trackout in accordance with the requirements of District Rule 8041 Section 5.0, unless specifically exempted under Section 4.0 of Rule 8041 (8/19/2004) or Rule 8011 (8/19/2004). [District Rules 8011 and 8041] Federally Enforceable Through Title V Permit

32. Whenever open areas are disturbed, or vehicles are used in open areas, the facility shall comply with the requirements of Section 5.0 of District Rule 8051, unless specifically exempted under Section 4.0 of Rule 8051 (8/19/2004) or Rule 8011 (8/19/2004). [District Rules 8011 and 8051] Federally Enforceable Through Title V Permit

33. Any paved road or unpaved road shall comply with the requirements of District Rule 8061 unless specifically exempted under Section 4.0 of Rule 8061 (8/19/2004) or Rule 8011 (8/19/2004). [District Rules 8011 and 8061] Federally Enforceable Through Title V Permit

34. Any unpaved vehicle/equipment area that anticipates more than 50 Average annual daily Trips (AADT) shall comply with the requirements of Section 5.1.1 of District Rule 8071. Any unpaved vehicle/equipment area that anticipates more than 150 vehicle trips per day (VDT) shall comply with the requirements of Section 5.1.2 of District Rule 8071. On each day that 25 or more VDT with 3 or more axles will occur on an unpaved vehicle/equipment traffic area, the owner/operator shall comply with the requirements of Section 5.1.3 of District Rule 8071. On each day when a special event will result in 1,000 or more vehicles that will travel/park on an unpaved area, the owner/operator shall comply with the requirements of Section 5.1.4 of District Rule 8071. All sources shall comply with the requirements of Section 5.0 of District Rule 8071 unless specifically exempted under Section 4.0 of Rule 8071 (9/16/2004) or Rule 8011 (8/19/2004). [District Rules 8011 and 8071] Federally Enforceable Through Title V Permit

35. Any owner or operator of a demolition or renovation activity, as defined in 40 CFR 61.141, shall comply with the applicable inspection, notification, removal, and disposal procedures for asbestos containing materials as specified in 40 CFR 61.145 (Standard for Demolition and Renovation). [40 CFR 61 Subpart M] Federally Enforceable Through Title V Permit

FACILITY-WIDE REQUIREMENTS CONTINUE ON NEXT PAGE

36. The permittee shall submit certifications of compliance with the terms and standards contained in Title V permits, including emission limits, standards and work practices, to the District and the EPA annually (or more frequently as specified in an applicable requirement or as specified by the District). The certification shall include the identification of each permit term or condition, the compliance status, whether compliance was continuous or intermittent, the methods used for determining the compliance status, and any other facts required by the District to determine the compliance status of the source. [District Rule 2520, 9.16] Federally Enforceable Through Title V Permit

37. The permittee shall submit an application for Title V permit renewal to the District at least six months, but not greater than 18 months, prior to the permit expiration date. [District Rule 2520, 5.2] Federally Enforceable Through Title V Permit

38. When a term is not defined in a Title V permit condition, the definition in the rule cited as the origin and authority for the condition in a Title V permits shall apply. [District Rule 2520, 9.1.1] Federally Enforceable Through Title V Permit

39. Compliance with permit conditions in the Title V permit shall be deemed in compliance with San Joaquin County Rule 110. A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

40. Compliance with permit conditions in the Title V permit shall be deemed in compliance with the following applicable requirements: SJVUAPCD Rules 1100, sections 6.1 and 7.0 (12/17/92); 2010, sections 3.0 and 4.0 (12/17/92); 2031 (12/17/92); 2040 (12/17/92); 2070, section 7.0 (12/17/92); 2080 (12/17/92); 4101 (2/17/05); 4601 (12/17/09); 8021 (8/19/2004); 8031 (8/19/2004); 8041 (8/19/2004); 8051 (8/19/2004); 8061 (8/19/2004); and 8071 (9/16/2004). A permit shield is granted from these requirements. [District Rule 2520, 13.2] Federally Enforceable Through Title V Permit

41. The reporting periods for the Report of Required Monitoring and the Compliance Certification Report begin June 1 of every year, unless alternative dates are approved by the District Compliance Division. These reports are due within 30 days after the end of the reporting period. [District Rule 2520] Federally Enforceable Through Title V Permit

42. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-339-1-3 **EXPIRATION DATE:** 07/31/2021

EQUIPMENT DESCRIPTION:
WOOD WASTE RECEIVING.

PERMIT UNIT REQUIREMENTS

1. See Facility-wide requirements for conditions applicable to this permit unit. [District Rule 2080] Federally Enforceable Through Title V Permit

These terms and conditions are part of the Facility-wide Permit to Operate.

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-339-9-5 **EXPIRATION DATE:** 07/31/2021

EQUIPMENT DESCRIPTION:
GASOLINE DISPENSING OPERATION WITH ONE 500 GALLON CONVAULT ABOVEGROUND STORAGE TANK SERVED BY MORRISON BROS EVR PHASE I VAPOR RECOVERY SYSTEM (VR-402-B), STANDING LOSS CONTROL (VR-301-E), AND 1 FUELING POINT WITH 1 PHASE II EXEMPT GASOLINE DISPENSING NOZZLE

PERMIT UNIT REQUIREMENTS

1. The Phase I and Standing Loss Control Vapor recovery systems shall be installed and maintained in accordance with the manufacturer specifications and the ARB Executive Orders specified in this permit, including applicable rules and regulations of the Division of Measurement Standards of the Department of Food and Agriculture, the Office of the State Fire Marshal of the Department of Forestry and Fire Protection, the Division of Occupational Safety and Health of the Department of Industrial Relations, and the Division of Water Quality of the State Water Resources Control Board that have been made conditions of the certification. [District Rule 4621 and CH&SC 41950] Federally Enforceable Through Title V Permit

2. The storage container(s) shall be installed, maintained, and operated such that they are leak-free. [District Rule 4621] Federally Enforceable Through Title V Permit

3. The Phase I vapor recovery systems and gasoline dispensing equipment shall be maintained without leaks as determined in accordance with the test method specified in this permit. [District Rule 4621] Federally Enforceable Through Title V Permit

4. A leak is defined as the dripping of VOC-containing liquid at a rate of more than three (3) drops per minute, or the detection of any gaseous or vapor emissions with a concentration of total organic compound greater than 10,000 ppmv, as methane, above background when measured in accordance with EPA Test Method 21. [District Rule 4621] Federally Enforceable Through Title V Permit

5. No gasoline delivery vessel shall be operated or be allowed to operate unless valid State of California decals are displayed on the cargo container, which attest to the vapor integrity of the container. [District Rule 4621] Federally Enforceable Through Title V Permit

6. The permittee shall conduct periodic maintenance inspections based on the greatest monthly throughput of gasoline dispensed by the facility in the previous year as follows: A) less than 2,500 gallons - one day per month; B) 2,500 to less than 25,000 gallons - one day per week; or C) 25,000 gallons or greater - five days per week. All inspections shall be documented within the O & M Manual. [District Rule 4621] Federally Enforceable Through Title V Permit

7. Periodic maintenance inspections of the Phase I vapor recovery system shall include, at a minimum, verification that 1) the fill caps and vapor caps are not missing, damaged, or loose; 2) the fill cap gasket and vapor cap gaskets are not missing or damaged; 3) the fill adapter and vapor adapter are securely attached to the risers; 4) where applicable, the spring-loaded submerged fill tube seals properly against the coaxial tubing; 5) the dry break (poppet-valve) is not missing or damaged; and 6) the submerged fill tube is not missing or damaged. [District Rule 4621] Federally Enforceable Through Title V Permit

8. The permittee shall conduct all periodic vapor recovery system performance tests specified in this permit, no more than 30 days before or after the required compliance testing date, unless otherwise required under the applicable ARB Executive Order. [District Rule 4621] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

9. The permittee shall perform and pass a Static Leak Test "Determination of Static Pressure Performance of Vapor Recovery Systems at Gasoline Dispensing Facilities with Aboveground Tanks" in accordance with the Executive Order specified in this permit for the Phase I Vapor Recovery System at least once every 36 months. [District Rule 4621] Federally Enforceable Through Title V Permit

10. The permittee shall notify the District at least 7 days prior to each performance test. The test results shall be submitted to the District no later than 30 days after the completion of each test. [District Rule 4621] Federally Enforceable Through Title V Permit

11. A person performing installation of, or maintenance on, a certified Phase I vapor recovery system shall be certified by the ICC for Vapor Recovery System Installation and Repair, or work under the direct and personal supervision of an individual physically present at the work site who is certified. The ICC certification shall be renewed every 24 months. [District Rule 4621] Federally Enforceable Through Title V Permit

12. Proof of the ICC certification and all other certifications required by the Executive Order and installation and operation manual shall be made available onsite. [District Rule 4621] Federally Enforceable Through Title V Permit

13. A person conducting testing of, or repairs to, a certified vapor recovery system shall be in compliance with District Rule 1177 (Gasoline Dispensing Facility Tester Certification). [District Rule 4621] Federally Enforceable Through Title V Permit

14. Total gasoline throughput for the facility shall not exceed either of the following: 10,000 gallons in any consecutive 30-day period or 24,000 gallons per calendar year. If throughput exceeds stated limits, the permittee shall submit a complete application for an Authority to Construct (ATC) to the District within 30 days of the loss of exemption and install and test a certified Phase II vapor recovery system within six (6) months from the date the ATC is issued. [District Rule 4622] Federally Enforceable Through Title V Permit

15. The permittee shall maintain monthly and annual gasoline throughput records. The records should allow the gasoline throughput for any 30-day period to be continuously determined. These records shall be maintained on the premises as long as exempt status is claimed. [District Rules 4621 and 4622] Federally Enforceable Through Title V Permit

16. All records required by this permit shall be retained on-site for a period of at least five years and shall be made available for District inspection upon request. [District Rule 4621] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-339-15-3 **EXPIRATION DATE:** 07/31/2021

EQUIPMENT DESCRIPTION:
SLUDGE DRYING OPERATION

PERMIT UNIT REQUIREMENTS

1. See Facility-wide requirements for conditions applicable to this permit unit. [District Rule 2080] Federally Enforceable Through Title V Permit

PERMIT UNIT: N-339-16-3 **EXPIRATION DATE:** 07/31/2021

EQUIPMENT DESCRIPTION:
BIOREMEDIATION OPERATION

PERMIT UNIT REQUIREMENTS

1. See Facility-wide requirements for conditions applicable to this permit unit. [District Rule 2080] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: N-339-17-17 **EXPIRATION DATE:** 07/31/2021

EQUIPMENT DESCRIPTION:
39.0 MILLION CUBIC METER CAPACITY (354.5 ACRES) LANDFILL WITH A LANDFILL GAS COLLECTION SYSTEM CONTROLLED BY A 2,000 SCFM (EQUIVALENT TO 60 MMBTU/HR) ENCLOSED LANDFILL GAS-FIRED FLARE AND A 3,400 SCFM (EQUIVALENT TO 102 MMBTU/HR) PERRENIAL ENERGY MODEL GHS-301 ENCLOSED LANDFILL GAS-FIRED FLARE WITH AN LPG-FIRED PILOT

PERMIT UNIT REQUIREMENTS

1. All equipment shall be constructed, maintained, and operated according to the specifications and plans contained in the permit applications, except as otherwise specified herein. [District Rule 2201] Federally Enforceable Through Title V Permit
2. The enclosed flares shall each be equipped with an LPG or natural gas-fired pilot. [District Rule 2201] Federally Enforceable Through Title V Permit
3. The enclosed flares shall each be equipped with automatic dampers, an automatic shutdown device, and a flame arrester. [District Rule 2201] Federally Enforceable Through Title V Permit
4. The gas collection system shall be operated in a manner which maximizes the quantity of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit
5. During maintenance of the gas collection system or flares, emissions of landfill gas shall be minimized. [District Rule 2201] Federally Enforceable Through Title V Permit
6. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District Rules, Regulations, and /or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit
7. The landfill gas collected by the landfill gas collection system shall be controlled by at least one of the following devices: 1) The 60 MMBtu/hr flare; 2) the 102 MMBtu/hr flare; and/or 3) The siloxane removal system and one of the IC engines permitted under Facility ID N-8573. Each device shall be operated at all times when the collected gas is routed to it. [District Rule 2201 and 40 CFR 60.752(b)(2)(iii)(B), 40 CFR 60.753(f), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit
8. The influent landfill gas flow rate to the 60 MMBtu/hr flare shall not exceed 2,000 SCFM (corrected to 50% methane). [District Rule 2201] Federally Enforceable Through Title V Permit
9. The influent landfill gas flow rate to the 102 MMBtu/hr flare shall not exceed 3,400 SCFM (corrected to 50% methane). [District Rule 2201] Federally Enforceable Through Title V Permit
10. The VOC destruction efficiency for the 60 MMBtu/hr flare shall be at least 98% by weight or the maximum non-methane organic compound NMOC emissions from the flare shall not exceed 20 ppmv @ 3% O2 (as hexane). [District Rule 2201, 40 CFR 60.752(b)(2)(iii)(B) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

11. The VOC destruction efficiency for the 102 MMBtu/hr flare shall be at least 98% by weight or the maximum non-methane organic compound NMOC emissions from the flare shall not exceed 20 ppmv @ 3% O2 (as hexane). [District Rule 2201, 40 CFR 60.752(b)(2)(iii)(B) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

12. Emissions from the 60 MMBtu/hr flare shall not exceed any of the following limits: 0.05 lb-NOx/MMBtu, 0.0215 lb-SOx/MMBtu, 0.034 lb-PM10/MMBtu, 0.2 lb-CO/MMBtu, and 0.0113 lb-VOC/MMBtu (equivalent to 20 ppmvd VOC as Hexane @ 3% O2). [District Rule 2201] Federally Enforceable Through Title V Permit

13. Emissions from the 102 MMBtu/hr flare shall not exceed any of the following limits: 0.05 lb-NOx/MMBtu, 0.0215 lb-SOx/MMBtu, (0.001 lb-PM10/hr)/scfm-methane, 0.2 lb-CO/MMBtu, and 0.0113 lb-VOC/MMBtu (equivalent to 20 ppmvd VOC as Hexane @ 3% O2). [District Rule 2201] Federally Enforceable Through Title V Permit

14. The volume of soil used for intermediate and final cover shall not exceed 61,768,080 cubic feet. [District Rule 2201] Federally Enforceable Through Title V Permit

15. PM10 emissions from the placement of the intermediate and final soil cover shall not exceed 0.008 lb/ton of soil. The volume of soil shall be converted to tons of soil using a soil density of 120 lb/cubic foot. [District Rule 2201] Federally Enforceable Through Title V Permit

16. The H2S concentration of the influent landfill gas to the flares shall not exceed 46.9 ppmv. [District Rule 2201] Federally Enforceable Through Title V Permit

17. For each flare, source testing to demonstrate compliance with the NOx (lb/MMBtu), CO (lb/MMBtu), and VOC (98% destruction efficiency or 20 ppmvd VOC @ 3% O2 as hexane) requirements of this permit shall be conducted at least once every 12 months. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

18. Source testing for NOx shall be conducted using CARB Method 7, CARB Method 20, or CARB Method 100. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

19. Source testing for CO shall be conducted using EPA Method 10 or 10B, CARB Methods 1 through 5 with CARB Method 10, or CARB Method 100. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

20. VOC emissions shall be conducted using EPA Method 18, 25, 25A, or 25C. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

21. Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081]

22. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit

23. The combustion chamber of each flare shall be maintained at a temperature of at least 1,400 degrees Fahrenheit during operation. [District Rule 2201] Federally Enforceable Through Title V Permit

24. Each flare shall be equipped with a temperature indicator and recorder that measures and continuously records the operating temperature. [District Rule 2201] Federally Enforceable Through Title V Permit

25. For each flare, the facility shall install and maintain in proper operating condition a gas flow meter with a continuous recording device that measures the quantity of landfill gas processed each day. [District Rule 2201] Federally Enforceable Through Title V Permit

26. Permittee shall perform testing to measure the H2S content of the landfill gas combusted in the flares on a quarterly basis using draeger tubes. If compliance with the landfill gas H2S content limit is demonstrated for two consecutive quarters, this testing frequency may be changed to annual. Quarterly testing shall resume if any annual test shows non-compliance with the H2S content limit. [District Rule 2201] Federally Enforceable Through Title V Permit

27. The landfill gas collection system shall be designed and operated to: 1) Handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment; 2) Collect gas from each area, cell or group of cells in the landfill in which the initial solid waste has been placed for a period of five years or more for an active landfill, or 2 years or more for a closed landfill or landfill at final grade; 3) Collect gas at a sufficient extraction rate; and 4) Minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A), 40 CFR 60.753(a), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

28. All exterior vapor extraction wells, leachate collection system components, and perimeter horizontal collectors shall not be located over any waste and are exempt from the operational standards of 40 CFR 60.753 and the compliance provisions of 40 CFR 60.755. Forward Inc. shall keep records of all components that qualify for this exemption and note their location with respect to the landfill's perimeter. [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758, 60.759, and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

29. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: 1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports provided in 40 CFR 60.757(f)(1); 2) Use of a geomembrane or synthetic cover. The owner shall develop acceptable pressure limits in the design plan; 3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the District. [40 CFR 60.753(b) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

30. Unless otherwise stated on this permit, the permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 degrees C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. [40 CFR 60.753(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

31. For each interior wellhead, the nitrogen level shall be determined using EPA Method 3C, unless an alternative test method is established as allowed by 40 CFR 60.752(b)(2)(i). [40 CFR 60.753(c)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

32. For each interior wellhead, unless an alternative test method is established as allowed by 40 CFR 60.752(b)(2)(i), the oxygen level shall be determined by an oxygen meter using EPA Method 3A or 3C except that: 1) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; 2) A data recorder is not required; 3) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; 4) A calibration check is not required; and 5) The allowable sample bios, zero drift, and calibration drive are plus or minus 10 percent. [40 CFR 60.753(c)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

33. Permittee shall operate the collection system so that the methane concentration is less than 500 parts per million above background at the surface of the landfill. To determine if this level is exceeded, the owner or operator shall conduct surface testing around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover on at least a quarterly basis. Permittee may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rational for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [40 CFR 60.753(d), 40 CFR 60.755, and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

34. Permittee shall operate the landfill gas collection and control system such that all collected gases are vented to a control system designed and operated in compliance with 40 CFR 60.752(b)(2)(iii). In the event the collection system or control system is inoperable, the gas mover system shall be shut down and all valves in the collection and control system contributing to the venting of the gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

35. If monitoring demonstrates that the operational requirements in 40 CFR 60.753(b), (c), or (d) are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3) through (5) or 40 CFR 60.755(c). If corrective actions are taken as specified in 40 CFR 60.755, the monitored exceedance is not a violation of the operational requirements in 40 CFR 60.753. [40 CFR 60.753(g) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

36. For the purpose of demonstrating that the gas collection system is designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control system, permittee shall use one of the equations that are listed in 40 CFR 60.755(a)(1). [40 CFR 60.755(a)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

37. For the purpose of determining whether there is a sufficient density of gas collectors, permittee shall design a system of vertical wells, horizontal collectors, or other collection devices satisfactory to the District, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

38. For the purpose of demonstrating whether the landfill gas collection system flow rate is sufficient, the owner or operator shall measure gauge pressure in the gas collection system header at each individual well on a monthly basis. Except in cases where the conditions allow the wellhead to operate without a negative pressure (as outlined in this permit), action shall be initiated to correct the exceedance within 5 calendar days if a positive pressure exists. If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of a positive pressure. Any attempted corrective measure shall not cause exceedances or other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the District for approval. Expansion of the collection system during the first 180 days after gas collection system startup is not required. [40 CFR 60.755(a)(3), 60.755(a)(4), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

39. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the permittee shall monitor the temperature and nitrogen or oxygen on a monthly basis. If a well exceeds one of the temperature, nitrogen, or oxygen operating parameters of this permit, action shall be initiated to correct the exceedance within five calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the District for approval. [40 CFR 60.755(a)(5) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

40. Extraction wells shall be installed no later than 60 days after the date on which the initial solid waste has been in place for a period of: 1) 5 years or more for an active landfill; 2) 2 years or more for a closed landfill or a landfill at final grade. [40 CFR 60.755(b) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

41. Monitoring to determine the surface concentration of methane shall be conducted using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications of 40 CFR 60.755(d). [40 CFR 60.755(c)(1), 40 CFR 60.755(d), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

42. The background concentration of methane shall be determined by moving the prove inlet upwind and downwind the outside boundary of the landfill at a distance of at least 30 meters from the perimeter walls. [40 CFR 60.755(c)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

43. Surface monitoring of the methane concentration shall be performed in accordance with Section 4.3.1 of EPA Method 21 of Appendix A of 40 CFR, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. [40 CFR 60.755(c)(3) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

44. Any surface monitoring reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the following actions shall be taken. As long as the following specified actions are taken, the exceedance is not a violation of the operational requirements of 40 CFR 60.753(d): 1) The location of each monitored exceedance shall be marked and the location recorded; 2) Cover maintenance or adjustments to the vacuum of the adjacent wells to increase the gas collection of the vicinity of each exceedance shall be made and the location shall be re-monitored within 10 calendar days of detecting the exceedance; 3) If the re-monitoring of the location shows a second exceedance, additional corrective action shall be taken and the location shall be monitored again within 10 days of the second exceedance. If re-monitoring shows a third exceedance, the action specified in item #5 of this condition shall be taken, and no further monitoring of that location is required until the action specified in item #5 has been taken; 4) Any location that initially showed an exceedance but has a methane concentration of less than 500 ppm above background at the 10-day re-monitoring shall be re-monitored 1 month from the initial exceedance. If the 1-month re-monitoring shows a concentration less than 500 parts per million above background, no further monitoring of that location is required until the next quarterly monitoring period. If the 1-month re-monitoring shows an exceedance, the actions specified in item #3 or item #5 of this condition shall be taken.; and 5) For any location where the monitored methane concentration equals or exceed 500 parts per million above background three times within a quarterly period, a new well or other collection device shall be installed within 120 calendar days of the initial exceedance. An alternative remedy to the exceedance, such as upgrading the blower, header pipes, or control device, and a corresponding timeline for installation may be submitted to the District for approval. [40 CFR 60.755(c)(4) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

45. Permittee shall implement a program to monitor for cover integrity and implement cover repairs, as necessary, on a monthly basis. [40 CFR 60.755(c)(5) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

46. The requirements of 40 CFR 60 Subpart WWW shall apply at all times, except during periods of start-up, shutdown, or malfunction. The duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

47. Permittee shall install a sampling port and a thermometer, other temperature measuring device, or an access port for temperature measurements at each wellhead. [40 CFR 60.756(a) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

48. For each enclosed flare, permittee shall calibrate, maintain, and operate according to the manufacturer's specifications a temperature monitoring device to measure temperature in the enclosed flare with a minimum accuracy of plus or minus 1 percent of the temperature being measured, expressed in degrees Celsius, or plus or minus 0.5 degrees Celsius, whichever is greater. [40 CFR 60.756(b)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

49. For each enclosed flare, permittee shall calibrate, maintain, and operate according to the manufacturer's specifications a device that records flow to or bypass of the control device. Permittee shall either: 1) Install, calibrate, and maintain a gas flow rate measuring device that shall record the flow to the control device at least once every 15 minutes; or 2) shall secure the bypass line valve in the closed position with a car-seal or a lock and key type configuration. A visual inspection of the seal or closure mechanism shall be performed at least once every month to ensure that the valve is maintained in a closed position and that the gas flow is not diverted through the bypass line. [40 CFR 60.756(b)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

50. For a closed landfill that has no monitored exceedances of the standard for surface concentrations of methane in three consecutive quarterly monitoring periods may skip to annual monitoring. Any methane reading of 500 ppm or more above background detected during the annual monitoring shall return the frequency of monitoring of surface concentrations to quarterly monitoring. [40 CFR 60.756(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

51. The permittee shall submit a closure report to the District within 30 days of waste acceptance cessation. The District may request additional information as may be necessary to verify that permanent closure has taken place in accordance with the requirements of 40 CFR 258.60. If a closure report has been submitted to the District, no additional wasted may be placed into the landfill without filing a notification of modification as described on 40 CFR 60.7(a)(4). [40 CFR 60.757(d) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

52. Permittee shall submit a report to the District, at least once every six months, that contains the following: 1) Value and length of time for each exceedance of applicable parameters monitored under 40 CFR 60.756(a), (b), (c), and (d); 2) Description of duration of all periods when the gas stream is diverted from the control device through a bypass line or the indication of bypass flow as specified under 40 CFR 60.756; 3) Description and duration of all periods when the control device was not operating for a period exceeding 1 hour and length of time control device was not operating; 4) All periods when the control system was not operating in excess of five days; 5)The location of each exceedance of the 500 parts per million methane concentration as provided in 40 CFR 60.753(d) and the concentration recorded at each location for which an exceedance was recorded in the previous month; and 6) The date of installation and the location of each well or collection system expansion added pursuant to 40 CFR 60.755(a)(3), (b), and (c)(4). [40 CFR 60.757(f) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

53. Permittee shall keep records of the design capacity report which triggered 40 CFR 60.752(b) requirements, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. [40 CFR 60.758(a) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

54. Permittee shall keep records of the following data, as measured during the initial performance test or compliance determination: 1) The maximum expected gas generation flow rate as calculated per 40 CFR 60.755(a)(1); 2) The density of wells, horizontal collectors, surface collectors, or other gas extraction devices as determined using the procedures specified in 40 CFR 60.759(a)(1); 3) For each enclosed flare, the average combustion temperature measured at least every 15 minutes and averaged over the same time period for the source test; and 4) For each enclosed flare, the percent reduction of NMOC determined as specified in 40 CFR 60.752(b)(2)(iii)(B). [40 CFR 60.758(b)(1) and (2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

55. Permittee shall keep continuous records of the equipment operating parameters specified to be monitored in 40 CFR 60.756, as well as up to date records of operation during with the parameter boundaries established during the most recent performance tests are exceeded. For each enclosed flare, all 3-hour periods of operation during with the average combustion temperature was more than 28 degree Celsius below the average combustion temperature during the most recent performance test shall constitute an exceedance and shall be recorded and reported under 40 CFR 60.757(f). [40 CFR 60.758(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

56. Permittee shall keep, for the life of the collection system, a plot map showing each existing and planned collector in the system and providing a unique identification location label of each collector. Permittee shall keep records of the installation date and location of all newly installed collectors as specified under 40 CFR 60.755(b). Permittee shall keep records of the date of disposition, amount, and location of asbestos-containing or non-degradable waste excluded from collection as provided in 40 CFR 60.759(a)(3)(i) as well as any non-productive areas excluded from collection as provided in 40 CFR 60.759(a)(3)(ii). [40 CFR 60.758(d) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

57. Permittee shall keep records of all collection and control system exceedances of the operational standards in 40 CFR 60.753, the reading in the subsequent month and whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

58. Permittee shall site active collection wells, horizontal collectors, surface collectors, and other extraction devices at a sufficient density throughout all gas producing areas of the landfill using the procedures listed in 40 CFR 60.759(a), unless alternative procedures have been approved by the District. [40 CFR 60.759(a) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

59. The collection devices within the landfill interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandibility, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. The design shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter and exterior. [40 CFR 60.759(a)(1) and (2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

60. The placement of gas collection devices shall control all gas producing areas except the following: 1) Any segregated area of asbestos or non-degradable material may be excluded from collection if documented as provided in 40 CFR 60.758(d). The documentation shall provide the nature, date of disposition, location, and amount of asbestos or non-degradable material deposited in the area, and shall be provided to the District upon request.; 2) Any nonproductive area of the landfill may be excluded from control, provided the total of all excluded areas can be shown to contribute to less than 1 percent of the total amount of non-methane organic compound emissions from the landfill. [40 CFR 60.759(a)(3) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

61. The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases, withstand installation, static, and settlement forces, and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration. [40 CFR 60.759(b)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

62. Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover area or refuse into the collection system or gas into the air. Any gravel used around pipe perforations shall be of a dimension so as not to penetrate or block perforations. [40 CFR 60.759(b)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

63. Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous materials of suitable thickness. [40 CFR 60.759(b)(3) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

64. Permittee shall convey the landfill gas to the control system through the collection header pipes. The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended period of gas moving equipment. For existing collection systems, the flow data, if flow data exists, shall be used to project the maximum flow rate. For new collection systems or existing collection systems for which no flow data exists, the maximum flow rate shall be in accordance with 40 CFR 60.755(a)(1). [40 CFR 60.759(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

65. Permittee shall develop a written SSM plan according to the provisions of 40 CFR 63.6(e)(3). A copy of the SSM plan shall be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of 40 CFR 63 Subpart AAAA. [40 CFR 63.1960] Federally Enforceable Through Title V Permit

66. For parameters required to be continuously monitored by 40 CFR 60 Subpart WWW, a deviation of 40 CFR 63 Subpart AAAA shall be deemed to have occurred when 1 hour or more of the hours during the 3-hour block averaging period does not constitute a valid hour of data. A valid hour of data must have measured values for at least three 15-minute monitoring periods within the hour. [40 CFR 63.1965(b)] Federally Enforceable Through Title V Permit

67. Permittee shall keep records and reports as specified in the general provisions of 40 CFR Part 60, and 40 CFR Part 63, as shown in Table 1 of 40 CFR part 63 Subpart AAAA. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit

68. For LFG extraction wellheads A11-04, A11-05, A11-06, A11-07, A11-08, A11-09, A11-10, A11-11, A12-02, A12-03, A12-04, A12-05, A12-14, A12-15, A13-08, A14-08, A14-09, A14-11, AO59RS, AO65RS, F-12-01, F12-06, F12-07, F12-08, F12-09, F12-10, F12-11, F13-01, FU03-01R, FU04-14R, FU04-15R, FU04-18R, FU04-19R FU04-27R, FU04-27R, FU05-08R, FU05-10R, FU05-15R, FU06-15, FU06-16, FU-08-02, FU08-03, Top Deck Well 01, Top Deck Well 02, Top Deck Well 03, Top Deck Well 04, Top Deck Well 05, and Top Deck Well 13, the permittee shall operate each of these wellheads with a landfill gas temperature less than 141 degrees F and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The following monitoring requirements are applicable to these wellheads: 1) The permittee shall perform monthly CO monitoring using Draeger tubes, or a District/EPA approved monitoring device, for wellheads with a measured temperature greater than 131 degrees F; 2) If the measured field CO readings are less than 200 ppmv, the well may continue to operate up to a temperature less than 141 degrees F; 3) If the measured field CO readings are equal to or greater than 200 ppmv and less than or equal to 500 ppmv, the well shall be monitored on a weekly basis to verify that there is no subsurface oxidation occurring. Once the CO levels decrease to below 200 ppmv, the monthly monitoring schedule shall resume; 4) If the measured field CO readings are in excess of 500 ppmv, the well shall be temporarily closed and documented and a sample shall be obtained within one week of the exceedance and analyzed for CO using EPA Method D-1946. If results confirm the readings are in excess of 500 ppmv, the well shall remain closed and off-line and the District shall be notified within 24 hours of the exceedance; and 5) Upon receiving notification from the District, the permittee shall undertake such actions as directed by the District and/or EPA to further investigate the potential for subsurface oxidation in the area of a wellhead and develop a plan for remediation. [40 CFR 60.753(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

69. The permittee may request an alternative gas temperature limit for LFG extraction wellheads by submitting a request in writing to US EPA and the District. Any such request shall contain all available sampling and other evidence relevant to EPA's and the District's consideration of the requesting, including, but not limited to, the existence of suspected or actual subsurface combustion. After considering the request, EPA and the District will either grant the request or deny it, in writing. If EPA and the District grant the request for an alternative wellhead gas temperature limit for an existing wellhead, the alternative approved limit shall immediately supersede the previously applicable limit and become the new temperature limit for that wellhead. [40 CFR 60.753(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

70. Permittee shall keep records of any maintenance to the landfill gas collection or control devices, including the reason for maintenance, duration of the maintenance, and any collection or control system downtime. [District Rule 2201] Federally Enforceable Through Title V Permit

71. Permittee shall maintain records of system inspections including: date, time, and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit

72. For each flare, permittee shall keep records of emission source tests results. [District Rule 2201] Federally Enforceable Through Title V Permit

73. For each flare, permittee shall keep records of the continuous flare combustion temperature measurements, and the continuous volumetric landfill gas flow rate measurements. Permittee shall keep a daily and an annual record of the quantity of landfill gas processed in each flare. [District Rule 2201] Federally Enforceable Through Title V Permit

74. All records shall be retained for a period of at least five years and shall be made available for District inspection upon request. [District Rules 1070, 2201, 40 CFR 60 Subpart WWW, and 40 CFR 60 Subpart AAAA] Federally Enforceable Through Title V Permit

75. The permittee shall notify the District by telephone at least 24 hours prior to performing any maintenance work that requires the landfill gas collection and control system to be shutdown. The notification shall include a description of the work, the date work will be performed, and the quantity of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit

76. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464]

77. Landfill collection and control system must be operated such that methane emission from the landfill do not exceed instantaneous or integrated limit requirements. [17 CCR 95464]

78. Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure when there is a fire or during other times as allowed in sections 95464 (c), 95464(d), and 95464(e) [17 CCR 95464]

79. Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. If compliance with the methane limit has been demonstrated for 4 consecutive quarters, then the component checking frequency shall be annually. If an annual test fails to show compliance, quarterly testing shall resume. [17 CCR 95464]

80. Each flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464]

81. Each flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464]

82. Landfill collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95464, 17 CCR 95465]

83. Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(1). [17 CCR 95469]

84. Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470]

85. Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470]

86. Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470]

87. Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470]

88. Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470]

89. Permittee shall terminate surface emission testing when the measured average wind speed is over 15 mph or the instantaneous wind speed is over 30 mph. [17 CCR 95468, 17 CCR 95471]

90. Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]

91. Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470]

92. Permittee shall keep records of the nature, location, amount , and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470]

93. Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470]

94. Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities; 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470]

PERMIT UNIT REQUIREMENTS CONTINUE ON NEXT PAGE

95. Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470]

96. Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470]

97. Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470]

98. Permittee may comply with the CARB regulation for landfill methane control measures by using approved alternative compliance options. The permittee shall obtain written District approval for the use of any alternative compliance options not approved by this permit. Changes to the approved alternate compliance options must be made and approved in writing. Documentation of approved alternative compliance options shall be available for inspection upon request. [17 CCR 95468]

Newspaper notice for publication in Stockton Record and for posting on valleyair.org

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SAN JOAQUIN VALLEY
AIR POLLUTION CONTROL DISTRICT
NOTICE OF FINAL DECISION TO ISSUE
RENEWED FEDERALLY MANDATED OPERATING PERMIT

NOTICE IS HEREBY GIVEN that the San Joaquin Valley Air Pollution Control District has made its final decision to issue the renewed Federally Mandated Operating Permit to Forward INC Landfill at 9999 S Austin Rd, Manteca, CA, California.

The District's analysis of the legal and factual basis for this action, project #N1162178, is available for public inspection at http://www.valleyair.org/notices/public_notices_idx.htm, the SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DISTRICT, 4800 ENTERPRISE WAY, MODESTO, CA 95356, and at any other District office. For additional information, please contact the District at (209) 557-6400.

AUTHORITY TO CONSTRUCT

PERMIT NO: N-339-17-15 **ISSUANCE DATE:** 12/08/2016

LEGAL OWNER OR OPERATOR: FORWARD INC LANDFILL
MAILING ADDRESS: 9999 S AUSTIN RD
MANTECA, CA 95336

LOCATION: 9999 S AUSTIN RD
MANTECA, CA 95336

EQUIPMENT DESCRIPTION:
MODIFICATION OF 39.0 MILLION CUBIC METER CAPACITY (354.5 ACRES) LANDFILL WITH A LANDFILL GAS COLLECTION SYSTEM CONTROLLED BY A 2,200 SCFM (EQUIVALENT TO 60 MMBTU/HR) ENCLOSED LANDFILL GAS-FIRED FLARE AND A 3,400 SCFM (EQUIVALENT TO 102 MMBTU/HR) PERRENIAL ENERGY MODEL GHS-301 ENCLOSED LANDFILL GAS-FIRED FLARE WITH AN LPG-FIRED PILOT: TO REPLACE THE 2000 SCFM FLARE WITH A 3200 SCFM ZTOF ENCLOSED FLARE SUCH THAT THE EQUIPMENT DESCRIPTION BECOMES: 39.0 MILLION CUBIC METER CAPACITY (354.5 ACRES) LANDFILL WITH A LANDFILL GAS COLLECTION SYSTEM CONTROLLED BY A 3,400 SCFM PERRENIAL ENERGY MODEL GHS-301 ENCLOSED LANDFILL GAS-FIRED FLARE WITH AN LPG-FIRED PILOT (FLARE #2) AND A 2,200 SCFM (ROLLING ANNUAL AVERAGE) ZTOF ENCLOSED FLARE (FLARE #3)

CONDITIONS

1. The facility shall submit an application to modify the Title V permit in accordance with the timeframes and procedures of District Rule 2520. [District Rule 2520] Federally Enforceable Through Title V Permit
2. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
3. No air contaminants shall be discharged into the atmosphere for a period or periods aggregating more than 3 minutes in any one hour which is as dark or darker than Ringelmann #1 or equivalent to 20% opacity and greater, unless specifically exempted by District Rule 4101 (02/17/05). If the equipment or operation is subject to a more stringent visible emission standard as prescribed in a permit condition, the more stringent visible emission limit shall supersede this condition. [District Rule 4101, and County Rules 401 (in all eight counties in the San Joaquin Valley)] Federally Enforceable Through Title V Permit
4. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (209) 557-6400 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

Arnaud Marjollet, Director of Permit Services

N-339-17-15 : Dec 8 2016 5:15PM – HARADERJ Joint Inspection NOT Required

5. The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]

6. All equipment shall be constructed, maintained, and operated according to the specifications and plans contained in the permit applications, except as otherwise specified herein. [District Rule 2201] Federally Enforceable Through Title V Permit

7. The enclosed flares shall each be equipped with an LPG or natural gas-fired pilot. [District Rule 2201] Federally Enforceable Through Title V Permit

8. The enclosed flares shall each be equipped with automatic dampers, an automatic shutdown device, and a flame arrester. [District Rule 2201] Federally Enforceable Through Title V Permit

9. The gas collection system shall be operated in a manner which maximizes the quantity of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system. [District Rule 2201] Federally Enforceable Through Title V Permit

10. During maintenance of the gas collection system or flares, emissions of landfill gas shall be minimized. [District Rule 2201] Federally Enforceable Through Title V Permit

11. Maintenance is defined as work performed on a gas collection system and/or control device in order to ensure continued compliance with District Rules, Regulations, and /or Permits to Operate, and to prevent its failure or malfunction. [District Rule 2201] Federally Enforceable Through Title V Permit

12. The landfill gas collected by the landfill gas collection system shall be controlled by at least one of the following devices: 1) The 3,400 scfm flare 2) the 2,200 scfm flare; and/or 3) The siloxane removal system and one of the IC engines permitted under Facility ID N-8573. Each device shall be operated at all times when the collected gas is routed to it. [District Rule 2201 and 40 CFR 60.752(b)(2)(iii)(B), 40 CFR 60.753(f), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

13. The VOC destruction efficiency for the 3,400 scfm flare shall be at least 98% by weight or the maximum non-methane organic compound NMOC emissions from the flare shall not exceed 20 ppmv @ 3% O2 (as hexane). [District Rule 2201, 40 CFR 60.752(b)(2)(iii)(B) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

14. The VOC destruction efficiency for the 2,200 scfm flare shall be at least 98% by weight or the maximum non-methane organic compound NMOC emissions from the flare shall not exceed 20 ppmv @ 3% O2 (as hexane). [District Rule 2201, 40 CFR 60.752(b)(2)(iii)(B) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

15. Emissions from each flare shall not exceed any of the following limits: 0.000025 lb-NOx/scf landfill gas combusted, 0.00001075 lb-SOx/scf landfill gas combusted, 0.00000833 lb-PM10/scf landfill gas combusted; 0.0001 lb-CO/scf landfill gas combusted, and 0.00000565 lb-VOC/scf landfill gas combusted. [District Rule 2201] Federally Enforceable Through Title V Permit

16. The volume of soil used for intermediate and final cover shall not exceed 61,768,080 cubic feet. [District Rule 2201] Federally Enforceable Through Title V Permit

17. PM10 emissions from the placement of the intermediate and final soil cover shall not exceed 0.008 lb/ton of soil. The volume of soil shall be converted to tons of soil using a soil density of 120 lb/cubic foot. [District Rule 2201] Federally Enforceable Through Title V Permit

18. The H2S concentration of the influent landfill gas to the flares shall not exceed 46.9 ppmv. [District Rule 2201] Federally Enforceable Through Title V Permit

19. For the 3,400 scfm flare, source testing to demonstrate compliance with the NOx (lb/scf landfill gas processed), CO (lb/scf landfill gas processed), and VOC (98% destruction efficiency or 20 ppmvd VOC @ 3% O2 as hexane) requirements of this permit shall be conducted at least once every 12 months. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

20. For the 2,200 scfm flare, source testing to demonstrate compliance with the NOx (lb/scf landfill gas processed), CO (lb/scf landfill gas processed), and VOC (98% destruction efficiency or 20 ppmvd VOC @ 3% O2 as hexane) requirements of this permit shall be conducted within 60 days of startup and at least once every 12 months thereafter. [District Rules 1080 and 2201] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

21. Source testing for NOx shall be conducted using CARB Method 7 or CARB Method 20. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

22. Source testing for CO shall be conducted using EPA Method 10 or 10B, CARB Methods 1 through 5 with CARB Method 10, or CARB Method 100. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

23. VOC emissions shall be conducted using EPA Method 18, 25, 25A, or 25C. [District Rules 1081 and 2201] Federally Enforceable Through Title V Permit

24. Source testing shall be conducted using the methods and procedures approved by the District. The District must be notified at least 30 days prior to any compliance source test, and a source test plan must be submitted for approval at least 15 days prior to testing. [District Rule 1081] Federally Enforceable Through Title V Permit

25. The results of each source test shall be submitted to the District within 60 days thereafter. [District Rule 1081] Federally Enforceable Through Title V Permit

26. The combustion chamber of each flare shall be maintained at a temperature of at least 1,400 degrees Fahrenheit during operation. [District Rule 2201] Federally Enforceable Through Title V Permit

27. Each flare shall be equipped with a temperature indicator and recorder that measures and continuously records the operating temperature. [District Rule 2201] Federally Enforceable Through Title V Permit

28. For each flare, the facility shall install and maintain in proper operating condition a gas flow meter with a continuous recording device that measures the quantity of landfill gas processed each day. [District Rule 2201] Federally Enforceable Through Title V Permit

29. Permittee shall perform testing to measure the H2S content of the landfill gas combusted in the flares on a quarterly basis using draeger tubes. If compliance with the landfill gas H2S content limit is demonstrated for two consecutive quarters, this testing frequency may be changed to annual. Quarterly testing shall resume if any annual test shows non-compliance with the H2S content limit. [District Rule 2201] Federally Enforceable Through Title V Permit

30. The landfill gas collection system shall be designed and operated to: 1) Handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment; 2) Collect gas from each area, cell or group of cells in the landfill in which the initial solid waste has been placed for a period of five years or more for an active landfill, or 2 years or more for a closed landfill or landfill at final grade; 3) Collect gas at a sufficient extraction rate; and 4) Minimize off-site migration of subsurface gas. [40 CFR 60.752(b)(2)(ii)(A), 40 CFR 60.753(a), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

31. All exterior vapor extraction wells, leachate collection system components, and perimeter horizontal collectors shall not be located over any waste and are exempt from the operational standards of 40 CFR 60.753 and the compliance provisions of 40 CFR 60.755. Forward Inc. shall keep records of all components that qualify for this exemption and note their location with respect to the landfill's perimeter. [40 CFR 60.752(b)(2)(ii), 60.753, 60.755, 60.756, 60.757, 60.758, 60.759, and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

32. Permittee shall operate the landfill gas collection system with negative pressure at each wellhead except under the following conditions: 1) A fire or increased well temperature. The owner or operator shall record instances when positive pressure occurs in efforts to avoid a fire. These records shall be submitted with the annual reports provided in 40 CFR 60.757(f)(1); 2) Use of a geomembrane or synthetic cover. The owner shall develop acceptable pressure limits in the design plan; 3) A decommissioned well. A well may experience a static positive pressure after shut down to accommodate for declining flows. All design changes shall be approved by the District. [40 CFR 60.753(b) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

33. Unless otherwise stated on this permit, the permittee shall operate each interior wellhead in the collection system with a landfill gas temperature less than 55 degrees C and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. [40 CFR 60.753(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

34. For each interior wellhead, the nitrogen level shall be determined using EPA Method 3C, unless an alternative test method is established as allowed by 40 CFR 60.752(b)(2)(i). [40 CFR 60.753(c)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

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35. For each interior wellhead, unless an alternative test method is established as allowed by 40 CFR 60.752(b)(2)(i), the oxygen level shall be determined by an oxygen meter using EPA Method 3A or 3C except that: 1) The span shall be set so that the regulatory limit is between 20 and 50 percent of the span; 2) A data recorder is not required; 3) Only two calibration gases are required, a zero and span, and ambient air may be used as the span; 4) A calibration check is not required; and 5) The allowable sample bios, zero drift, and calibration drive are plus or minus 10 percent. [40 CFR 60.753(c)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

36. Permittee shall operate the collection system so that the methane concentration is less than 500 parts per million above background at the surface of the landfill. To determine if this level is exceeded, the owner or operator shall conduct surface testing around the perimeter of the collection area and along a pattern that traverses the landfill at 30 meter intervals and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover on at least a quarterly basis. Permittee may establish an alternative traversing pattern that ensures equivalent coverage. A surface monitoring design plan shall be developed that includes a topographical map with the monitoring route and the rational for any site-specific deviations from the 30 meter intervals. Areas with steep slopes or other dangerous areas may be excluded from the surface testing. [40 CFR 60.753(d), 40 CFR 60.755, and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

37. Permittee shall operate the landfill gas collection and control system such that all collected gases are vented to a control system designed and operated in compliance with 40 CFR 60.752(b)(2)(iii). In the event the collection system or control system is inoperable, the gas mover system shall be shut down and all valves in the collection and control system contributing to the venting of the gas to the atmosphere shall be closed within one hour. [40 CFR 60.753(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

38. If monitoring demonstrates that the operational requirements in 40 CFR 60.753(b), (c), or (d) are not met, corrective action shall be taken as specified in 40 CFR 60.755(a)(3) through (5) or 40 CFR 60.755(c). If corrective actions are taken as specified in 40 CFR 60.755, the monitored exceedance is not a violation of the operational requirements in 40 CFR 60.753. [40 CFR 60.753(g) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

39. For the purpose of demonstrating that the gas collection system is designed to handle the maximum expected gas flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control system, permittee shall use one of the equations that are listed in 40 CFR 60.755(a)(1). [40 CFR 60.755(a)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

40. For the purpose of determining whether there is a sufficient density of gas collectors, permittee shall design a system of vertical wells, horizontal collectors, or other collection devices satisfactory to the District, capable of controlling and extracting gas from all portions of the landfill sufficient to meet all operational and performance standards. [40 CFR 60.755(a)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

41. For the purpose of demonstrating whether the landfill gas collection system flow rate is sufficient, the owner or operator shall measure gauge pressure in the gas collection system header at each individual well on a monthly basis. Except in cases where the conditions allow the wellhead to operate without a negative pressure (as outlined in this permit), action shall be initiated to correct the exceedance within 5 calendar days if a positive pressure exists. If negative pressure cannot be achieved without excess air infiltration within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial measurement of a positive pressure. Any attempted corrective measure shall not cause exceedances or other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the District for approval. Expansion of the collection system during the first 180 days after gas collection system startup is not required. [40 CFR 60.755(a)(3), 60.755(a)(4), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

42. For the purpose of identifying whether excess air infiltration into the landfill is occurring, the permittee shall monitor the temperature and nitrogen or oxygen on a monthly basis. If a well exceeds one of the temperature, nitrogen, or oxygen operating parameters of this permit, action shall be initiated to correct the exceedance within five calendar days. If correction of the exceedance cannot be achieved within 15 calendar days of the first measurement, the gas collection system shall be expanded to correct the exceedance within 120 days of the initial exceedance. Any attempted corrective measure shall not cause exceedances of other operational or performance standards. An alternative timeline for correcting the exceedance may be submitted to the District for approval. [40 CFR 60.755(a)(5) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

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43. Extraction wells shall be installed no later than 60 days after the date on which the initial solid waste has been in place for a period of: 1) 5 years or more for an active landfill; 2) 2 years or more for a closed landfill or a landfill at final grade. [40 CFR 60.755(b) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

44. Monitoring to determine the surface concentration of methane shall be conducted using an organic vapor analyzer, flame ionization detector, or other portable monitor meeting the specifications of 40 CFR 60.755(d). [40 CFR 60.755(c)(1), 40 CFR 60.755(d), and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

45. The background concentration of methane shall be determined by moving the prove inlet upwind and downwind the outside boundary of the landfill at a distance of at least 30 meters from the perimeter walls. [40 CFR 60.755(c)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

46. Surface monitoring of the methane concentration shall be performed in accordance with Section 4.3.1 of EPA Method 21 of Appendix A of 40 CFR, except that the probe inlet shall be placed within 5 to 10 centimeters of the ground. Monitoring shall be performed during typical meteorological conditions. [40 CFR 60.755(c)(3) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

47. Any surface monitoring reading of 500 parts per million or more above background at any location shall be recorded as a monitored exceedance and the following actions shall be taken. As long as the following specified actions are taken, the exceedance is not a violation of the operational requirements of 40 CFR 60.753(d): 1) The location of each monitored exceedance shall be marked and the location recorded; 2) Cover maintenance or adjustments to the vacuum of the adjacent wells to increase the gas collection of the vicinity of each exceedance shall be made and the location shall be re-monitored within 10 calendar days of detecting the exceedance; 3) If the re-monitoring of the location shows a second exceedance, additional corrective action shall be taken and the location shall be monitored again within 10 days of the second exceedance. If re-monitoring shows a third exceedance, the action specified in item #5 of this condition shall be taken, and no further monitoring of that location is required until the action specified in item #5 has been taken; 4) Any location that initially showed an exceedance but has a methane concentration of less than 500 ppm above background at the 10-day re-monitoring shall be re-monitored 1 month from the initial exceedance. If the 1-month re-monitoring shows a concentration less than 500 parts per million above background, no further monitoring of that location is required until the next quarterly monitoring period. If the 1-month re-monitoring shows an exceedance, the actions specified in item #3 or item #5 of this condition shall be taken.; and 5) For any location where the monitored methane concentration equals or exceed 500 parts per million above background three times within a quarterly period, a new well or other collection device shall be installed within 120 calendar days of the initial exceedance. An alternative remedy to the exceedance, such as upgrading the blower, header pipes, or control device, and a corresponding timeline for installation may be submitted to the District for approval. [40 CFR 60.755(c)(4) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

48. Permittee shall implement a program to monitor for cover integrity and implement cover repairs, as necessary, on a monthly basis. [40 CFR 60.755(c)(5) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

49. The requirements of 40 CFR 60 Subpart WWW shall apply at all times, except during periods of start-up, shutdown, or malfunction. The duration of start-up, shutdown, or malfunction shall not exceed 5 days for collection systems and shall not exceed 1 hour for treatment or control devices. [40 CFR 60.755(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

50. Permittee shall install a sampling port and a thermometer, other temperature measuring device, or an access port for temperature measurements at each wellhead. [40 CFR 60.756(a) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

51. For each enclosed flare, permittee shall calibrate, maintain, and operate according to the manufacturer's specifications a temperature monitoring device to measure temperature in the enclosed flare with a minimum accuracy of plus or minus 1 percent of the temperature being measured, expressed in degrees Celsius, or plus or minus 0.5 degrees Celsius, whichever is greater. [40 CFR 60.756(b)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

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52. For each enclosed flare, permittee shall calibrate, maintain, and operate according to the manufacturer's specifications a device that records flow to or bypass of the control device. Permittee shall either: 1) Install, calibrate, and maintain a gas flow rate measuring device that shall record the flow to the control device at least once every 15 minutes; or 2) shall secure the bypass line valve in the closed position with a car-seal or a lock and key type configuration. A visual inspection of the seal or closure mechanism shall be performed at least once every month to ensure that the valve is maintained in a closed position and that the gas flow is not diverted through the bypass line. [40 CFR 60.756(b)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

53. For a closed landfill that has no monitored exceedances of the standard for surface concentrations of methane in three consecutive quarterly monitoring periods may skip to annual monitoring. Any methane reading of 500 ppm or more above background detected during the annual monitoring shall return the frequency of monitoring of surface concentrations to quarterly monitoring. [40 CFR 60.756(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

54. The permittee shall submit a closure report to the District within 30 days of waste acceptance cessation. The District may request additional information as may be necessary to verify that permanent closure has taken place in accordance with the requirements of 40 CFR 258.60. If a closure report has been submitted to the District, no additional wasted may be placed into the landfill without filing a notification of modification as described on 40 CFR 60.7(a)(4). [40 CFR 60.757(d) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

55. Permittee shall submit a report to the District, at least once every six months, that contains the following: 1) Value and length of time for each exceedance of applicable parameters monitored under 40 CFR 60.756(a), (b), (c), and (d); 2) Description of duration of all periods when the gas stream is diverted from the control device through a bypass line or the indication of bypass flow as specified under 40 CFR 60.756; 3) Description and duration of all periods when the control device was not operating for a period exceeding 1 hour and length of time control device was not operating; 4) All periods when the control system was not operating in excess of five days; 5)The location of each exceedance of the 500 parts per million methane concentration as provided in 40 CFR 60.753(d) and the concentration recorded at each location for which an exceedance was recorded in the previous month; and 6) The date of installation and the location of each well or collection system expansion added pursuant to 40 CFR 60.755(a)(3), (b), and (c)(4). [40 CFR 60.757(f) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

56. Permittee shall keep records of the design capacity report which triggered 40 CFR 60.752(b) requirements, the current amount of solid waste in-place, and the year-by-year waste acceptance rate. [40 CFR 60.758(a) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

57. Permittee shall keep records of the following data, as measured during the initial performance test or compliance determination: 1) The maximum expected gas generation flow rate as calculated per 40 CFR 60.755(a)(1); 2) The density of wells, horizontal collectors, surface collectors, or other gas extraction devices as determined using the procedures specified in 40 CFR 60.759(a)(1); 3) For each enclosed flare, the average combustion temperature measured at least every 15 minutes and averaged over the same time period for the source test; and 4) For each enclosed flare, the percent reduction of NMOC determined as specified in 40 CFR 60.752(b)(2)(iii)(B). [40 CFR 60.758(b)(1) and (2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

58. Permittee shall keep continuous records of the equipment operating parameters specified to be monitored in 40 CFR 60.756, as well as up to date records of operation during with the parameter boundaries established during the most recent performance tests are exceeded. For each enclosed flare, all 3-hour periods of operation during with the average combustion temperature was more than 28 degree Celsius below the average combustion temperature during the most recent performance test shall constitute an exceedance and shall be recorded and reported under 40 CFR 60.757(f). [40 CFR 60.758(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

59. Permittee shall keep, for the life of the collection system, a plot map showing each existing and planned collector in the system and providing a unique identification location label of each collector. Permittee shall keep records of the installation date and location of all newly installed collectors as specified under 40 CFR 60.755(b). Permittee shall keep records of the date of disposition, amount, and location of asbestos-containing or non-degradable waste excluded from collection as provided in 40 CFR 60.759(a)(3)(i) as well as any non-productive areas excluded from collection as provided in 40 CFR 60.759(a)(3)(ii). [40 CFR 60.758(d) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

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60. Permittee shall keep records of all collection and control system exceedances of the operational standards in 40 CFR 60.753, the reading in the subsequent month and whether or not the second reading is an exceedance, and the location of each exceedance. [40 CFR 60.758(e) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

61. Permittee shall site active collection wells, horizontal collectors, surface collectors, and other extraction devices at a sufficient density throughout all gas producing areas of the landfill using the procedures listed in 40 CFR 60.759(a), unless alternative procedures have been approved by the District. [40 CFR 60.759(a) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

62. The collection devices within the landfill interior and along the perimeter areas shall be certified to achieve comprehensive control of surface gas emissions by a professional engineer. The following issues shall be addressed in the design: depths of refuse, refuse gas generation rates and flow characteristics, cover properties, gas system expandibility, leachate and condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat. The design shall address landfill gas migration issues and augmentation of the collection system through the use of active or passive systems at the landfill perimeter and exterior. [40 CFR 60.759(a)(1) and (2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

63. The placement of gas collection devices shall control all gas producing areas except the following: 1) Any segregated area of asbestos or non-degradable material may be excluded from collection if documented as provided in 40 CFR 60.758(d). The documentation shall provide the nature, date of disposition, location, and amount of asbestos or non-degradable material deposited in the area, and shall be provided to the District upon request.; 2) Any nonproductive area of the landfill may be excluded from control, provided the total of all excluded areas can be shown to contribute to less than 1 percent of the total amount of non-methane organic compound emissions from the landfill. [40 CFR 60.759(a)(3) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

64. The landfill gas extraction components shall be constructed of polyvinyl chloride (PVC), high density polyethylene (HDPE) pipe, fiberglass, stainless steel, or other nonporous corrosion resistant material of suitable dimensions to: convey projected amounts of gases, withstand installation, static, and settlement forces, and withstand planned overburden or traffic loads. The collection system shall extend as necessary to comply with emission and migration standards. Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control. Perforations shall be situated with regard to the need to prevent excessive air infiltration. [40 CFR 60.759(b)(1) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

65. Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill. Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-section so as to allow for their proper construction and completion. Collection devices shall be designed so as not to allow indirect short circuiting of air into the cover area or refuse into the collection system or gas into the air. Any gravel used around pipe perforations shall be of a dimension so as not to penetrate or block perforations. [40 CFR 60.759(b)(2) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

66. Collection devices may be connected to the collection header pipes below or above the landfill surface. The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings and at least one sampling port. The collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other nonporous materials of suitable thickness. [40 CFR 60.759(b)(3) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

67. Permittee shall convey the landfill gas to the control system through the collection header pipes. The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended period of gas moving equipment. For existing collection systems, the flow data, if flow data exists, shall be used to project the maximum flow rate. For new collection systems or existing collection systems for which no flow data exists, the maximum flow rate shall be in accordance with 40 CFR 60.755(a)(1). [40 CFR 60.759(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

68. Permittee shall develop a written SSM plan according to the provisions of 40 CFR 63.6(e)(3). A copy of the SSM plan shall be maintained on site. Failure to write or maintain a copy of the SSM plan is a deviation from the requirements of 40 CFR 63 Subpart AAAA. [40 CFR 63.1960] Federally Enforceable Through Title V Permit

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69. For parameters required to be continuously monitored by 40 CFR 60 Subpart WWW, a deviation of 40 CFR 63 Subpart AAAA shall be deemed to have occurred when 1 hour or more of the hours during the 3-hour block averaging period does not constitute a valid hour of data. A valid hour of data must have measured values for at least three 15-minute monitoring periods within the hour. [40 CFR 63.1965(b)] Federally Enforceable Through Title V Permit

70. Permittee shall keep records and reports as specified in the general provisions of 40 CFR Part 60, and 40 CFR Part 63, as shown in Table 1 of 40 CFR part 63 Subpart AAAA. [40 CFR 63.1980(b)] Federally Enforceable Through Title V Permit

71. For LFG extraction wellheads A11-05, A11-06, A11-07, A11-08, A11-09, A11-10, A11-11, A12-02, A12-03, A12-14, F12-08, F12-09, F12-10, FU03-01R, FU04-14R, FU04-15R, FU04-18R, FU04-19R FU04-27R, FU04-27R, FU05-08R, FU05-10R, FU05-15R, FU06-15, FU06-16, FU-08-02, and FU08-03, the permittee shall operate each of these wellheads with a landfill gas temperature less than 141 degrees F and with either a nitrogen level less than 20 percent or an oxygen level less than 5 percent. The following monitoring requirements are applicable to these wellheads: 1) The permittee shall perform monthly CO monitoring using Draeger tubes, or a District/EPA approved monitoring device, for wellheads with a measured temperature greater than 131 degrees F; 2) If the measured field CO readings are less than 200 ppmv, the well may continue to operate up to a temperature less than 141 degrees F; 3) If the measured field CO readings are equal to or greater than 200 ppmv and less than or equal to 500 ppmv, the well shall be monitored on a weekly basis to verify that there is no subsurface oxidation occurring. Once the CO levels decrease to below 200 ppmv, the monthly monitoring schedule shall resume; 4) If the measured field CO readings are in excess of 500 ppmv, the well shall be temporarily closed and documented and a sample shall be obtained within one week of the exceedance and analyzed for CO using EPA Method D-1946. If results confirm the readings are in excess of 500 ppmv, the well shall remain closed and off-line and the District shall be notified within 24 hours of the exceedance; and 5) Upon receiving notification from the District, the permittee shall undertake such actions as directed by the District and/or EPA to further investigate the potential for subsurface oxidation in the area of a wellhead and develop a plan for remediation. [40 CFR 60.753(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

72. The permittee may request an alternative gas temperature limit for LFG extraction wellheads by submitting a request in writing to US EPA and the District. Any such request shall contain all available sampling and other evidence relevant to EPA's and the District's consideration of the requesting, including, but not limited to, the existence of suspected or actual subsurface combustion. After considering the request, EPA and the District will either grant the request or deny it, in writing. If EPA and the District grant the request for an alternative wellhead gas temperature limit for an existing wellhead, the alternative approved limit shall immediately supersede the previously applicable limit and become the new temperature limit for that wellhead. [40 CFR 60.753(c) and 40 CFR 63 Subpart AAAA] Federally Enforceable Through Title V Permit

73. Permittee shall keep records of any maintenance to the landfill gas collection or control devices, including the reason for maintenance, duration of the maintenance, and any collection or control system downtime. [District Rule 2201] Federally Enforceable Through Title V Permit

74. Permittee shall maintain records of system inspections including: date, time, and inspection results. [District Rule 1070] Federally Enforceable Through Title V Permit

75. For each flare, permittee shall keep records of emission source tests results. [District Rule 2201] Federally Enforceable Through Title V Permit

76. For each flare, permittee shall keep records of the continuous flare combustion temperature measurements, and the continuous volumetric landfill gas flow rate measurements. Permittee shall keep a daily and an annual record of the quantity of landfill gas processed in each flare. [District Rule 2201] Federally Enforceable Through Title V Permit

77. For the 2,200 SCFM flare, the operator shall keep a record of the daily average flowrate, based on a rolling 365-day average. [District Rule 2201] Federally Enforceable Through Title V Permit

78. All records shall be retained for a period of at least five years and shall be made available for District inspection upon request. [District Rules 1070, 2201, 40 CFR 60 Subpart WWW, and 40 CFR 60 Subpart AAAA] Federally Enforceable Through Title V Permit

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79. The permittee shall notify the District by telephone at least 24 hours prior to performing any maintenance work that requires the landfill gas collection and control system to be shutdown. The notification shall include a description of the work, the date work will be performed, and the quantity of time needed to complete the maintenance work. [District Rule 2201] Federally Enforceable Through Title V Permit

80. The methane destruction efficiency for the enclosed flares shall be at least 99% by weight. [17 CCR 95464]

81. Landfill collection and control system must be operated such that methane emission from the landfill do not exceed instantaneous or integrated limit requirements. [17 CCR 95464]

82. Landfill gas collection system wellheads must be operated under vacuum. Monthly monitoring of wellheads is required. Landfill gas collection system wellheads may be operated under neutral or positive pressure when there is a fire or during other times as allowed in sections 95464 (c), 95464(d), and 95464(e) [17 CCR 95464]

83. Landfill gas collection system components downstream of blower have a leak limit of 500 ppmv as methane. Components must be checked quarterly. If compliance with the methane limit has been demonstrated for 4 consecutive quarters, then the component checking frequency shall be annually. If an annual test fails to show compliance, quarterly testing shall resume. [17 CCR 95464]

84. Each flare must have automatic dampers, an automatic shutdown device, a flame arrester, and continuous recording temperature sensors. [17 CCR 95464]

85. Each flare must operate within the parameter ranges established during the initial or most recent source test. [17 CCR 95464]

86. Landfill collection and control system must be operated such that landfill surface methane emissions shall not exceed instantaneous surface emission limit of 500 ppmv as methane or integrated surface emission limit of 25 ppmv as methane. [17 CCR 95464, 17 CCR 95465]

87. Instantaneous and integrated landfill surface emissions measurements shall be done quarterly. The landfill may monitor annually provided they comply with requirements of 17 CCR 95469 (a)(1). [17 CCR 95469]

88. Permittee shall keep records of all gas collection system downtime exceeding five days, including individual well shutdown and disconnection times and the reason for downtime. [17 CCR 95470]

89. Permittee shall keep records of all gas control system downtime in excess of one hour, the reason for the downtime and the length of time the gas control system was shutdown. [17 CCR 95470]

90. Permittee shall keep records of the expected gas generation flow rate calculated pursuant to section 95471(e). [17 CCR 95470]

91. Permittee shall keep records of all instantaneous surface readings of 200 ppmv or greater; all exceedances of the limits in sections 95464(b)(1)(B) or 95465, including the location of the leak (or affected grid), leak concentration in ppmv, date and time of measurement, the action taken to repair the leak, date of repair, any required re-monitoring and the re-monitored concentration in ppmv, and wind speed during surface sampling; and the installation date and location of each well installed as part of a gas collection system expansion. [17 CCR 95470]

92. Permittee shall keep records of any positive wellhead gauge pressure measurements, the date of the measurements, the well identification number, and the corrective action taken. [17 CCR 95470]

93. Permittee shall terminate surface emission testing when the measured average wind speed is over 15 mph or the instantaneous wind speed is over 30 mph. [17 CCR 95468, 17 CCR 95471]

94. Permittee shall only conduct surface emission testing when precipitation has met the following requirements. It has been 24 hours since measured precipitation of 0.01 to 0.15 inches. It has been 48 hours since measured precipitation of 0.16 to 0.24 inches. It has been 72 hours since measured precipitation of 0.25 or more inches. [17 CCR 95468]

95. Permittee shall keep records of the annual solid waste acceptance rate and the current amount of waste-in-place. [17 CCR 95470]

96. Permittee shall keep records of the nature, location, amount , and date of deposition of non-degradable waste for any landfill areas excluded from the collection system. [17 CCR 95470]

97. Permittee shall keep records of any source tests conducted pursuant to section 95464(b)(4). [17 CCR 95470]

CONDITIONS CONTINUE ON NEXT PAGE

98. Permittee shall keep records describing the mitigation measures taken to prevent the release of methane or other emissions into the atmosphere during the following activities: 1. When solid waste was brought to the surface during the installation or preparation of wells, piping, or other equipment; 2. During repairs or the temporary shutdown of gas collection system components; or, 3. When solid waste was excavated and moved. [17 CCR 95470]

99. Permittee shall keep records of any construction activities pursuant to section 95466. The records must contain the following information: 1. A description of the actions being taken, the areas of the MSW landfill that will be affected by these actions, the reason the actions are required, and any landfill gas collection system components that will be affected by these actions. 2. Construction start and finish dates, projected equipment installation dates, and projected shut down times for individual gas collection system components. 3. A description of the mitigation measures taken to minimize methane emissions and other potential air quality impacts. [17 CCR 95470]

100. Permittee shall keep records of the equipment operating parameters specified to be monitored under section 95469(b)(1) as well as records for periods of operation during which the parameter boundaries established during the most recent source test are exceeded. The records must include the following information: 1. For enclosed flares, all 3-hour periods of operation during which the average temperature difference was more than 28 degrees Celsius (or 50 degrees Fahrenheit) below the average combustion temperature during the most recent source test at which compliance with sections 95464(b)(2) was determined and a gas flow rate device which must record the flow to the control device at least every 15 minutes. [17 CCR 95470]

101. Permittee shall submit the following reports as required in section 95470(b): Closure notification, Equipment removal report and Annual report. All reports must be accompanied by a certification of truth, accuracy, and completeness signed by a responsible official. [17 CCR 95470]

102. Permittee may comply with the CARB regulation for landfill methane control measures by using approved alternative compliance options. The permittee shall obtain written District approval for the use of any alternative compliance options not approved by this permit. Changes to the approved alternate compliance options must be made and approved in writing. Documentation of approved alternative compliance options shall be available for inspection upon request. [17 CCR 95468]

APPENDIX E

SOURCE TEST DATA

- **Forward Landfill Source Test Report dated 06/04/07, (SCEC)**

COMPLIANCE SOURCE TEST REPORT
AUSTIN ROAD LANDFILL, STOCKTON

PREPARED FOR:
Bryan A. Stirrat & Associates
1360 Valley Vista Drive
Diamond Bar, CA 91765

EQUIPMENT LOCATION:
Forward Inc. (Austin Road Landfill)
9060 S. Austin Rd.
Stockton, CA 95206

TEST DATES:
May 3, 2007

SUBMITTAL DATE:
June 4, 2007

TESTED BY:
Mr. Tom Taylor
SCEC
1582-1 N. Batavia Street
Orange, California 92867

Report No: 2060.1069 rpt.1

Written By: Leslie A. Johnson

Reviewed By: Michael W. Bell

1.0 SUMMARY OF RESULTS

Facility: Ogden Power, Stockton
Source: ICE #1
Load: Normal, Full
Start Date: 12/13/06

Parameter	Units	Run 1	Run 2	Run 3	Average	Limits	Pass/Fail?
NO_x	ppmv	45.66	38.47	38.17	40.77		
NOx @ 15 % O2	ppmv	22.12	19.55	19.35	20.34	65	Pass
Emission Rate	lb/hr	0.89	0.78	0.77	0.81		
Emission Rate	g/bhp-hr	0.367	0.321	0.317	0.335	1.00	Pass
Emission Rate	LB/Mmbtu	0.091	0.080	0.080	0.084		
CO	ppmv	636.83	546.24	565.75	582.94		
CO @ 15 % O2	ppmv	308.49	277.64	286.79	290.97	485	Pass
Emission Rate	lb/hr	7.95	6.81	7.14	7.30		
Emission Rate	g/bhp-hr	3.276	2.807	2.944	3.009	4.50	Pass
Emission Rate	LB/Mmbtu	0.811	0.703	0.739	0.751		
VOCs	ppmv	69.1	75.4	80.7	75.07		
VOCs @ 15 % O2	ppmv	33.49	38.32	40.89	37.568	143.4	Pass
Emission Rate	lb/hr	0.493	0.537	0.582	0.537		
Emission Rate	g/bhp-hr	0.203	0.221	0.240	0.222	0.76	Pass
Emission Rate	LB/Mmbtu	0.050	0.055	0.060	0.055		
Particulate Matter	gr/dscf	0.001	0.001	0.002	0.001	0.10	Pass
Emission Rate	lb/hr	0.026	0.031	0.039	0.032		
Emission Rate	g/bhp-hr	0.011	0.013	0.016	0.013	0.17	Pass
Emission Rate	LB/Mmbtu	0.003	0.003	0.004	0.003		
Outlet Total Reduced Sulfur, as H_2S	ppmv*	0.10	0.10	0.10	0.10	2000	Pass
H2S Emisson Rate	lb/hr	0.002	0.002	0.002	0.002		
H2S Emisson Rate	g/bhp-hr	0.001	0.001	0.001	0.001	0.94	Pass
Emission Rate	LB/Mmbtu	0.0002	0.0002	0.0002	0.0002		
Inlet Total Reduced Sulfur, as H_2S	ppmv	14.0	–	–	14.0		
H2S Emisson Rate	lb/hr	0.027	–	–	0.027	-	-
SOx, as SO2	ppmv	3.23	2.93	2.37	2.84		
SOx @ 15 % O2	ppmv	1.57	1.49	1.20	1.419		
Emission Rate	lb/hr	0.092	0.083	0.068	0.081		
Emission Rate	g/bhp-hr	0.038	0.034	0.028	0.034	2.6	Pass
Emission Rate	LB/Mmbtu	0.0094	0.0086	0.0071	0.0084		
O_2	%	8.67	9.24	9.21	9.04	-	-
Flow (measured)	dscfm	2860	2857	2893	2,870	-	-
Flow (calculated)	dscfm	2,720	2,824	2,809	2,784	-	-

Note: All emission rates were computed using measured flow rate, calculated flow (fuel usage) is shown for comparison only.
* Laboratory Analysis was Non-detected. Detection limit used for calculation purposes.

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1.0 INTRODUCTION

On May 3, 2007 SCEC conducted an emissions test program on one landfill gas-fired flare at the Austin Road Landfill in Stockton, California. Testing was done as specified in the Source Test Plan which was submitted to San Joaquin Valley Air Pollution Control District (SJVAPCD) on April 3, 2007.

The purpose of the source test was to quantify emissions from the flare system for comparison with SJVAPCD permit requirements and to assess the combustion efficiency of the flare. The source test described herein complies with the SJVAPCD requirements as delineated in the Permit No. N-339-17-7.

2.0 BACKGROUND

2.1 Design and Operation

The flare has an 88 inch internal diameter and is 38' in height. Actual design capacity is 2000 scfm and it's permitted capacity is up to 804 MMSCF/YR and 48 MMBTU/HR. The flare is equipped with a propane gas pilot and a control system to retain combusted landfill gas for 0.6 seconds at a temperature of 1,400 °F. A flame arrester is provided between the flare and the landfill gas supply piping. A safety control system shuts down the supply landfill gas valve and blower power in cases of flameout or other alarm conditions. A filter is used for removing moisture and particulates from the landfill gas. One blower is used and induces a vacuum to pull landfill gas through piping from the landfill's gas extraction system and an identical blower is available for backup.

2.2 Authority to Construct

The permit No. N-339-17-7 was issued by the SJVAPCD March 15, 2005. Among other parameters, the permit requires that criteria pollutants, nitrogen oxides (NO_x), carbon monoxide (CO), methane (CH_4), and volatile organic compounds (VOC) be evaluated from the flare's exhaust. In addition, CH_4, VOC, volume flow and heating value were evaluated from the flare inlet.

3.0 TEST SUMMARY

3.1 Source Test Requirements

The Source Test Plan submitted to SJVAPCD was approved on May 2, 2007. The plan proposed testing the flare to quantify criteria pollutant emissions and destruction efficiencies for non-methane hydrocarbons.

The Source Test Plan described specific measurement, sampling and analytical methods to be used during the testing. In addition, it specified the number of samples to be collected as well as their sampling locations (flare system inlet and flare exhaust).

3.0 TEST SUMMARY (continued)

3.2 Source Test Overview

SCEC conducted the compliance source test of the flare systems on May 3, 2007. The work was performed in accordance with the SJVAPCD approved plan. Testing was observed by Ms. Lisa Middleton of SJVAPCD.

Prior to performing the source test, SCEC performed CARB Method 1 at both the flare inlet and exhaust to identify the optimum sampling traverse locations and number of sampling points per traverse. SCEC then obtained measurements of the average exhaust gas velocity, volumetric flow rate, temperature, dry molecular weight and moisture content using CARB Methods 2, 3 and 4, respectively. NO_x, CO, O_2, and CO_2 data were collected on a data acquisition system (DAS) for all tests.

Exhaust samples from the flare were collected and analyzed to quantify emissions of NO_x, CO, O_2, CH_4 and VOC. All exhaust samples were collected while traversing the stack to minimize gaseous stratification bias. Inlet and exhaust samples were tested for CH_4 and VOC. In addition, sulfur compounds were analyzed in the inlet samples.

SCEC also evaluated the flare for VOC destruction efficiency. SCEC collected landfill gas samples at the inlet of the flare station and flare exhaust samples and analyzed them for VOC. Comparison of the inlet and exhaust sample results allowed the flare destruction efficiency to be calculated.

TABLE 3-1
Test Program Overview
Compliance Program

Parameter	Reference Method	Measurement Principle	Inlet	Outlet
Methane and Total Gaseous Non-Methane Organics	EPA Method 18 EPA Method 18	GC/FID	- 3	3 -
BTU, C1-C6, O_2, CO_2 and N_2	ASTM D-1945/3588	GC/TCD	3	-
O_2, CO_2, CO, NO_x	CARB 100.1	Micro Fuel Cell, NDIR, Chemiluminescence	-	3
Total Reduced Sulfur & H_2S	SCAQMD 307-91	Gas Chromatography	3	-
Flow Rate	CARB Method 2	Pitot Traverse	3	3
Moisture	CARB 4	Gravimetric Wet Bulb/dry bulb	- 3	3

3.0 TEST SUMMARY (Continued)

3.3 Flare Performance

During the source test the flare was operated with a landfill gas flow rate of 1,552 scfm. The landfill gas BTU/scf values ranged between 362-399 for the flare. The flare combustion temperature controller (top temperature probe) was set and maintained at 1550 °F.

3.4 Criteria Pollutant Results

The results of the criteria pollutant testing are shown in Table 5-1 and contained in Appendix A through D of this report. As indicated in Table 5-1 and 5-2 (Summary of Results), CO and NO_x emissions were below the prescribed permit conditions. The select CO range was 0-500 ppm. The measured CO levels were 8-10 ppm and are presented in Appendix A as measured. Defaulting to 20% of the selected range (100 ppm) still demonstrate that the flare was in compliance. The data presented in Tables 5-1 and 5-2 are set to the default value. Four (4) runs were conducted for NO_x, CO, O_2, CO_2, and flows. During Run #1 the CO concentration spiked off scale. The test run was not used. The analyzer was reset to a higher range (0-500 ppm).

3.5 VOC (NMOC) Results

VOC and NMOC are considered the same constituents. As shown in Table 5-1, emissions of VOC were in compliance with all permit conditions. The NMOC emissions demonstrated compliance with the 20 ppm (as hexane) corrected to 3% O_2 and 98% destruction efficiency. The VOC results presented in Table 5.1 are the average of three samples.

4.0 CONCLUSIONS

Based on the results of this test program, the Austin Road Landfill flare system is in compliance with all requirements of the permit. All exhaust emission rates (lb/hr and lbs/mmscf) values were calculated using EPA Method 19 (Appendix E). All quality assurance requirements specified by the utilized test methods were met. The on-site NO_2 converter check was found to be 93.9%.

5.0 SUMMARY OF RESULTS

TABLE 5-1
SUMMARY OF TEST RESULTS
BAS Stockton Forward
Austin Road LF Flare
May 3, 2007

PARAMETER	INLET	EXHAUST	PERMIT LIMIT
O_2, %	5.20	10.98	
CO_2, %	28.47	8.83	
N_2, %	27.47	80.19	
H_20, %	2.00	6.52	
Flow Rate, wscfm	1552.1	13,070	
Flow Rate, dscfm	1521.1	12,083	
Temperature, °F	71	1,491.8	>1,400
Btu/scf	379.7		
MMBtu/Hr	35.36		48.0
NOx:			
ppm		16.0	
ppm @ 3% O_2		28.8	
lb/hr (as NO_2)		1.38	
lb/day (as NO_2)		33.2	
lb/MMBtu (as NO_2)		0.039	0.05
lb/MMCF (as NO_2)		15.15	
CO: (defaulted to 20% of analyzer range)			
ppm		100	
ppm @ 3% O_2		180.5	
lb/hr		5.27	
lb/day		126.4	
lb/MMBtu		0.149	0.2
lb/MMCF		57.72	
Hydrocarbons:			
CH_4, ppm	371,667	0.91	
TGNMO, ppm (as CH_4)	5,717	0.50	
TGNMO, ppm @ 3% O_2 (as methane)		0.90	20
TGNMO, lb/hr (as CH_4)	21.7	0.02	
TGNMO, lb/MM Btu (as CH_4)	-	0.000	0.0113
TGNMO, lb/day (as CH_4)	519.8	0.36	
TGNMO, ppm (as hexane)		0.08	
TGNMO, ppm @ 3% O_2 (as hexane)		0.15	<20 NSPS
TGNMO, lb/hr (as hexane)		0.01	
Destruction Eff. %		99.93	>98%
lb/MMCF		0.15	
Total Sulfur Compounds,			
Total Reduced Sulfur Inlet, ppm	29.37		
SOx Exhaust, lb/hr (as SO_2)		0.45	
SOx Exhaust, lb/day(as SO_2)		10.68	
SOx Exhaust, lb/MMBtu(as SO_2)		0.013	0.0215
lb/MMCF		4.88	

Notes:
The results in this table are the averages of all measurements.

5.0 SUMMARY OF RESULTS (Continued)

TABLE 5-2
GENERAL RESULTS
BAS Stockton Forward
Austin Road LF Flare
May 3, 2007

	INLET				EXHAUST			
Parameter	First Run	Second Run	Third Run	Average	First Run	Second Run	Third Run	Average
O_2, %	5.72	5.21	4.66	5.20	11.08	11.11	10.74	10.98
CO_2, %	27.4	28.2	29.8	28.5	8.77	8.69	9.03	8.83
N_2, %	29.6	27.5	25.3	27.5	80.1	80.2	80.2	80.2
H_2O, %	1.90	1.95	2.15	2.00	7.15	6.74	5.68	6.52
Flow Rate, wscfm	1,551.2	1,554.6	1,550.4	1,552.1	13,202	13,198	12,811	13,070
Flow Rate, dscfm	1,521.8	1,524.3	1,517.1	1521	11,683	12,259	12,308	12,083
Temperature, °F	66.0	70.0	76.0	70.7	1,502	1,485	1,488	1,492
Btu/scf	362	378	399	380				
MMBtu/Hr	33.69	35.26	37.12	35.36				
NOx:								
ppm					15.54	15.70	16.68	15.97
ppm @ 3% O_2					28.3	28.7	29.4	28.8
lb/hr (as NO_2)					1.30	1.38	1.47	1.38
lb/MM Btu (as NO_2)					0.039	0.039	0.040	0.039
CO: (defaulted to 20% of analyzer range)								
ppm					100	100	100	100
ppm @ 3% O_2					182.3	182.8	176.2	180.5
lb/hr					5.093	5.344	5.366	5.268
lb/MM Btu					0.151	0.152	0.145	0.149
Hydrocarbons:								
CH_4, ppm	355,000	370,000	390,000	371,667	0.69	0.99	1.05	0.91
EthanE, ppm	< 10	< 10	< 10	< 10	< 0.07	< 0.07	< 0.07	< 0.07
TGNMO, ppm (as CH_4)	4,920	5,830	6,400	5,717	< 0.5	< 0.5	< 0.5	< 0.5
TGNMO, lb/hr (as CH_4)	18.65	22.14	24.19	21.66	0.01	0.02	0.02	0.02
TGNMO, ppm (as hexane)	820.0	971.7	1,066.7	952.8	0.08	0.08	0.08	0.08
TGNMO, ppm @ 3% O_2 (as hexane)	966.9	1,108.5	1,175.7	1,083.7	0.15	0.15	0.15	0.15
TGNMO, lb/hr (as hexane)	16.71	19.83	21.67	19.40	0.01	0.01	0.01	0.01
Destruction Eff. %					99.92	99.93	99.93	99.93
Sulfur Compounds:								
H_2S, ppm	20.0	21.7	19.8	20.5				
Carbonyl Sulfide, ppm	< 0.2	< 0.2	< 0.2	< 0.2				
Methyl Mercaptan, ppm	1.88	2.0	2.1	2.0				
Ethyl Mercaptan, ppm	< 0.2	< 0.2	< 0.2	< 0.2				
Dimethyl Sulfide, ppm	5.96	6.07	6.86	6.30				
Carbon Disulfide, ppm	0.10	0.11	0.12	0.11				
isoprpyl mercaptan, ppm	0.16	0.18	0.20	0.17				
n-propyl mercaptan, ppm	< 0.1	< 0.1	< 0.1	< 0.1				
Dimethyl Disulfide,ppm	0.11	0.10	0.11	0.11				
Total Sulfur Compounds,								
Total Reduced Sulfur Inlet, ppm	28.4	30.3	29.4	29.4				
SOx Exhaust, lb/hr (as SO_2)(1)					0.431	0.460	0.444	0.445

The exhaust volume flow values are based on EPA Method 19.

6.0 SAMPLING AND ANALYTICAL PROCEDURES

CARB METHOD 1 - SAMPLING AND VELOCITY TRAVERSE FOR STATIONARY SOURCES

A preliminary source test site assessment was performed prior to the source test in order to determine applicable testing port locations and sample point traverse locations. The stack diameter, and the distance upstream and downstream from sample ports to disturbances, (i.e. bends, flanges, etc.,) were measured. This information was utilized to determine the minimum number of sampling points per traverse, and the distance from the inner stack wall to each sample point location.

CARB METHOD 2 - VELOCITY AND VOLUMETRIC FLOW RATE

The velocity of the flare exhaust gas stream was determined using an "S" type pitot tube, a magnehelic differential pressure gauge or inclined manometer, and type "K" thermocouple with a digital temperature measuring device. A standard pitot tube was used to measure the inlet velocity. The calibrated pitot tube was connected to the calibrated magnehelic gauge or inclined manometer and leak checked at 80-100% of full scale. A temperature and delta P was obtained at each traverse point, and a duct static pressure was measured and recorded. The dry standard volumetric flow rate was determined from the gas velocity data, stack pressure, stack gas moisture content, stack gas molecular weight, and cross-sectional area of duct.

CALCULATIONS

$MW_D = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$
$MW_W = MW_D\ (1 - BW_S) + (BW_S)$

Where: MW_D = Dry Molecular Weight of Exhaust Gas, lb/lb mole
MW_W = Wet Molecular Weight of Exhaust Gas, lb/lb mole
BW_S = Exhaust Gas Moisture Content
$\%CO_2$ = Percent CO_2 by Volume (dry basis)
$\%O_2$ = Percent O_2 by Volume (dry basis)
$\%N_2$ = Percent N_2 by Volume (dry basis) Calculated by Differences
$\%CO$ = Percent CO by Volume (dry basis)

6.0 SAMPLING AND ANALYTICAL PROCEDURES (Continued)

CARB METHOD 3 - GAS ANALYSIS FOR DRY MOLECULAR WEIGHT AND EXCESS AIR SAMPLING AND ANALYTICAL PROCEDURES

An inlet gas sample was extracted from the stack using a Tedlar bag and Teflon line, and analyzed by GC/TCD. The exhaust gas sample was analyzed for CO_2 and O_2 using CARB Method 100.

CARB METHOD 4 - DETERMINATION OF MOISTURE CONTENT IN STACK GASES

Moisture content was determined using a sampling train consisting of a stainless steel probe, teflon line, four impingers in an ice water bath, leak free pump, vacuum gauge, and temperature compensated dry gas meter. Prior to sampling a leak check of the sampling train was performed to insure system integrity. After the initial check, the initial meter reading, inlet meter temperature, and outlet meter temperature were recorded and the sample pump started. The sample rate was adjusted to approximately 1 cubic foot per minute and sampled for approximately 30 minutes or until a minimum of 20 corrected cubic feet of sample gas was obtained. Additionally, tare weights of the charged individual impingers were recorded using an electronic balance capable of weighing to the nearest 0.1 grams or less.

After sampling, the final meter readings and the final weights of each impinger were determined and recorded. Percent moisture content was calculated from the weight of water collected and the dry gas volume sampled.

Inlet moisture was measured using a wet bulb/dry bulb and calculated with a psychometric chart.

CALCULATIONS

$$\text{Moisture } (B_w) = \frac{\text{Vwstd}}{\text{Vmstd} + \text{Vwstd}} \times 100$$

Where: $$\text{Vwstd} = \frac{0.0464\ ft^3}{ml} * \text{Vol } H_2O \text{ Collected (ml)}$$

$$\text{Vmstd} = \text{Y Meter} * \frac{528^{o}R}{29.92 \text{ in Hg}} * \frac{\text{Vol Metered}}{\text{Temp. Meter}} * \text{Pres. Meter.}$$

6.0 SAMPLING AND ANALYTICAL PROCEDURES (Continued)

CARB Method 100 – Continuous Monitoring

A continuous sample was extracted from the stack through a stainless steel probe, coarse filter, sample conditioner (condensate train) and then drawn via 3/8" Teflon line to the Mobile Emissions Laboratory (MEL). The sample was filtered again through a fine Balston filter and finally delivered to the analyzers through the sample manifold and dedicated flow meters.

Prior to beginning the compliance test, a system leak check and calibration check were performed. The leak check was accomplished by plugging the probe tip and drawing to a minimum of 25" Hg of vacuum on the entire sampling system. When all flow meters indicate 0.0 scfh flow, the system was proven to be free of all leaks. A system calibration check was performed by injecting calibration gas to the probe tip and drawing sample. The bias check did not exceed 5%.

After zeroing all analyzers, EPA Protocol 1 gases were used to calibrate each analyzer within 80-90% and 40-60% full scale of the selected range.

All concentrations from the NO_x, CO, CO_2, and O_2 analyzers were recorded on a Yokogawa DR240. The data was interpreted from the strip charts and reduced via computer in SCEC's Laboratory.

EQUATIONS:

$$\text{COppm} = (\text{CO\%FS} - \text{Average CO Zero}) \times \frac{\text{CO Cal Gas Value}}{\text{Average CO Span} - \text{Average CO Zero}}$$

ppm @ 3% O_2 = ppm obsv. x 17.95/(20.95-%O_2 obsv.)
ppm @ 15% O_2 = ppm obsv. x 5.95/(20.95-%O_2 obsv.)

lb/hr (NO_x/CO/NMHC) = ppm obsv. x 1.551×10^{-7} x DSCFM calc. x MW (@ 70°F)

Grams/Bhp-Hr = (lb/hr x 453.6)/Bhp

Molecular Weight (MW)
NO_x = 46
CO = 28
NMHC as CH_4 = 16

6.0 SAMPLING AND ANALYTICAL PROCEDURES (Continued)

CONTINUOUS MONITORING LAB - TVV

O2/CO2 ANALYZER, PARAMAGNETIC / NDIR TYPE	CALIFORNIA ANALYTICAL INSTRUMENTS MODEL 601P S/N T08042-M
Response Time	<2 seconds to 60 seconds NDIR <2 seconds paramagnetic
Output	0-10 volts / 4-20 mA
Range	From 0-50 ppm up to 0-100% full scale
NO_x CHEMILUMINESCENT ANALYZER	THERMO ELECTRON MODEL 42H S/N 42H-49814-284
Response Time (0-90%)	2.5 seconds in NO mode 5.0 seconds in NO_x mode
Noise	25 PPB
Zero Drift (24 hrs)	50 PPB
Detection Limit	50 PPB
Span Drift (24 hrs)	1% of full scale
Linearity	+/- 1% of full scale
Sample Flow Rate	25 cc/min.
Bypass Flow Rate	250 to 1100 cc/min.
Output	NO, NO_2, NO_x, 0-10V, Selectable Voltage 4-20 mA, RS-232
Ranges	0-10, 0-20, 0-100, 0-200, 0-500, 0-1000, 0-2000, 0-5000 ppm

6.0 SAMPLING AND ANALYTICAL PROCEDURES (Continued)

CONTINUOUS MONITORING LAB - TVV

CO NON-DISPERSIVE INFRARED (NDIR)	CALIFORNIA ANALYTICAL INST. MODEL 602 CO/CO S/N T08043-M
Response Time	< 2 seconds to 60 seconds adjustable
Zero and Span Drift	< 1% Full Scale per 24 Hours
Linearity	< 0.5% of Full Scale
Output	0-10 Volts / 4-20 mA
Range	Low Level- any selected range 0-1000 ppm High Level- any selected range 0-10,000 ppm
STRIP CHART RECORDER	YOKOGAWA MODEL DR240
Scan Cycle Time	1-60 seconds
Scanning Rate	60ms/Channel
Input Impedance	More than 10 M ohms for 2V or lower ranges, approximately 1 M ohms on 6V or higher ranges
Input Bias	Less than 10mA
Temperature Spread on Terminals	0.3% among input terminals
Temperature Coefficient	Zero drift 0.01% of range/°C Full span 0.01% of range/°C
Max. Allowable Input Voltage	60 VDC
Chart Speed	1-15,000 mm/hr
Recording Accuracy	+/- 0.1% of effective
Chart Speed Accuracy	+/- 0.1% for recordings greater than 1m

6.0 SAMPLING AND ANALYTICAL PROCEDURES (Continued)

Figure 6-2

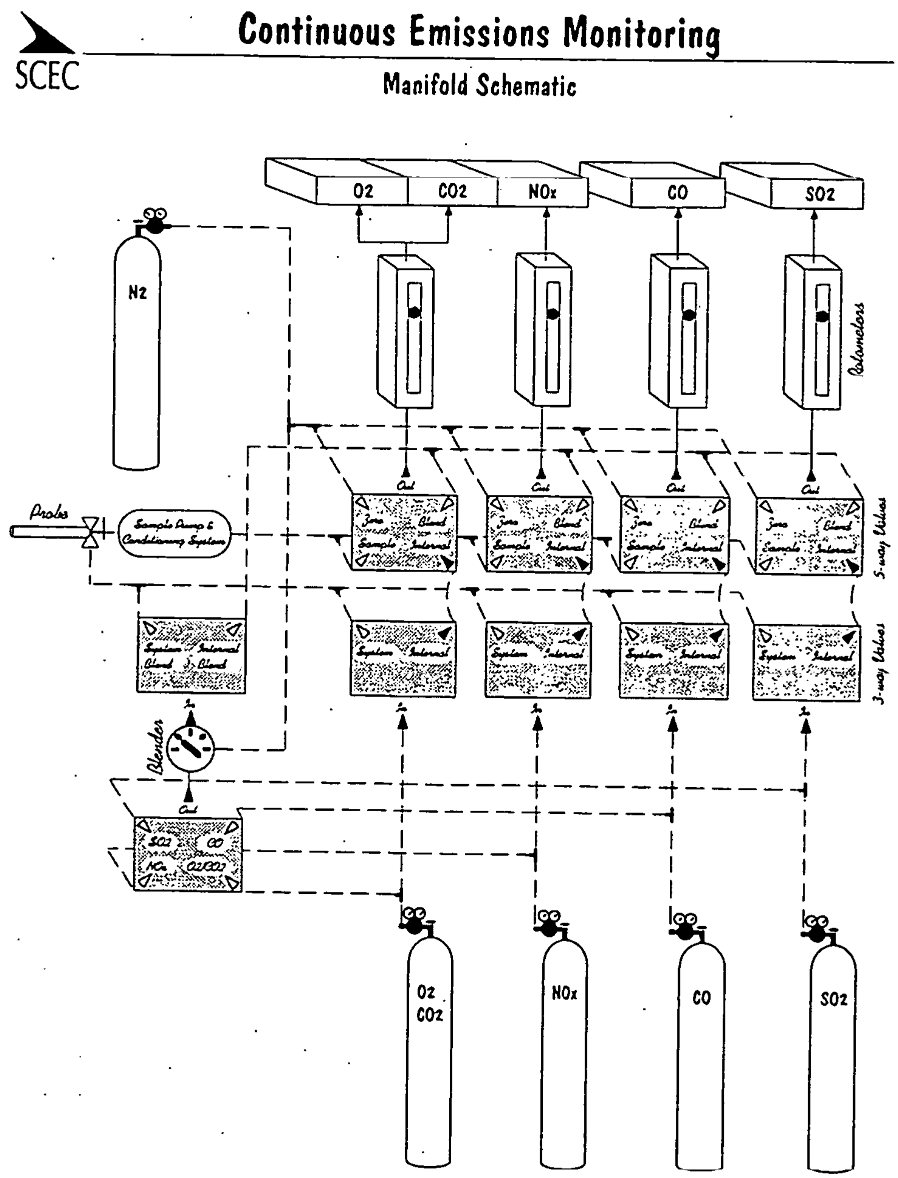

EXHIBIT A

RESUMES

PATRICK S. SULLIVAN, CPP, REPA

Education

BA – Harvard University, Biology/Ecology, 1989

Professional License/Certifications

Approved Lead Verifier under California Air Resources Board (CARB) AB 32 Greenhouse Gas (GHG) Program

South Coast Air Quality Management District, Certified Permitting Professional (No. A-1716)

Registered Environmental Property Assessor, No. 519692, National Registry of Environmental Professionals

Professional Affiliations

Solid Waste Association of North America (SWANA): Vice Chairman of Landfill Gas (LFG) Division

Air and Waste Management Association (AWMA); Vice Chairman, Mother Lode Chapter

Technical Advisory Group; Cal Recycle, LFG

Technical Advisory Group, CARB, AB 32 Landfill Methane Rule

Waste Industry Air Coalition (WIAC); Co-Chairman

California Biomass Collaboration; Executive Board

Solid Waste Industry Group in California

Solid Waste Industry for Climate Solutions (SWICS), Co-Chairman

Society for Risk Analysis

Professional Experience

Mr. Sullivan has over 24 years of experience in the area of environmental engineering, specializing in solid waste-related issues. He is the Managing Director of SCS Engineers' (SCS) consulting and engineering operations within the Southwestern United States; the largest of all of SCS's engineering business units. He also serves as the Practice Leader for SCS's Solid Waste Practice in the same region. Mr. Sullivan is the National Partner for SCS's companywide Air Quality and GHG programs. He also oversees SCS's company-wide Risk Assessment program and one of the national experts on risk assessment and toxic exposure issues for solid waste facilities. Mr. Sullivan is a company Senior Vice President and Principal-in-Charge for compliance and permitting projects for related to solid waste facilities as well as related engineering services. SCS has published over 25 technical papers in industry journals and publications and presented at over 35 conferences, seminar, and workshops.

Because of this expertise, Mr. Sullivan has been the Principal-in-Charge and/or lead technical expert on a variety of projects related to solid waste facility investigations, risk assessments, LFG management, air quality and GHG, as well as other environmental issues at landfills and solid waste facilities.

Air Quality

Title V Permit Applications and Documentation for Industrial Facilities and Landfill Sites. Mr. Sullivan has been involved with over 100 Title V permitting projects, including Title V compliance reporting for over 75 facilities.

New Source Review (NSR)/Prevention of Significant Deterioration (PSD) Permit Applications and Documentation for Industrial Facilities and Landfill Sites. Mr. Sullivan has been involved with over 50 NSR/PSD permitting projects for various types of industrial facilities. This includes permitting for over 30 landfill expansions in California and over 30 energy facilities.

New Source Performance Standard (NSPS) Applicability Reviews and Compliance Activities. Mr. Sullivan has overseen the completion of NSPS Tier 1 and 2 emission rate studies and reports, LFG system (GCCS) design plans, surface emission monitoring plans, and other documentation for over 100 landfills under the NSPS program, including NSPS compliance reporting for over 75 landfill sites. In addition, Mr. Sullivan has worked on NSPS compliance activities for various other sources, including boilers, incinerators, engines, turbines, etc.

National Emission Standards for Hazardous Air Pollutants (NESHAPs)/Maximum Achievable Control Technology (MACT) Compliance Activities. Mr. Sullivan has been involved with over 75 NESHAPs/MACT projects for various regulated sources, including development of Startup, Shutdown, and Malfunction (SSM) plans and various other compliance documents. This has included landfills and various industrial facilities, such as aerospace facilities, boilers, incinerators, engines, etc.

Development and Teaching of Training Courses for Air Quality and GHG Compliance at over 40 Seminars. Compliance and regulatory issues that have been taught included Title V, NSPS, NESHAPs/MACT, NSR/PSD, Urban Air Toxic Strategy (UATS), Tailoring Rule, federal GHG reporting rule, and related state and local requirements.

Regulatory Advocacy for the Landfill Industry on the NSPS Rule, Title V Operating Permit Programs, NESHAPSs rule, and other regulations, where landfills are included as a regulated source. Mr. Sullivan has developed industry comments and negotiated with the agencies on behalf of the industry.

Preparation of Numerous Local Air District, State, and Federal Permitting Documents for the installation of air pollution control devices and industrial equipment, including boilers, cooling towers, air strippers, wastewater treatment plants, biogas collection systems and flares, biogas and recovery plants, and various industrial systems. Mr. Sullivan has managed over 100 state or local air permitting projects for landfills.

Permitting, Compliance, and Due Diligence Projects for over 35 Renewable Energy Projects throughout the United States. Some of these projects have also included registration of GHG credits, facilitation of trades for GHG credits, and development of methodologies for estimation of GHG reductions as well as all of the air quality and GHG permitting tasks. Mr. Sullivan has permitted over 30 biogas to energy and biomass plants across the country.

Air Quality, GHG, and Risk Assessment Sections of Environmental Impact Reports (EIRs) for approximately 35 landfill expansions, new landfills, transfer stations, other solid waste facilities, and various commercial/industrial projects in California, including evaluations of health risks, air quality, GHG, and/or odors. This has included the preparation of a variety of California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) documentation.

Air Quality Solid Waste Assessment Tests (SWATs) for various landfill sites in California.

Air Sampling and Source Testing for Various Emitting Devices, including sampling for volatile organic compounds (VOCs), criteria pollutants, particulate heavy metals, and asbestos fibers. Oversight of sources testing at over 75 landfill sites and development of a database of landfill source tests for use in the work of the WIAC.

Mr. Sullivan has completed air permitting and compliance activities for the following types of industrial facilities:

- Solid waste incinerators.
- Biomass energy plants.
- Landfills.
- Recycling facilities and transfer stations.
- LFG recovery plants.
- Cement and asphalt plants.
- Chemical manufacturing facilities.
- Aerospace facilities.
- Jewelry manufacturing facilities.
- Sand and gravel facilities.
- Electronics facilities.
- Site remediation projects.
- Paint and solvent manufacturing plants.
- Boat manufacturing plants.

Completed Landfill Air Quality Services in the Following Air Districts in California and States: San Joaquin Valley Air Pollution Control District (APCD), Bay Area Air Quality Management District (BAAQMD), South Coast AQMD, Sacramento Metropolitan AQMD, San Diego County APCD, Yolo-Solano AQMD, Feather River AQMD, Kern County APCD, Ventura County APCD, Santa Barbara County APCD, Shasta County APCD, Antelope Valley APCD, Mojave Desert AQMD, Placer County APCD, North Coast Unified AQMD, Butte County APCD, and El Dorado County APCD. States of Nevada, Oregon, Washington, Hawaii, Arizona, Idaho, Montana, New Mexico, Colorado, Utah, Texas, Ohio, Pennsylvania, Illinois, Kansas, Oklahoma, and several others.

Landfill Gas

Principal-in-Charge for Design, Bidding Support, and Construction Oversight for LFG Control System, Highway 59 Landfill, Merced County, CA. The system was initially designed to prevent LFG migration and provide corrective action for groundwater impacts. The system successfully remediated LFG migration and brought the facility in compliance with Resource Conservation and Recovery Act (RCRA) Subtitle D requirements. Currently, Mr. Sullivan oversees the operations and maintenance (O&M) of the LFG system. Recently, Mr. Sullivan oversaw the design and construction quality assurance (CQA) for a major expansion of the existing LFG system to meet federal and state air quality and GHG requirements. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality and GHG tasks for the project, including permitting and compliance reporting as well as closure design and groundwater corrective action.

Principal-in-Charge, Completion of Various LFG Engineering/Construction Oversight and Groundwater Services, Various Waste Management, Inc. (WM) Landfills. Landfill sites have included Bradley, Simi Valley, Columbia Ridge, DADS, Lancaster, Redwood, Lockwood, Antelope Valley, Rio Rancho, Butterfield, Northwest Regional, Anderson, and El Sobrante. Engineering tasks have included design of wellfield expansions, new blower/flare stations, header upgrades and replacements, groundwater monitoring and reporting, groundwater corrective action plans, as well as a variety of air quality services.

Principal-in-Charge, LFG Engineering, American Avenue Landfill, Fresno County, CA. SCS first developed a LFG master plan for the site. Upon completion of the conceptual plan, Mr. Sullivan oversaw the completion of the engineering design, including preparation of formal plans and specifications for bidding for the original and one expansion to the LFG system. Bid assistance was provided to the County as well as construction management and CQA services. The County expanded SCS's contract to include O&M of the LFG system as well as design of two subsequent phases of LFG system expansion. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality and GHG tasks for the project.

Principal-in-Charge, Completion of LFG Planning and Engineering for Various Republic Services (Republic's) Landfills. Landfill sites have included Otay, Sycamore, Vasco Road, West Contra Costa Sanitary, Foothills, Tower Road, ECDC, Wasatch, Ox Mountain, Wasatch, and Central Landfills. Engineering tasks have included design of wellfield expansions, new blower/flare stations, and header upgrades and replacements as well as CQA. Under SCS's direction, SCS upgraded Republic's LFG Master Plans and prepared a LFG remediation plan to address LFG migration issues. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality and GHG tasks for the projects.

Principal-in-Charge, Planning, Design, and Construction Oversight for LFG System at Recology's Landfills, California. Project Director and Manager for the planning, design, and construction oversight for an expansion to the LFG system at Recology's Pacheco Pass, Ostrom Road, and YSDI Landfills to address air quality requirements, LFG migration, and groundwater impacts. These projects were completed on a design-build basis. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality and GHG tasks for Recology landfills.

Principal-in-Charge, Completion of LFG Planning and Engineering for Waste Connections, Inc.'s (WCI's) Landfills. Sites have included Chiquita Canyon, Fairmead, Potrero Hills, Cold Canyon, LRI, and Avenal Landfills. Engineering tasks have included design of wellfield expansions, new blower/flare stations, and header upgrades and replacements as well as CQA. SCS has upgraded WCI's LFG Master Plans and developed long-term cost estimates for LFG system expenditures. In addition to the LFG services, Mr. Sullivan has completed a variety of air quality and GHG tasks for the sites.

Principal-in-Charge, Various Other LFG Planning or Engineering Projects throughout California, Arizona, Nevada, Oregon, and Colorado, including Stanislaus County's Geer and Fink Road Landfills, Butte County's Neal Road Landfill, Sunnyvale Landfill, L&D Landfill, Sacramento County's Kiefer Landfill, Madera County's Fairmead Landfill, Yolo Central Landfill, as well as various other smaller closed landfill sites. Many of these projects included engineering design, CQA, and/or design-build of LFG system expansions.

CEQA/NEPA Analyses

CEQA Air Quality Analysis and Toxics Risk Assessment, Proposed Expansion to Fink Road Landfill, Stanislaus County, CA. As part of an EIR for a proposed expansion to the Fink Road Landfill in Stanislaus County, California, SCS completed an air toxics risk assessment, which evaluated the potential human health impacts due to current and future exposures from the project. The risk assessment was part of a larger air quality analysis completed for the expansion EIR. The analysis included an evaluation of health risk due to diesel exhaust from heavy equipment and refuse hauling vehicles at the landfill. As part of this project, SCS also researched the conversion of refuse hauling fleets to alternative fuels in order to generate ERCs for CEQA mitigation measures.

CEQA Air Quality Analysis and Toxics Risk Assessment, Salinas Valley Solid Waste Authority Landfill Project, Monterey County, CA. SCS completed air quality and risk assessment sections of a large EIR being prepared for long-term refuse collection and disposal options for the Salinas Valley Solid Waste Authority's Regional Landfill Project. The project included three landfills and 10 transfer stations, which were combined into four different project scenarios. The project included emissions estimates, air dispersion modeling, and risk calculations. The analysis included an evaluation of health risk due to diesel exhaust from heavy equipment and refuse hauling vehicles at the landfills and transfer stations, which were part of the project.

CEQA Mitigation Measures Development and Implementation for El Sobrante Landfill, Corona, CA. SCS was enlisted to develop a series of mitigation measures for fugitive dust emissions from landfill construction and operations at the El Sobrante Landfill in Corona, California. SCS also developed an implementation plan for the CEQA Mitigation Monitoring and Reporting Program (MMRP), which was required as part of the approval of the EIR. SCS is currently doing ambient monitoring for particulate matter less than 10 microns (PM10) levels and working with the SCAQMD to develop a long-term strategy to reduce dust emissions.

Landfill Risk Assessment, Closure and Post-Closure Development BKK Landfill, West Covina, CA. As part of an EIR for proposed closure and post-closure development of the Class III portion of the BKK Landfill, SCS completed a risk assessment that evaluated the potential human health impacts due to current and future exposures to contaminants in LFG and other environmental media. The risk assessment was part of a larger air quality analysis completed for the EIR. Through reasonable risk estimates, SCS was able to demonstrate that the proposed development of the landfill (i.e., golf course and Business Park) could occur without causing adverse health effects above CEQA significance levels.

CEQA Air Quality/GHG Analyses and Toxics Risk Assessments and Air Permitting, Proposed Landfill Expansions. Projects included expansions to the Newby Island, Forward, Crazy Horse, Johnson Canyon, Jolon, Fairmead, Keller Canyon, Redwood, Altamont, and various other landfills. As part of EIRs for the proposed expansions, SCS completed an air quality impact analyses that included risk assessments evaluating the potential human health impacts due to current and future exposures to contaminants from the project. The risk assessments were part of larger air quality analyses completed for the expansion EIRs. The projects included emissions estimates, air dispersion modeling, GHG evaluation, and risk calculations.

Landfill Investigation and Risk Assessment

Landfill Investigation, LFG Engineering, Human Health Risk Evaluation and Impact Assessment, Proposed Residential Developments, Adjacent to the Otay Landfill, Chula Vista, CA. Project activities at the site have included an evaluation of LFG migration, LFG engineering and testing, air quality permitting and compliance, soil and LFG sampling and analysis, human health risk assessment and nuisance/odor evaluation, CEQA assistance, operations and maintenance of the LFG collection and control system, and other landfill engineering and construction services. The risk assessment and odor/nuisance analysis was completed to support residential development adjacent to the landfill.

Environmental Investigations and Risk Assessment at the Former BKK Main Street Landfill in Los Angeles County. This landfill is a closed site that may have received both hazardous and non-hazardous wastes; it is currently occupied by two golf courses and other commercial and residential developments and is being considered for additional redevelopment. Project work at this facility has included completion of soil vapor surveys, installation and monitoring of LFG migration probes, LFG sampling/analysis, oversight of cover and subsurface soil and groundwater sampling, completion of a human health risk assessment, CEQA assistance, and negotiations with regulatory agencies. The site is currently being considered for listing on the National Priorities List (NPL) as a potential Superfund site. Oversight of the landfill is provided by EPA Region IX, Department of Toxic Substance Control (DTSC), and the Los Angeles County landfill local enforcement agency (LEA).

LFG Assessment, Cover Maintenance, and Monitoring, Cogen Kramer Landfill, Los Angeles, CA. The site is located adjacent to residential development and two County correctional facilities have been developed on landfill property. Project tasks include LFG assessment, installation of LFG migration probes, emergency cover repair and ongoing cover maintenance, preparation of

LFG and cover assessment work plan, regulatory liaison with the Los Angeles County LEA, Cal Recycle, and the South Coast AQMD. In addition, methane monitoring is conducted associated with the use of one of the closed jail facilities for TV and movie productions.

Environmental Monitoring and Postclosure Care, Cal-Compact Landfill, Carson, CA. The site is a former hazardous waste landfill that is being considered for redevelopment. The site is currently under the oversight of the DTSC. Project tasks have included LFG assessment, LFG engineering, design of methane protection systems, and development of a LFG monitoring program. In addition, Mr. Sullivan currently oversees the completion of post-closure care services at the site, including LFG monitoring, LFG system operations and maintenance (O&M), groundwater sampling and analysis, cover maintenance and repair, site security, storm water sampling/analysis and inspections, and regulatory liaison.

LFG Assessment, Cover Maintenance, and Monitoring, Lane Road Disposal Site, Irvine, CA. The site is located adjacent to residential development and has been redeveloped into a golf course. Project tasks have included LFG assessment, including methane testing in nearby homes, installation of LFG migration probes, cover repair and ongoing cover maintenance, preparation of LFG assessment and cover maintenance plan, regulatory liaison with the Orange County LEA, Santa Ana Regional Water Quality Control Board (RWQCB), CIWMB, and SCAQMD. SCS also completed the design and installation of LFG collection and control system to prevent migration onto residential properties.

Burn Dump Investigation in San Joaquin County, CA. As part of this project, Mr. Sullivan provided technical oversight for investigations of a burn dump site, which included soil investigations, trenching investigations to determine extent of refuse, LFG migration assessment, waste sampling/analysis, hazardous waste determination, and other project tasks. The project site was slated for residential development; therefore, all project elements we completed in consideration for this type of development.

Investigation, Risk Assessment, and Remediation Kaiser Ventures Inc. Facilities, Fontana, CA. For the former Kaiser Steel plant in Fontana, Remedial Investigation (RIs)/Feasibility Studies (FSs), Remedial Action Plans (RAPs), and Remedial Designs were prepared for three on-site operable units under DTSC's oversight. Mr. Sullivan was responsible for a number of individual soil, groundwater, surface water, and waste investigations at the Kaiser site, including treatability studies, risk assessments, RAPs, and hydrogeological studies, storm water pollution prevention plans, and spill prevention, control, and countermeasure (SPCC) plans. These projects included investigations of two landfill sites, with both hazardous and non-hazardous wastes, including soil, waste materials, hazardous waste, groundwater, and surface water issues. The site has been redeveloped into the California Speedway, a NASCAR race track.

Investigation, Risk Assessment, and Remediation Feasibility Study, Mission Bay Landfill, San Diego, CA. For this site, Mr. Sullivan managed a significant forensic investigation and site assessment of the former landfill site, which is located next to a river, bay, and amusement park and is used heavily for recreational purposes. This work has included investigations of extent of refuse, cover thickness, LFG composition and migration, soil, surface water, groundwater, and other environmental media associated with Mission Bay. The field investigations will be followed by a risk assessment, and given the highly visible and public nature of the landfill project; focus on risk communication will be of primary importance. Ultimately, several candidate risk-based remediation methods applicable to the site will be identified with typical costs associated with each method. This project included interface with the San Diego County APCD, RWQCB, LEA, and DTSC.

Landfill Engineering, LFG Migration Assistance, and Human Health Risk Assessment, Geer Road Landfill, Modesto, CA. Mr. Sullivan has managed and been involved with a variety of project at the Geer Road site including closure design and CQA services, cover repair, LFG engineering, air quality compliance, human health risk assessment, LFG system O&M, LFG and groundwater monitoring, as well as acted as an expert witness in defending the landfill against a citizen lawsuit. Project work was under the jurisdiction of the landfill LEA and RWQCB.

Odor Evaluations

Air Quality and Odor Analysis for proposed municipal solid waste (MSW) landfill and composting operation in Mariposa County, CA.

Air Quality and Odor Analysis, including ambient air testing and air dispersion modeling, for MSW landfill, composting facility, and materials recovery facility (MRF) in Placer County, CA.

Air Quality and Odor Analysis, including air dispersion modeling, for MSW landfill in Chula Vista, CA.

Odor Analysis for proposed MRF in San Bernardino County, CA.

Odor Analysis for an MSW landfill expansion in Kings County, CA.

Odor Analysis for an MSW landfill expansion in Santa Clara County, CA.

Compliance Review and Odor/Air Quality Impact Assessment for existing composting operation in San Diego, CA, which is adjacent to a proposed residential development.

Development of Expert Report and review of opposing experts' work on air quality and odor analyses of a composting facility in Adelanto, CA.

Air Quality Permitting and Compliance, including Odor Analyses, for landfills and composting facilities in Vacaville, Milpitas, and Novato, CA.

Feasibility Analysis, Best Available Control Technology (BACT) Cost-Effectiveness Analysis, and Hydrogen Sulfide Testing for the evaluation of sulfur removal technologies as odor control for LFG-derived odors for 10 landfill sites.

Odor analyses as part of the air quality sections of over 10 EIRs for landfill expansions.

Management of numerous LFG design projects related to odor control of LFG emissions.

Litigation Support

- **<u>Expert Witness Experience:</u>**
  - Last 4 years
    - Crane et al vs. County of Merced. Expert report and deposition and trial testimony.
    - Brian Kahn vs. The Dewey Group. Expert deposition and trail testimony
    - Tommy McCarty, et. al., vs. Oklahoma City Landfill, LLC. Expert report and deposition.

Litigation Support and Preparation of Expert Report in Defense of a Landfill Company in Pittsburgh, PA, which was sued under the third-party provisions of the federal Clean Air Act. Project tasks including emissions estimation, regulatory applicability review, and preparation of an expert report. The case was settled in favor of our client.

Litigation Support as part of a CERCLA Cost Recovery Action Filed by a Group of PRPs Against Various Municipalities and Public Agencies that Disposed Refuse at a Mixed Hazardous and Municipal Solid Waste Landfill in California. Project tasks included review of depositions, evaluation of industrial and hazardous waste disposed in the landfill, and development of a draft report on the contribution of the various PRPs to contamination in the landfill. Our clients were successful in the litigation.

Litigation Support in Defense of a Landfill Company in San Antonio, Texas Against Enforcement Action Brought by the State of Texas. Project tasks including emissions estimation, odor assessment, and air modeling. The case was settled in favor of our client.

Litigation Support in a Lawsuit Filed by a Landfill Owner/Operator in New Mexico Versus the State Environmental Agency with Respect to Air Quality Permitting for Landfills. The case included litigation support and preparation of expert reports.

Litigation Support and Expert Testimony as Part of a Toxic Tort Litigation filed by a Local Residence Against a County-owned Closed Landfill in Modesto, CA. Project tasks included a site investigation, risk assessment, groundwater evaluation, and expert testimony (deposition and trial). The case was settled with minimal damages for our client.

Litigation Support and Expert Testimony as Part of a Toxic Tort Litigation filed by a Local Residence against a County-owned Active Landfill in Merced, CA. Project tasks included a LFG assessment, site investigation, risk assessment, groundwater evaluation, and expert testimony (deposition and trial). The case was ruled in favor of our client.

Litigation Support and Expert Testimony in Defense of a Nuisance Claim and a CERCLA Cost Recovery Action Filed Against an Electronic Relay Manufacturing Facility in Los Angeles, CA. Project tasks included a remedial investigation, feasibility study, remedial design, remedial action, risk assessment, and expert testimony (deposition only). The first case was settled with insurance coverage; the second case was settled for deminimis contribution from our client.

Litigation Support in Defense of a CERCLA Cost Recovery Action Filed Against an Electronic Relay Manufacturing Facility in Azusa, CA. Project tasks included a review of documents and preparation of a technical response to U.S. EPA's proposed settlement offer.

Litigation Support and Expert Testimony as Part of a Toxic Tort Litigation Filed by a Plaintiff Group against a Large Aerospace Company in Burbank, CA. Project tasks included emissions estimation, air dispersion modeling, air toxics risk assessment, and expert testimony before arbitration judge. The case was settled in favor of our clients.

Litigation Support and Preparation of an Expert Report as Part of a Toxic Tort Litigation in Defense of a Metal Heat Treating Facility in Phoenix, AZ. Project tasks included emissions estimation, air dispersion modeling, and air toxics risk assessment. The case was settled in favor of our client.

Litigation Support and Expert Testimony as Part of a Nuisance Lawsuit Filed by the Current Owner of a Screw Manufacturing Facility against the Former Owner in Santa Fe Springs, CA. Project tasks included a site investigation, compliance audit, evaluation of on-site disposal of waste oil, and expert testimony before an arbitration judge.

Litigation Support as Part of an Insurance Claim Filed by an Aerospace Facility Against Its Insurance Carrier in Natick, MA. Project tasks included review of soil vapor data, vadose zone modeling, determination of the vapor-phase plume, and preparation of exhibits to be used in court. Our client was successful in the litigation.

Litigation Support in Defense of a Nuisance Claim and a CERCLA Cost Recovery Action Filed Against a Steel Mill in Fontana, CA. Project tasks included a remedial investigation, feasibility study, remedial design, remedial action, risk assessment, and assistance in the cross-examination of opposing experts. The case was settled in favor of our client.

Litigation Support in two Lawsuits Where Contractors Were Unwittingly Exposed to Asbestos during Building Demolition after the property owners claimed that the buildings did not have asbestos-containing materials.

Litigation Support as Part of a Property Damage Filed by the Property Owner Against its Former Tenant at a Plastic and Rubber Manufacturing Plant in Ontario, CA. Project tasks included a site investigation, remediation, risk assessment, and expert testimony (deposition only).

Mr. Sullivan's litigation experience includes the following Proposition 65 cases in California. These cases include preparation of exposures and risk analyses and participation in settlement conferences:

- Litigation support for a defendant in a Proposition 65 lawsuit concerning exposure to methylene chloride in a silk flower cleaner.

- Litigation support for a defendant in a Proposition 65 lawsuit concerning exposure to dichlorobenzene and toluene in a bicycle tire repair kit.
- Litigation support for a defendant in a Proposition 65 lawsuit concerning exposure to lead in PVC grips and handles for various tools and equipment.
- Litigation support for a defendant in a Proposition 65 lawsuit concerning exposure to lead in cosmetics.
- Litigation support for a defendant in a Proposition 65 lawsuit concerning exposure to chromated copper arsenate in treated wood used for children's playground equipment.
- Litigation support for a defendant in a Proposition 65 lawsuit concerning the exposure to various pollutants emitted from landfills and other solid waste facilities in California (six total facilities).

Greenhouse Gas

CARB, Approved Lead Verifier or Internal Senior Reviewer

- Alameda Municipal Power[1]
- Biggs Municipal Utility[1]
- Cal Portland Company – Mojave Plant[2]
- Cal Portland Company – Colton Plant[2]
- California Steel Industries
- City of Lompoc[1]
- City of Roseville, CA[1]
- City of Ukiah, Electric Utilities Division[1]
- City of Victorville[1]
- Collins Pine Company
- Corn Products
- Georgia Pacific
- Gridley Electric Utility[1]
- Healdsburg Electric Department[1]
- Hilmar Cheese Company
- Imperial Irrigation District[1]
- Imperial Irrigation District – Coachella Gas Turbines
- Imperial Irrigation District – El Centro Generating Station
- Imperial Irrigation District – Niland Gas Turbines Plant
- Imperial Irrigation District – Rockwood Gas Turbines
- JP Morgan Chase Bank[1]
- Kinergy[1]
- Lodi Electric Utility[1]
- Metropolitan Water District[1]
- Orange County Sanitation District
- Pacific Ethanol[1]
- Port of Oakland[1]
- Port of Stockton, CA[1]
- Riverside Wastewater Treatment Plant
- San Francisco Hetch Hetchy Water & Power[1]
- Truckee Donner Public Utility District[1]
- Temple Inland University of California at Davis
- University of California at Irvine
- University of California at Santa Cruz
- University of California at San Diego
- Western Area Power Authority[1]

[1] Verification includes electrical/fuel transactions.
[2] Verification included process emissions (landfill, wastewater treatment, geothermal, or other process emissions).
[3] Verification includes oil and gas emissions.

Climate Action Reserve (CAR) GHG Project Reduction Services

Landfill Protocol

- Dalton-Whitfield Regional Solid Waste Management Authority
- L & D Landfill
- Larimer County Landfill Electric Generation Project
- Hay Road Landfill Feasibility Study
- Montana-Dakota Utilities Billings Landfill
- YSDI Landfill Feasibility Study Central Landfill, Citrus County, Florida
- Raleigh County Solid Waste Authority
- Pendleton County Landfill
- Eagle Point, Wolf Creek, and Stones Throw Landfills Project

Organic Waste Composting OWC) Protocol

- American Organics OWC
- Grover Environmental Products
- Jepson Prairie Organics
- South Valley Organics

AB32 Mandatory Reporting. Completed State of California Mandatory GHG reporting under AB32 for the following general stationary combustion facilities:

- Altamont Landfill
- Bradley Landfill
- CalEnergy Geothermal Plants City of Fresno Wastewater Treatment Plant
- El Sobrante Landfill
- G2 Ostrom Road
- Kirby Canyon Landfill
- Mid-Valley Landfill
- Penrose Landfill Gas Conversion, LLC
- Redwood Landfill
- San Bernardino County Solid Waste Mgmt. - MVSL
- Simi Valley Landfill
- Sunnyvale WWTP Toyon Landfill Gas Conversion, LLC

GHG Compliance for Landfills. Completed GHG compliance services for over 75 landfills related to the AB32 mandatory reporting rule, AB32 landfill methane rule, and federal "Tailoring" rule for GHG.

U.S. EPA GHG Reporting Rule. Management and oversight for over 250 U.S. EPA GHG mandatory reporting rule projects for landfills.

GHG Emissions Inventory and Verification of Creditable GHG Reductions. Performed GHG emissions inventory services, verification of creditable GHG reductions, and development of GHG management plan under CEQA for Kern County Waste Management Department, California.

GHG Consulting. Provided GHG consulting services for Sacramento County, Los Angeles County, City of Carlsbad, City of Alameda, and the City of Palo Alto and virtually all of the major solid waste companies. Acted as the primary consultant supporting the membership of the SWICS group. As part of this effort, Mr. Sullivan has developed protocols for landfill GHG emission estimates and lead SWICS advocacy efforts on the proposed AB 32 early action rule for landfills.

GHG Emissions Inventory and Certification of Donated GHG Reductions (to make event GHG neutral), Super Bowl, Houston, TX.

Certification of Donated GHG Reductions (to make event GHG neutral), Winter Olympics, Salt Lake City, UT.

GHG Inventory and CCAR Reporting for Republic Services, Inc. Under Mr. Sullivan's direction, SCS prepared an entity-wide GHG inventory for Republic's solid waste operations and facilities in California. In addition, SCS completes federal GHG reporting for all Republic landfills nationally.

SWICS Group. Involvement with the leadership of the SWICS group. As part of this effort, Mr. Sullivan has developed protocols for landfill GHG emission estimates and led SWICS advocacy efforts on the proposed AB32 early action rule for landfills, cap and trace, as well as the AB32 and federal GHG mandatory reporting rules.

Private Waste Company GHG Consulting. Provided GHG consulting for all of the large private waste management companies.

Development of GHG Guidance Document. Developed the guidance document titled, *"Technologies and Management Options for Reducing Greenhouse Gas Emissions from Landfills,"* under contract to the California Integrated Waste Management Board (CIWMB).

Publications and Presentations

Sullivan, Patrick S., and Zbozinek, Jasenka V., *Exposure Assessment and Toxic Distribution Modeling In Toxic Tort Litigation: Air and Soil Pathways*, Seminar Proceedings, Phoenix Chapter of the State of Arizona Bar Association, One-Day Technical Meeting, November 1996.

Sullivan, Patrick S., and Lister, Kenneth H., *Use of Screening Level Risk Assessment for Risk-Based Corrective Action*, Conference Proceedings, Association for the Environmental Health of Soils, 7th Annual West Coast Conference on Contaminated Soil and Groundwater, Oxnard, California, February 1997.

Sullivan, Patrick S., Nuno, Julio A., and Lister, Kenneth H., *The Use of Risk-Based Corrective Action in Site Mitigation Projects*, Conference Proceedings, Environmental Engineering Conference, Canadian Society of Civil Engineers/American Society of Civil Engineers (CSCE/ASCE), Edmonton, Alberta, July 1997.

Albert, Lon, Kubis, Elizabeth L., and Sullivan, Patrick S., *Ongoing Challenges of Emission Inventories at Municipal Solid Waste Landfills*, Conference Proceedings, Emission Inventory Conference, Air and Waste Management Association (AWMA), Raleigh-Durham, North Carolina, October 1997.

Kubis, Elizabeth L., Rankin, Sue, and Sullivan, Patrick S., *Strategic Planning for Landfill Gas and Air Quality Compliance at Municipal Solid Waste Landfills*, Conference Proceedings,

28th Annual SWANA Western Regional Symposium, South Lake Tahoe, Nevada, April 1999.

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Sullivan, Patrick S., *A Practical Approach to Clean Air Act Compliance for Landfills*, Presentation at the Annual WASTECON Conference, Reno, Nevada, October 1999.

Sullivan, Patrick S., *The Use of Methane Gas from Landfills as an Alternative Fuel Source*, Presentation at the U.S. Conference of Mayors/Municipal Solid Waste Management Association Fall Summit, San Jose, California, November 1999.

Sullivan, Patrick S. (lead author: Risk Assessment section), *Environmental Site Characterization and Remediation Design Guidance*, American Society of Civil Engineers (ASCE) Manuals and Reports on Engineering Practice No. 99, ASCE, Reston, Virginia, 1999.

Michels, Mike, and Sullivan, Patrick S., *Actual LFG Emissions Lower than EPA Estimates*, Conference Proceedings, National Solid Waste Management Association (NSWMA)/ Environmental Industries Association (EIA) Waste Tech 2000 Conference, Orlando, Florida, March 2000.

Sullivan, Patrick S., and Michels, Mike, *The Time Is Now for Changes to the AP-42 Section on Landfills*, Conference Proceedings, 23rd Annual SWANA Landfill Gas Symposium in La Jolla, California, March 2000.

Sullivan, Patrick S., *U.S. EPA's Urban Air Toxics Strategy*, Conference Proceedings, Conference Proceedings, 10th Annual Technical Conference, Air and Waste Management Association (AWMA) Golden Empire Chapter, Golden West Section, Bakersfield, California, March 2000.

Mezzacappa, David, and Sullivan, Patrick S., *Air Quality Pre-Construction Permits for Municipal Solid Waste Landfills*, Conference Proceedings, 9th Annual SWANA Landfill Symposium in Austin, Texas, June 2000.

Sullivan, Patrick S., *Risk Characterization in Site Characterization and Remediation Design*, Conference Proceedings, Convergence 2000 Environmental Engineering and Pipeline Engineering Conference, American Society of Civil Engineers (ASCE), Kansas City, Missouri, July 2000.

Nuno, Julio A., and Sullivan, Patrick S., *Site Characterization*, Presentation at Convergence 2000 Environmental Engineering and Pipeline Engineering Conference, ASCE, Kansas City, Missouri, July 2000.

Sullivan, Patrick S., *Getting Down to Cases: Just What Is a Bioreactor Landfill*, MSW Management, July/August 2000.

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Vogt, W. Gregory, and Sullivan, Patrick S., *Literature Review and Research Needs for Bioreactor Landfills*, Conference Proceedings, NSWMA/ EIA Waste Tech 2001 Conference in San Diego, California, February 2001.

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Sullivan, Patrick S., *Bioreactor Landfill Energy Recovery*, Proceedings of the U.S. EPA's and Water Environment Federation's Innovative Processes to Produce Useful Materials from Biosolids and Animal Manures—A Symposium, Chicago, Illinois, June 2001.

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Sullivan, Patrick S., *Landfill Gas Modeling and Emission Estimates for a Large Bioreactor Landfill in California*, Presentation at the 10th Annual SWANA Landfill Symposium, San Diego, California, June 2001.

Sullivan, Patrick S., and Green, Roger, *Air Emissions, Methane Generation and Recovery, and Energy Potential for Bioreactor Landfills: Comparing the Theoretical to the Actual*, Proceedings of the Annual SWANA WASTECON Conference, Baltimore, Maryland, October 2001.

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Sullivan, Patrick S., and Caponi, Frank R., Air Quality Compliance for Landfill Gas to Energy Projects, Conference Proceedings, 25th Annual SWANA, 25th Annual Landfill Gas Symposium, Monterey, California, March 2002.

Sullivan, Patrick S., Huff, Raymond, and Tinker, Amy, *Human Health Risk Assessment Issues for Landfills*, Conference Proceedings, 25th Annual SWANA Landfill Gas Symposium in Monterrey, California, March 2002.

Sullivan, Patrick S., *Update on Air Quality Permitting and Compliance Issues for MSW Landfills*, Presentation at the 31st Annual SWANA Western Regional Symposium, South Lake Tahoe, Nevada, May 2002.

Walsh, James, and Sullivan, Patrick S., *NSPS and Other Clean Air Act Issues—Recent Development and Workarounds*, Proceedings of the SWANA WASTECON Conference, Long Beach, California, October 2002.

Sullivan, Patrick S., and Bins, John, *Measurement of Toxic Emissions from Landfills: History and Current Developments*, Conference Proceedings, Symposium on Air Quality Measurement Methods and Technology—2002, AWMA, San Francisco, California, November 2002.

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Sullivan, Patrick S., et al., *Landfill Gas Module, Performance-Based System for Post-Closure Care at MSW Landfill*, Conference Proceedings, Conference Proceedings, 26th Annual SWANA Landfill Gas Symposium in Tampa, Florida, March 2003.

Sullivan, Patrick S., *Landfill Gas Aspects of Bioreactor Landfills*, Presentation at Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Annual State Solid Waste Managers' Conference, Salt Lake City, Utah, July 2003.

Huff, Raymond H., Leonard, Michelle P., and Sullivan, Patrick S., *Composting Emissions Update and New Southern California Regulations*, Presentation at SWANA WASTECON Conference, St. Louis, Missouri, October 2003.

Huff, Raymond H., and Sullivan, Patrick S., *Unique Landfill Gas Issues on Urban Inactive Landfills*, Conference Proceedings, 27th Annual SWANA Landfill Gas Symposium, San Antonio, Texas, March 2004.

Clarke, Steve, and Sullivan, Patrick S., *Estimating the Trend in NMOC Generation and Emissions After Closure of MSW Landfills*, Conference Proceedings, 27th Annual SWANA Landfill Gas Symposium, San Antonio, Texas, March 2004.

Huff, Raymond H., and Sullivan, Patrick S., *Air Quality and Odor Impacts from Landfill-Related Emissions*, Conference Proceedings, Water Environment (WEF) and AWMA Odor and Air Emissions 2004, Bellevue, Washington, April 2004.

Sullivan, Patrick S., *Air Quality and Odor Impacts from Landfill-Related Emissions*, Presentation at the 33rd Annual SWANA Western Regional Symposium, San Luis Obispo, California, May 2004.

Sullivan, Patrick S., *The Role of LFGTE in California's RPS and the California Biomass Collaborative*, Presentation at the 8th Annual U.S. EPA LMOP Conference and Project Expo, Baltimore, Maryland, January 2005.

Sullivan, Patrick S., *Where Should I Put My Organic Waste: Bioreactor Landfill or Composting Facility*, Conference Proceedings, NSWMA/EIA Waste Expo, Las Vegas, Nevada, May 2005.

Sullivan, Patrick S., *LFG and Development on and Adjacent to Landfills in California*, Presentation at the 34th Annual SWANA Western Regional Symposium, San Luis Obispo, California, May 2005.

Sullivan, Patrick S., *Comparison of Air, Health, and Odor Impacts from Landfills vs. Composting*, Presentation at the Annual SWANA WASTECON Conference, St. Louis, Missouri, September 2005.

Sullivan, Patrick S., *LFG and Air Quality Aspects of Bioreactor Landfills*, Presentation at the Annual Technical Meeting, SWANA Evergreen Chapter, Yakima, Washington, October 2005.

Sullivan, Patrick S., *LFG Issues During Post-Closure Development of Landfills*, Presentation at the California Integrated Waste Management Board's Post-Closure Land Use Symposium, Stockton and Ontario, California, February 2006.

Leonard, Michelle L., Huff, Raymond H., and Sullivan, Patrick S., *Unique Solutions to Complex LFG Migration Problems*, Conference Proceedings, 29th Annual SWANA Landfill Gas Symposium, St. Petersburg, Florida, March 2006.

Sullivan, Patrick S., *Current Status of Air Quality Regulations in the Solid Waste Industry*, SWANA Arizona Landfill Seminar, Phoenix, Arizona, May 2006.

Sullivan, Patrick S., et al., *Fugitive Dust Modeling with AERMOD for PM10 Emissions from a Municipal Solid Waste Landfill*, Proceeding of Guidelines on Air Quality Models; an AWMA Specialty Conference, Denver, Colorado, September 2006.

Sullivan, Patrick S., *CNG, LNG, and Other Fuels from LFG*, Presentation at 4th Annual Forum CA Biomass Collaborative, Sacramento, California, March 2007.

Sullivan, Patrick S., et al., *Field Comparison of Landfill Gas Collection Efficiency Measurements*, Conference Proceedings, 30th Annual SWANA Landfill Gas Symposium, Monterey, California, March 2007.

Sullivan, Patrick S., *Update on Major Air Quality Regulations Affecting Landfills*, Conference Proceedings, 30th Annual SWANA Landfill Gas Symposium, Monterey, California, March 2007.

Sullivan, Patrick S., *Landfill Management Practices for Reducing GHG Emissions*, Presentation for the California Integrated Waste Management Board (CIWMB) Strategic Policy Development Committee Public Workshop, Sacramento, California, May 2007.

Sullivan, Patrick S., *Mitigation of Unique LFG Migration Issues*, Conference Proceedings, SWANA WASTECON Conference, Reno, Nevada, October 2007.

Sullivan, Patrick S., *SWICS Landfill GHG Inventory Methodology*, Presentation for SWANA WASTECON Conference Landfill Gas Division Meeting, Reno, Nevada, October 2007.

Sullivan, Patrick S., *Air Quality Issues Affecting Landfills in California*, Presentation at SWANA Sierra Chapter Board Meeting, Fresno, California, January 2008.

Sullivan, Patrick S., *GHG Programs in California and their Impacts on MSW Landfills*, Conference Proceedings, 31st Annual SWANA Landfill Gas Symposium, Houston, Texas, March 2008.

Sullivan, Patrick S., *Air Quality Issues Affecting Landfills in California*, Presentation SWANA Gold Rush Chapter Board Meeting, Monterey, California, April 2008.

Sullivan, Patrick S., *Practicalities of Implementing and Permitting a Landfill Methane Project*, Presentation for the California Climate Action Registry (CCAR) Climate Action Reserve Workshop on California Landfill Methane Projects, Los Angeles, California, April 2008.

Sullivan, Patrick S., *Air Quality Issues for Composting Facilities*, Presentation at the 38th Annual SWANA Western Regional Symposium, Seaside, California, May 2009.

Huff, Raymond H., and Sullivan, Patrick S., *Carbon Footprint and Impact of Biosolids*, Presentation at CWEA's "Government Affairs: Global Climate Issues" Specialty Conference for the Cities of Whittier and Roseville, California, June 2008.

Huff, Raymond H., and Sullivan, Patrick S., *GHG Credit Trading*, Presentation at CWEA's "Government Affairs: Global Climate Issues" Specialty Conference for the Cities of Whittier and Roseville, California, June 2008.

Sullivan, Patrick S., *The New World of GHG Emissions for Landfills*, Presentation for SWANA Landfill Symposium, Palm Springs, California, June 2008.

Sullivan, Patrick S., *Quantification Methods for GHG Emissions from Landfills,* SWANA E-Session, October 2008.

Sullivan, Patrick S., *AB 32 Climate Change Issues Impacting Landfills in California,* Presentation at Rural Counties' Environmental Services Joint Power Authority Board and Technical Advisory Meeting, Sacramento, California, December 2008.

Sullivan, Patrick S., *Greenhouse Gas Regulations, Programs, and Reporting,* Presentation to Clark County Department of Air Quality and Environmental Management, Las Vegas, Nevada, January 27, 2009.

Sullivan, et al., *New LFG Monitoring Requirements in California: More Stringent and Expensive,* Conference Proceedings, 32nd Annual SWANA Landfill Gas Symposium, Atlanta, Georgia, March 2009

Sullivan, Patrick S., *Operational and Financial Impacts of CARB's New Early Action Rule for Landfills,* Presentation at the 38th Annual SWANA, Western Regional Symposium, Palm Springs, California, April 2009.

Sullivan, Patrick S., *Estimating Your Landfill's Carbon Footprint*, Presentation at the NSWMA/EIA Waste Expo in Las Vegas, Nevada, June 2009.

Sullivan, Patrick S., *CARB's New Early Action Rule for Landfills: Beyond NSPS and into the Climate Change World,* Presentation for SWANA WASTECON Conference, Long Beach, California, September 2009.

Sullivan, Patrick S., *Global Setting: Waste Management's Response to Climate Change,* Presentation for SWANA WASTECON Conference, Long Beach, California, September 2009.

Sullivan, Patrick S., *AB 32/Scoping Plan Impact on Solid Waste Industries and Local Governments,* Presentation at the Southern California Waste Management Forum Annual Conference, Ontario, California, November 2009.

Sullivan, Patrick S., *Meeting EPA's Mandatory GHG Reporting Requirements,* NSWMA Webinar, December 2009.

Sullivan, Patrick S., *General Overview of EPA's Mandatory GHG Reporting Rule for Landfills,* Presentation at the SWANA Oregon Chapter, Winter Forum, January 2010.

Sullivan, et al., *The Impact of Federal Climate Change Legislation and Regulation on The Solid Waste Industry***,** Conference Proceedings, 33rd Annual SWANA Landfill Gas Symposium, San Diego, California, March 2010.

Sullivan, Patrick S., *Comparison of Landfilling and Organic Waste Diversion in Terms of Air Quality and GHG Impacts,* Presentation at the 39th Annual SWANA Western Regional Symposium, San Luis Obispo, California, April 2010.

Sullivan, Patrick S., *The Importance of Landfill Gas Capture and Utilization in the U.S.*, Columbia University, Earth and Engineering Center, Council for the Sustainable Use of Resources (SUR), April 2010.

Sullivan, Patrick S., *Federal Mandatory Reporting Rule (MRR) and Tailoring Rule for Greenhouse Gas (GHG)*, Presentation at Waste Connections, Inc., Meeting, Copper Mountain, Colorado, August 2010.

Sullivan, Patrick S., *The Confusing Maze of State and Federal Greenhouse Gas (GHG) Reporting Programs,* Presentation for SWANA WASTECON Conference, Boston, Massachusetts, August 2010.

Van Kolken Banister, Amy, and Sullivan, Patrick S., *LFG Collection Efficiency: Debunking the Rhetoric,* MSW Magazine, Elements 2011 Issue, September 2010.

Sullivan, Patrick S., *Tailoring Talk,* Waste Age, February 2011.

Sullivan, Patrick S., *Not Another GHG Regulation—The Impact of the Tailoring Rule on Landfills,* Presentation for 34th Annual SWANA Landfill Gas Symposium, Dallas, Texas, March 2011.

Sullivan, Patrick S., *When Can Co-Located Facilities be Considered Separate Sources for Air Compliance Purposes the Concept of Common Control,* Presentation for 34th Annual SWANA Landfill Gas Symposium, Dallas, Texas, March 2011.

Sullivan, Patrick S., *GHG Regulatory Overload,* Presentation for 40th Annual SWANA Western Regional Symposium, Seaside, California, May 2011.

Sullivan, Patrick S., *Comparison of Air Quality and GHG Impacts from Organic Waste Disposal,* Presentation for AWMA Golden West Chapter Annual Technical Conference, Bakersfield, California, May 2011.

Sullivan, Patrick S., *Comparison of GHG Emissions Methodologies for Landfills,* Presentation for AWMA Annual Conference, Orlando, Florida, June 2011.

Sullivan, Patrick S., *Air Modeling for LFG Projects,* Presentation for SWANA WASTECON Conference, Nashville, Tennessee, August 2011.

Sullivan, Patrick S., *Impacts from Organic Waste Management,* AWMA Mother Lode Chapter Meeting, Sacramento, California, September 2011.

Sullivan, Patrick S., *The Effects of New Air Modeling Standards on Landfill Gas Projects,* Presentation for 35th Annual SWANA Landfill Gas Symposium, Orlando, Florida, March 2012.

Sullivan, Patrick S., *The Impact of the GHG Tailoring Rule on Title V and PSD Permitting for Landfills,* Regulation Week e-Seminar, April 2012.

Sullivan, Patrick S., *Clean Air Act Update,* Conference Proceedings, Waste Expo, Las Vegas, Nevada, April 2012.

Sullivan, Patrick S., *Air Quality Requirements for Composting Facilities are Changing—Are You Ready?,* 41st Annual SWANA Western Regional Symposium, April 2012.

Sullivan, Patrick S., *The Effects of New Air Modeling Standards on Landfill Gas Projects,* SWANA E-Session, May 2012.

Sullivan, Patrick S., et al., *Defending Landfills Accused of Landfill Gas Impacts on Neighboring Properties,* Paper and Presentation for SWANA WASTECON Conference, Washington, D.C., August 2012.

Sullivan, Patrick S., et al., *Lessons Learned from the First Two Years of Compliance with the Federal GHG* Mandatory *Reporting Rule,* Paper and Presentation for 36th Annual SWANA Landfill Gas Symposium, Las Vegas, Nevada, March 2013.

Sullivan, Patrick S., *Why Won't They Just Stop? More Changes to the Air and GHG Regulations for Landfills,* 42nd Annual SWANA Western Regional Symposium, San Luis Obispo, California, April 2013.

Sullivan, Patrick S., et. al., *LFG Rules and Regulations Committee Update,* Panel Presentation at SWANA WASTECON Conference, Long Beach, California, September 2013.

Sullivan, Patrick S., *The Implications of California Air Regulations on Composting Facilities, P*resentation at the U.S. Composting Council Annual Conference, Oakland, California, January 2014.

Sullivan, Patrick S., et al., *Lessons Learned from California Landfill Methane Rule Reporting*, Presentation at the 37th Annual SWANA Landfill Gas Symposium, Monterey, California, March 2014.

Sullivan, Patrick S., et al., *Update on Federal Air and GHG Regulations Affecting Landfills*, Published in *Waste Advantage* magazine, Volume 5, Number 3, March 2014.

JOHN HENKELMAN

Education

BS – Chemical Engineering, University of Nevada, 2002

Professional Licenses and Registrations

Engineer-in-Training (EIT)

Professional Affiliations

Air and Waste Management Association (AWMA)

Certifications

OSHA 40-Hour Hazardous Waste Operator

Professional Experience

Mr. Henkelman has 15 years of experience as a chemist and engineer. His duties have included air dispersion modeling using several regulatory models, including AMS/EPA Regulatory Model (AERMOD), Industrial Source Complex Short Term 3 (ISCST3), Screen 3, AERSCREEN, and Areal Locations of Hazardous Atmospheres (ALOHA). He uses modeling results in risk assessments, accidental release planning, permit applications, and environmental impact assessments. He writes work plans and samples soil vapor, landfill gas, soil, and water. He assists with compliance and permitting under the Clean Air Act, including greenhouse gas (GHG) reporting and verification under the California Climate Action Registry (CCAR), The Climate Registry (TCR), and California's mandatory GHG reporting regulation. He also has experience in manufacturing that includes production scheduling, quality assurance and quality control (QA/QC), product development, and health and safety (H&S).

Select project experience includes the following:

Quality Assurance for Landfill Gas Sampling, Honolulu, HI. Mr. Henkelman reviewed third-party reports to determine compliance with Quality Assurance Project Plan (QAPP) requirements.

New Source Performance Compliance Standards (NSPS) Tier 1, South Hilo Landfill, HI. Mr. Henkelman collected samples at the landfill and created a work plan calculating emissions which were submitted to regulators. He reviewed the NSPS applicability and worked with the EPA and the County of Hawaii to evaluate future compliance options.

New Source Performance Compliance Standards (NSPS) Tier 2, 15 Landfills, CA. Mr. Henkelman collected samples at the landfills and created work plans calculating emissions which were submitted to regulators.

Air Quality Impact Assessment (AQIA) for Landfill Gas Engines, San Jose, CA. The project included an AQIA used in support of an Environmental Impact Report (EIR) and California Environmental Quality Act (CEQA) report. Mr. Henkelman evaluated all major emission sources at the site. The AQIA included modeling for a health risk assessment (HHRA) to demonstrate National Ambient Air Quality Standards (NAAQS) compliance.

AQIA, Newby Island Sanitary Landfill, Milpitas, CA. The project included AQIA used in support of an EIR and CEQA report. Mr. Henkelman evaluated all major emission sources at the site. He used model results to evaluate the HHRA and NAAQS compliance.

AQIA, Forward Landfill, Manteca, CA. The project included AQIA used in support of an EIR and CEQA report. Mr. Henkelman evaluated all major emission sources at the site. He used model results to evaluate the HHRA and NAAQS compliance.

AQIA, Fairmead Landfill, Madera, CA. The project included AQIA used in support of an EIR and CEQA report. Mr. Henkelman evaluated all major emission sources at the site. He used model results to evaluate the HHRA and NAAQS compliance.

Title V Permit Applications, Five Kern County Landfills, Kern County, CA. Mr. Henkelman prepared a permit renewal application package which was a review of landfill compliance and potential new compliance requirements.

HHRA and Nuisance Evaluation of Landfill, Otay, CA. Mr. Henkelman prepared an HHRA and odor dispersion modeling, and evaluated potential nuisance impacts from a landfill on proposed residential development. The reports were used to seek CEQA approval.

Modeling Evaluation, Avenal Landfill, Avenal, CA. Mr. Henkelman evaluated dispersion modeling used in an EIR and CEQA evaluation. The modeling was completed using an ISCST3. The results were used to evaluate the HHRA.

Modeling Evaluation, Central County Landfill, Petaluma, CA. Mr. Henkelman evaluated dispersion modeling used in an EIR and CEQA evaluation. The modeling was completed using CAL3QHCR, and the results were used to evaluate the HHRA.

Modeling for Permitting, Hay Road Landfill, Vacaville, CA. Mr. Henkelman evaluated dispersion modeling using a complex model (AERMOD) in support of an EIR and CEQA report. He evaluated all major emission sources at the site, and the used model results to evaluate the HHRA and NAAQS compliance.

Modeling Evaluation, East Los Angeles Transfer Station, East Los Angeles, CA. Mr. Henkelman's evaluation included dispersion modeling used in an EIR and CEQA evaluation. The modeling was completed using SCREEN3, and the results were used to evaluate the HHRA and NAAQS compliance.

Modeling Evaluation, West Artesia Material Recovery Facility, Compton, CA. Mr. Henkelman evaluated dispersion modeling used in an EIR and CEQA evaluation. The modeling was completed using SCREEN3, and the results were used to evaluate the HRRA and NAAQS compliance.

Litigation Support for Landfill, Oklahoma City, OK. Mr. Henkelman evaluated odor emission rates and calculations to prepare rebuttal arguments for expert witness reports.

Litigation Support, Newby Island Landfill, Milpitas, CA. Mr. Henkelman evaluated the odor emission rates and calculations to prepare rebuttal arguments for expert witness reports.

Litigation Support for Landfill, Sylmar, CA. Mr. Henkelman evaluated the odor emission rates and calculations to prepare rebuttal arguments for expert witness reports.

Litigation Support for Landfill, Tullytown, PA. Henkelman evaluated the odor emission rates and odor dispersion modeling for expert witness reports.

HHRA, Former Plastic Bottle Manufacturing Facility, Toluca, Mexico. Mr. Henkelman's assessment included developing a soil vapor sampling plan, collecting soil vapor samples, developing exposure scenarios for soils and soil vapor, developing toxicity criteria, and developing exposure parameters.

Focused HHRA, Former Aerospace Research Facility, Los Angeles, CA. Mr. Henkelman developed exposure scenarios for groundwater and indoor air, as well as toxicity criteria and exposure parameters.

HHRA, Former Industrial Sites, Southern CA. In order for the sites to be developed for residential use, the assessment included developing exposure scenarios for soil vapor and modeling risk using the Johnson Ettinger model.

HHRA to Assess Effectiveness of Synthetic Vapor Barrier. The focused HRA evaluated the potential effectiveness of a synthetic vapor barrier to mitigate health risk from soil vapor contamination.

Development of Copper and Cyanide Cleanup Levels for Surface and Air, San Marcos, CA. Mr. Henkelman's duties focused on exposure scenarios, toxicity criteria, and exposure parameters. Chronic health hazard-based cleanup levels for both contaminants were developed for future residential and commercial use of the facility.

Development of Health Based Beryllium Cleanup Levels for Surfaces, Kansas City, MO. Mr. Henkelman duties included defining exposure scenarios, toxicity criteria, and exposure parameters. Cleanup levels were based on increased cancer risk for commercial workers.

Development of Contaminant Cleanup Levels for Soil Gas, California. Mr. Henkelman duties included defining exposure scenarios, toxicity criteria, and exposure parameters. Cleanup levels were based on both increased cancer risk and chronic health effects.

HHRA for Asbestos Landfill, Copperopolis, CA. Mr. Henkelman's duties included calculating emission rates of asbestos, modeling dispersion of asbestos emissions using the ISCST3 model to determine downwind concentrations, and developing exposure scenarios for outdoor air, toxicity criteria, meteorological data, and exposure parameters.

Soil Vapor Surveys, Sample Location Selection, Sample Collection, and Sample Analysis, California and Oregon. Mr. Henkelman performed surveys in support of vapor intrusion risk assessments.

Modeling for Permitting, Kirby Canyon Landfill, Morgan Hill, CA. Mr. Henkelman performed dispersion modeling using screening and complex models (ISCST3, AERMOD, and SCREEN3) for permitting of flares and potential engines. The modeling results were used to determine the human health risk.

Modeling for Permitting, Tri-Cities Landfill, Fremont, CA. Mr. Henkelman performed dispersion modeling using screening and complex models (ISCST3, AERMOD, and SCREEN3) for permitting of flares and potential engines. The modeling results were used to determine the human health risk.

Modeling for Permitting, McCommas Landfill, Dallas, TX. Mr. Henkelman performed dispersion modeling using a screening model (SCREEN3) in support of a permit application for flares. The modeling results were used to determine NAAQS compliance.

Modeling for Permitting, Frank R. Bowerman Landfill, Irvine, CA. Mr. Henkelman performed dispersion modeling using screening model (SCREEN3) for permitting of flares. The modeling results were used to determine human health risk.

Modeling for Permitting, Simi Valley Landfill and Recycling Center, Simi Valley, CA. Mr. Henkelman performed dispersion modeling using screening model (SCREEN3) for permitting of a flare condensate injection system. The modeling results were used to determine human health risk.

Review of Modeling, Redwood Landfill, Novato, CA. Mr. Henkelman's review included dispersion modeling completed for Prevention of Serious Deterioration (PSD) evaluation of flares and engines for a landfill gas-to-energy (LFGTE) project using AERMOD. The model results were used to determine human health risk.

Air Toxics HHRA, Los Angeles Unified School District (LAUSD), Los Angeles, CA. Mr. Henkelman's review included emission calculations, air dispersion modeling using ISCST3, risk and exposure criteria selection, and risk calculation. He reviewed hazardous material accidental release scenarios.

Air Toxics Risk Assessment, Quarry, Novato, CA. Mr. Henkelman reviewed the assessment performed by another firm, which included emissions calculations, modeling, and risk evaluation. The review concluded that emission calculations were fundamentally flawed, and that the quarry may pose a significant health risk to nearby residential areas.

Specialized Training

Completed 2-Day Training Course for ISCST3 and AERMOD. The course included model selection, meteorological data processing, source and receptor parameters selection, and terrain processing.