Comparative Greenhouse Gas Emissions Analysis of Alternative Scenarios for Waste Treatment and/or Disposal

BASELINE SCENARIO - LANDFILL

1,000 tpd

ALTERNATIVE SCENARIO - INTEGRATED MRF WITH CONVERSION TECHNOLOGIES

1,000 tpd

County of Los Angeles
Department of Public Works

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AD	Anaerobic Digestion
ARB	Air Resources Board
CalEEMod	California Emissions Estimator Model
CFR	Code of Federal Regulations
CT	Conversion Technology
DV	Digestible Component
EMFAC2011	ARB-developed model to calculate GHG emission for transport
EPA	United States Environmental Protection Agency
EpE	Entreprises pour l'Environmental Model
GHG	Greenhouse Gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LandGEM	EPA model to calculate GHG emissions for buried refuse
LFG	Landfill Gas
LFG-to-energy	Landfill gas-to-energy
MBT	Mechanical and Biological Treatment
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MTCO2E	Metric Tons of Carbon Dioxide Equivalent
NMOC	Non-Methane Organic Compounds
NSCR	Non-Selective Catalytic Reduction
RDF	Refuse-Derived Fuel
SCAQMD	South Coast Air Quality Management District
SCR	Selective Catalytic Reduction
tpd	Tons per Day
WARM	Waste Reduction Model

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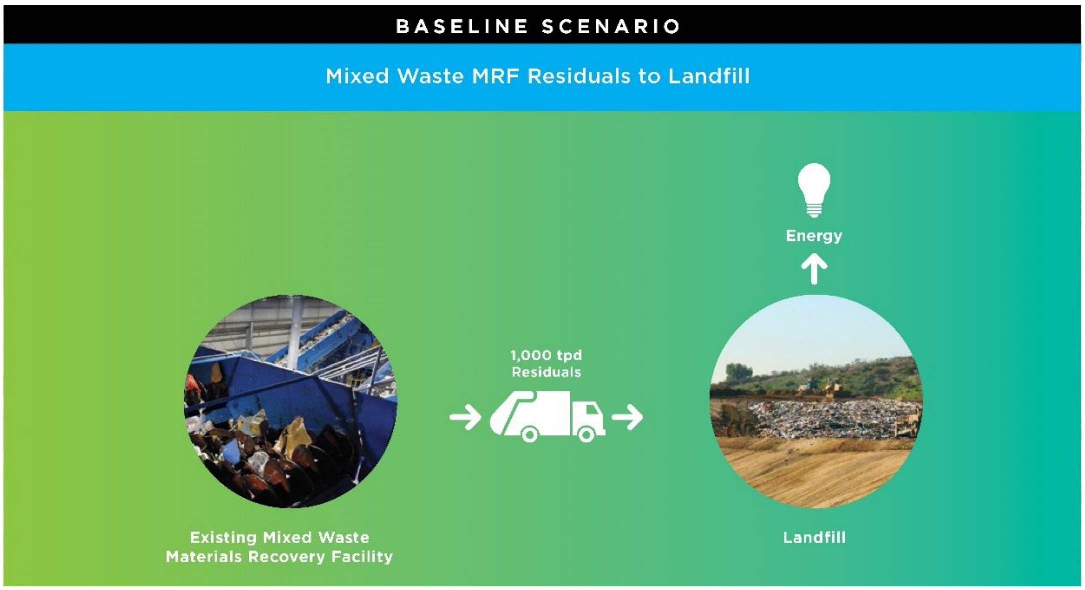
EXECUTIVE SUMMARY

This analysis compares the net greenhouse gas (GHG) emissions of two scenarios. The first scenario is the transport and disposal of 1,000 tons per day (tpd) of residuals from a mixed waste Materials Recovery Facility (MRF) to a modern sanitary landfill (Baseline Scenario). The second scenario proposes to process the same residuals at an Integrated MRF with Conversion Technologies (Alternative Scenario). The Baseline Scenario results in a net increase of approximately 1.64 million metric tons of carbon dioxide equivalent ($MTCO_2E$), while the Alternative Scenario results in net avoided GHG emissions of (0.67) million $MTCO_2E$. Therefore, shifting from the Baseline Scenario to the Alternative Scenario would result in a total GHG reduction of approximately 2.31 million $MTCO_2E$. The study parameters were strictly focused on analysis of GHG emissions and other air pollutants and do not consider other environmental, social or economic parameters.

In both scenarios, cumulative GHG emissions were analyzed for handling 1,000 tpd of post-recycled residuals (i.e., after recycling efforts) from a mixed waste MRF over a period of 25 years. For the Baseline Scenario, GHG emissions were modeled for a 100-year period after the landfill ceased to accept waste to account for GHG emissions generated by the decomposition of the waste disposed in the landfill.

The models used in the analysis to estimate GHG emissions from transportation and landfill operations are developed by air districts throughout California and consider future truck fleets with better emissions controls such as alternative fuels. The Baseline Scenario also assumes a soil cover (or cap) for the refuse and landfill gas to energy (LFG-to-energy) which is common of landfills in Southern California.



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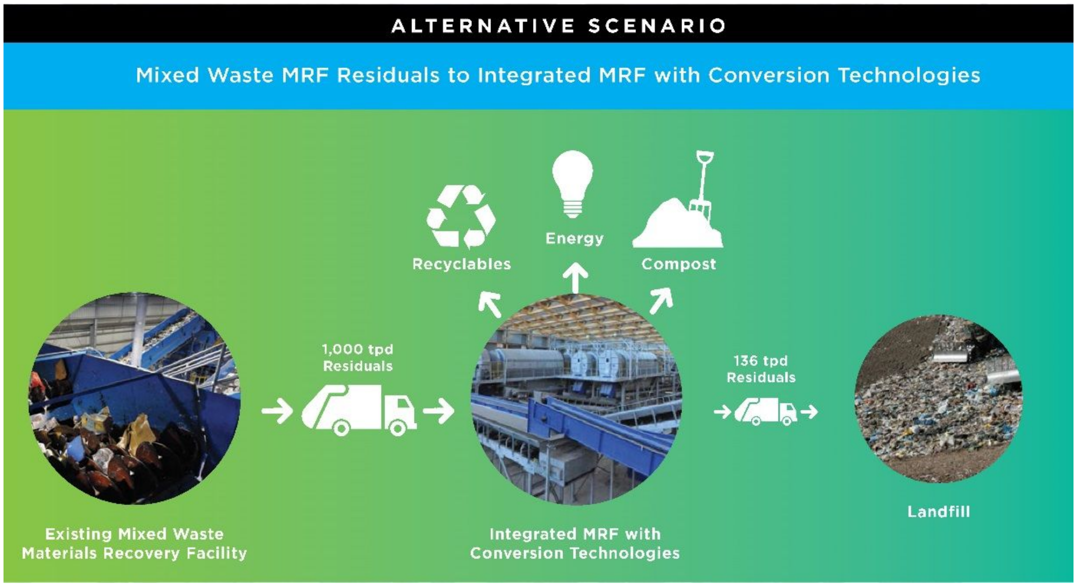


Under the Alternative Scenario, the post-recycled residuals from a mixed waste MRF are assumed to be further processed in an Integrated MRF with Conversion Technologies over a 25 year period, after which the facility is assumed to cease operating. The Integrated MRF with Conversion Technologies assumed in this study is modeled after a combination of technologies employed elsewhere in the world, including mechanical pre-processing to recover additional recyclable material and to separate residuals into a wet fraction for anaerobic digestion and composting, and a dry fraction for thermal gasification. These facility components and practices reflect actual modern, commercial scale operating mechanical pre-processing and anaerobic digestion facilities in the European Union, and thermal gasification and ash melting facilities in Asia.

In order to model emissions from a facility in California, the latest available statewide post-recycled MRF residual waste composition data (at the time of the analysis) from CalRecycle was assumed as the feedstock for the analysis. The Alternative Scenario also accounts for transport and disposal of the Integrated MRF with Conversion Technologies residuals to landfill, assuming a landfill with a cap and flare (due to residuals having very low organic content and thus low landfill gas generation from those residuals not sufficient for LFG-to-energy).

The net GHG emissions results calculated in this study are based on non-biogenic emissions (i.e., fugitive methane emissions from landfills and emissions from combustion of fossil fuels) pursuant to the Intergovernmental Panel on Climate Change (IPCC) guidelines, and industry accepted GHG models such as EPA Waste Reduction Model (WARM), European Union's EpE model and California Air Resources Board models. Biogenic emissions are not included in these conclusions, as these emissions naturally cycle through the atmosphere by processes such as photosynthesis, and are therefore carbon neutral and do not impact net GHG emissions.

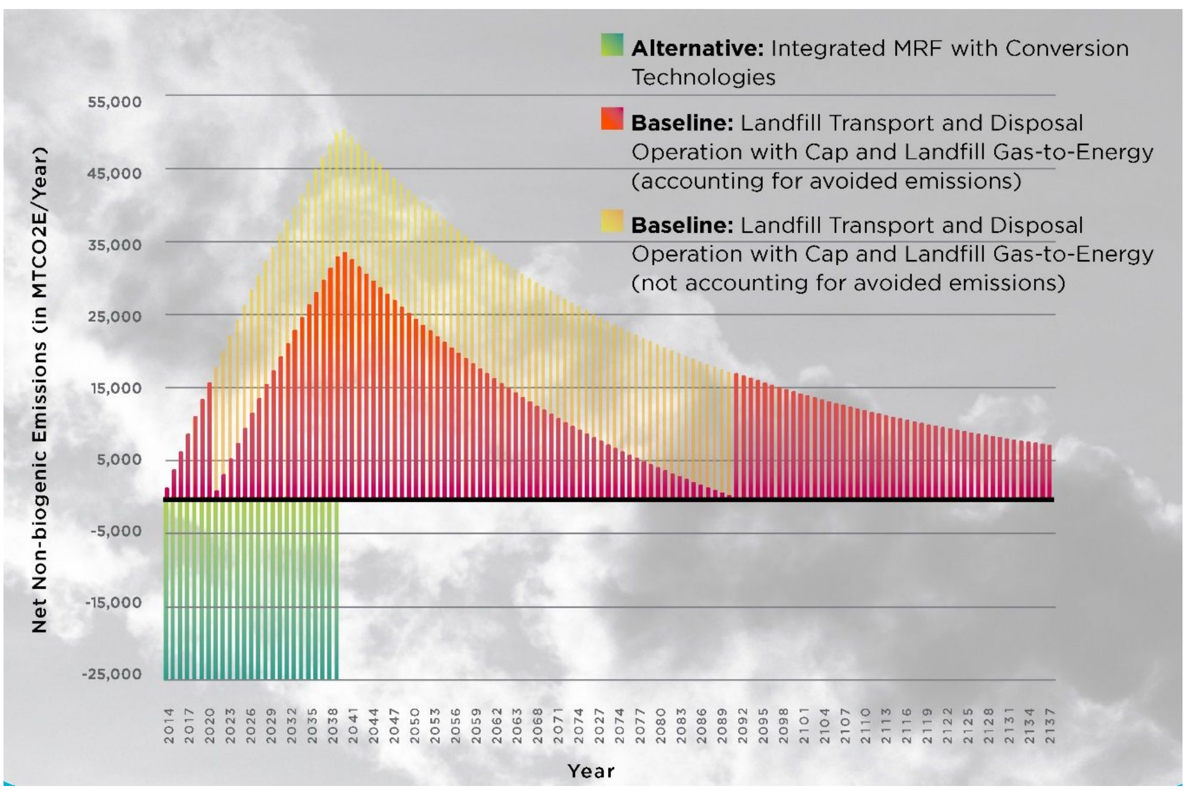
The analysis compares the overall net GHG emissions for the two scenarios measured in terms of $MTCO_2E$ for 1,000 tpd of post-recycled MRF residuals. The Baseline Scenario results in net

GHG emissions of approximately 1.64 million $MTCO_2E$, over a 125 year period taking into account continued GHG emissions from waste decomposition in the landfill, which is comparable to 340,000 passenger vehicles driven for one year. The Alternative Scenario results in net avoided GHG emissions of (0.67) million $MTCO_2E$ over a 25 year period, which is comparable to 140,000 fewer passenger vehicles driven for one year.

The two scenarios evaluated emissions from transportation, operation, and avoided emissions. The most significant difference between the two scenarios is that the avoided emissions are much greater for the Alternative Scenario. This is due to the energy generated from anaerobic digestion and gasification, which would replace fossil fuels, as well as the additional integrated MRF recycling in the Alternative Scenario. Avoided emissions in the Baseline Scenario are due to LFG-to-energy replacing the use of fossil fuels.

The avoided emissions in the Baseline Scenario are due to LFG-to-energy replacing the use of fossil fuels during the time period that enough landfill gas is generated to support a LFG-to-energy facility. The net annual GHG emissions results (after accounting for avoided emissions) associated with the management of waste materials for the Baseline and Alternative Scenarios is graphically shown below.

Figure ES: Net Non-Biogenic GHG Emissions Over Time: Baseline vs. Alternative Scenario



The analysis results found that the Baseline Scenario (landfill disposal with LFG-to-energy of 1000 tpd of MRF residuals) generates 2.31 million more $MTCO_2E$ of net GHG emissions than the Alternative Scenario (Integrated MRF with Conversion Technologies).

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PART I: INTRODUCTION

SECTION 1: INTRODUCTION

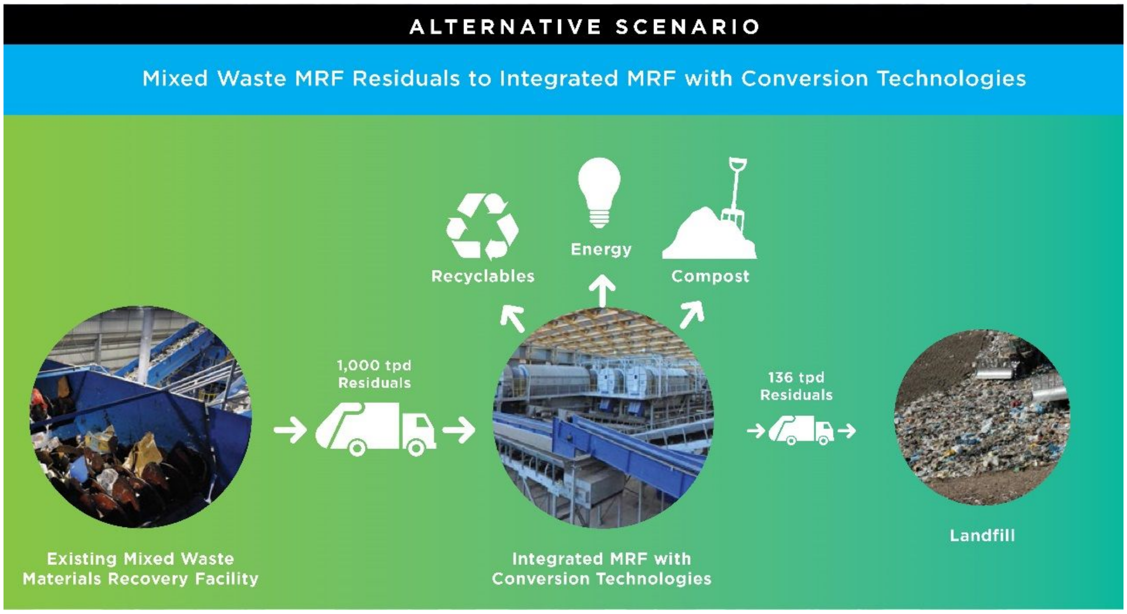
This analysis was commissioned by the County of Los Angeles Department of Public Works (DPW) to compare the net greenhouse gas (GHG) emissions for two waste management scenarios. The analysis compares GHG emissions resulting from traditional transport and landfill disposal of residuals from a mixed waste Material Recovery Facility (MRF) with the GHG emissions of processing those same MRF residuals through an Integrated MRF with Conversion Technologies. The material assumed to be processed under both scenarios is 1,000 tons per day (tpd) of post-recycled (after initial recycling efforts) residuals from a mixed waste MRF.

Conversion technologies refers to a wide array of technologies capable of converting post-recycled or residual solid waste into useful products, green fuels, and renewable energy through non-combustion thermal, chemical, or biological processes. Conversion technologies may include mechanical pre-processing when combined with a non-combustion thermal, chemical, or biological conversion process.[1] The conversion technologies selected includes a thermal process to treat the dry waste fraction and a biological process to treat the wet waste fraction. The study parameters were focused on analysis of GHG emissions and other air pollutants and do not consider other environmental, social or economic parameters.

The Baseline Scenario depicted below assumes that 1,000 tpd of post-recycled residuals from a mixed waste MRF are transported directly to a landfill for disposal over a 25-year period. The cumulative GHG emissions from the landfill were evaluated over a 125-year period to account for continued GHG emissions from the decomposition of waste disposed in the landfill.

[1] http://dpw.lacounty.gov/epd/SoCalConversion/Technologies/Definitions

In the Alternative Scenario depicted below, it is assumed that 1,000 tpd of post-recycled mixed-waste MRF residuals are additionally treated at an Integrated MRF with Conversion Technologies to achieve maximum diversion from landfills for a 25-year period. The typical useful life of an Integrated MRF with Conversion Technologies equipment is at least 25 years (therefore, dismantling the equipment is not included in GHG emissions calculations).



The purpose of the Integrated MRF with Conversion Technologies is to recover additional recyclables and materials not recovered by source separation programs or by a mixed waste MRF (i.e., facility which recovers recyclables from commingled municipal solid waste, utilizing manual and mechanical separation processes). In the Integrated MRF, a mechanical material separation process removes additional recyclables and prepares feedstock for conversion technologies. Additional diversion from landfill disposal is achieved by combining technologies that include anaerobic digestion, composting, and thermal processing with ash recovery/recycling.

<u>Baseline Scenario – Landfill Transport and Disposal</u>

The Baseline Scenario assumes transport of 1,000 tpd of post-recycled residuals from a mixed waste MRF to a modern sanitary landfill. Emissions were analyzed for the following: (1) transporting refuse from a location in Los Angeles County to a hypothetical out-of-County landfill location; (2) routine landfill operations including the use of equipment used in grading, compaction, and applying cover; and (3) landfill gas emissions from buried waste. The models used in the analysis to estimate GHG emissions from transportation and landfill operations are developed by air districts throughout California and consider future truck fleets and landfill equipment with better emissions controls such as alternative fuels.

Furthermore, the Baseline Scenario landfill operation was analyzed for two options: (1) landfill with cap and flare; and (2) landfill with cap and a LFG-to-energy system. For the summary comparison, the option including LFG-to-energy was assumed, because this is a common practice for sanitary landfills in Southern California.

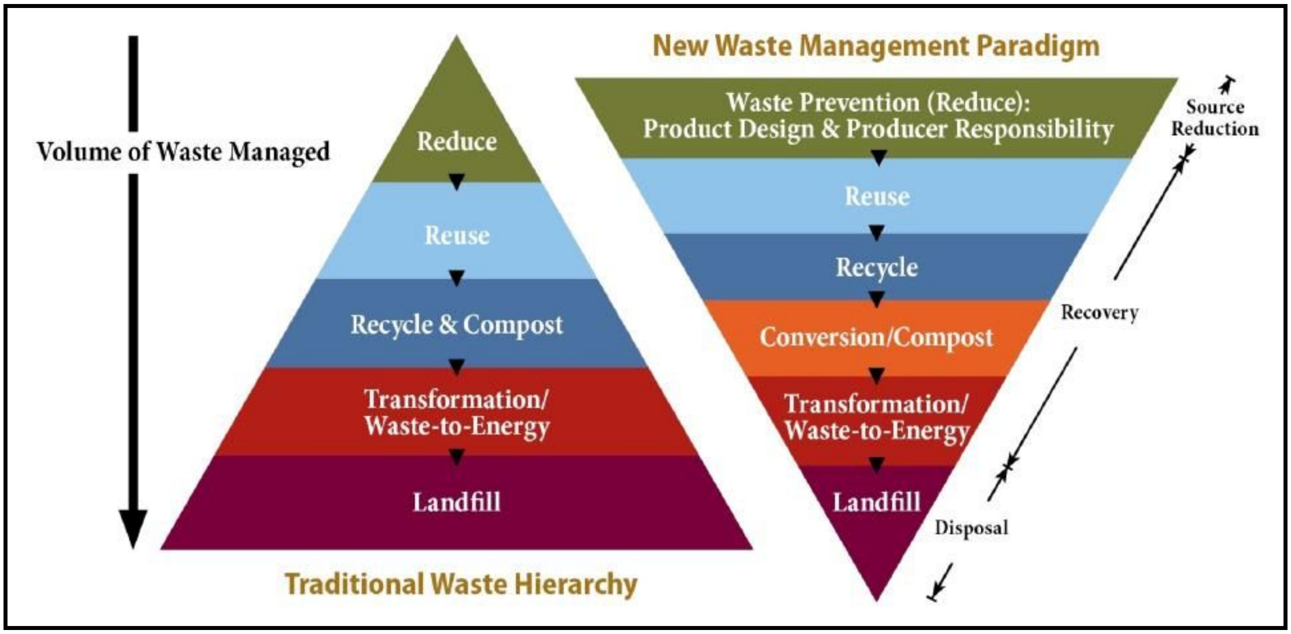
Assumptions and emissions models used in these analyses are provided in more detail in Section 2, Data Source and Calculation Methodology and in the Appendices.

Alternative Scenario – Integrated MRF with Conversion Technology

The Integrated MRF with Conversion Technologies assumed for this study is a modeled facility that combines traditional MRF recycling operations with a combination of full-scale, commercially operating technologies from other countries. Optimizing material reduction, reuse and recycling upstream is a higher priority for solid waste management but residuals still need to be handled. In order to better model emissions from a facility in California, the latest available statewide post-recycled MRF residual waste composition from CalRecycle (at the time of the analysis) was assumed as the feedstock for the analysis. The modeled facility was intended to maximize the beneficial uses of solid waste to achieve minimum landfill disposal, consistent with the current U.S. Environmental Protection Agency (EPA) waste management hierarchy and "MRF-First" policy of recovering marketable recyclables to the maximum extent reasonably possible.

The waste management hierarchy adopted by the Los Angeles County Solid Waste Management Committee/Integrated Waste Management Task Force is represented in two images below (Figure 1). A Traditional Waste Management Hierarchy integrates waste reduction measures, reuse practices, recycling and composting techniques, and waste-to-energy processing to manage a large portion of the typical solid waste stream. This has resulted in increased diversion of solid waste from landfills, however, a large volume of waste is still disposed of at landfill facilities (Californian's disposed approximately 30.2 million tons in 2013). By inverting the Traditional Waste Management Hierarchy and establishing a New Waste Management Paradigm, a greater emphasis is placed on maximizing the benefits and use of materials over disposal. This creates a new vision to significantly reduce, and someday, eliminate waste. The Integrated MRF with Conversion Technologies addresses the new integrated waste management hierarchy by prioritizing recycling, conversion technologies, and composting, with landfill disposal as a final option.

Figure 1: Waste Management Hierarchy



Note: Conversion refers to energy, fuels and/or products.

There are several regulations driving the implementation of conversion technologies in California. Assembly Bill (AB) 32, the California Global Warming Solutions Act and CalRecycle's AB 341, the Mandatory Commercial Recycling Law, are designed to reduce the greenhouse gas emissions through increased diversion from landfills. In May 2014, the California Air Resources Board (ARB) issued the "First Update to the Climate Change Scoping Plan", and the "Key Recommended Actions for the Waste Sector" include the following:

> ARB and CalRecycle will lead the development of program(s) to eliminate disposal of organic materials at landfills. Options to be evaluated will include: legislation, direct regulation, and inclusion of landfills in the Cap-and-Trade Program. If legislation requiring businesses that generate organic waste to arrange for recycling services is not enacted in 2014, then ARB, in concert with CalRecycle, will initiate regulatory action(s) to prohibit/phase out landfilling of organic materials with the goal of requiring initial compliance actions in 2016.

In 2014, California enacted mandatory organics diversion (AB 1826) and elimination of the use of green material as alternative daily cover at landfills to be counted as diversion (AB 1594). CalRecycle's focus for these laws is to reduce GHG emissions and reduce disposal of organics at landfills which is the source for methane generation resulting in GHG emissions (see Appendices 3 and 4 for additional discussion of regulatory drivers). The European Union (Directive 1999/31/EC) and many countries in Asia have taken similar approaches to solid waste management.

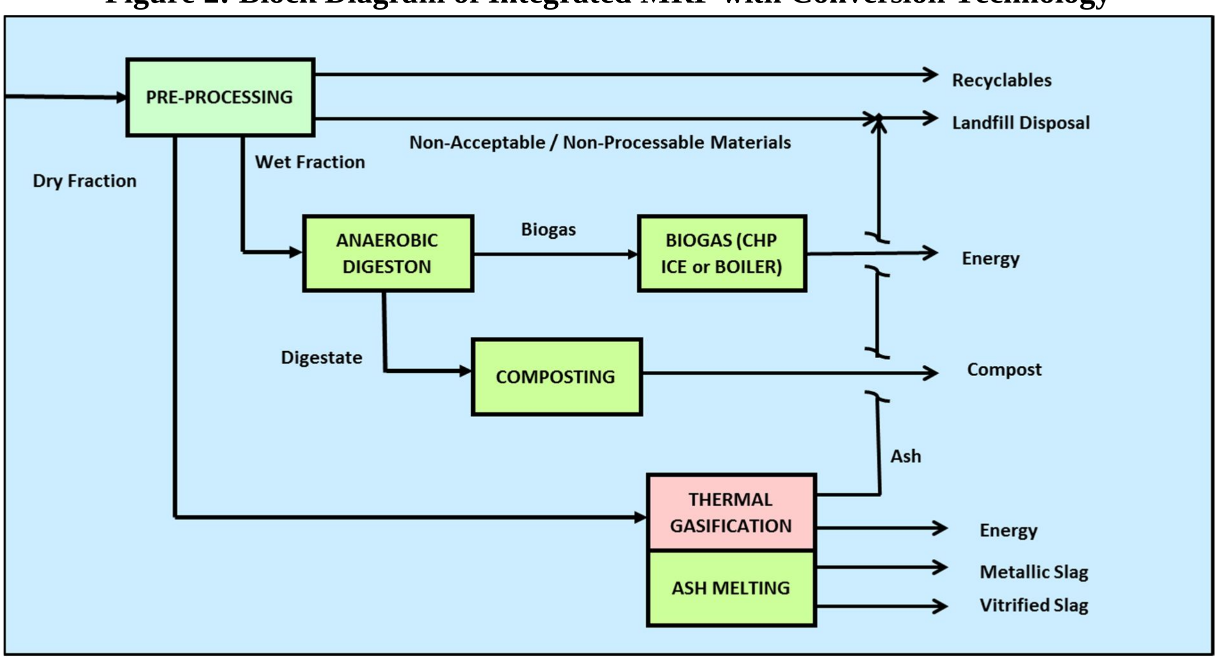
Diversion of organics and other materials have been modeled herein for an idealized Integrated MRF with Conversion Technologies. For this case study, Project Team members selected internationally recognized technologies for the purpose of obtaining reference data to be analyzed for use in conducting the comparative assessment in this study.

The Project Team intended for this study analysis to reflect real-world facility designs, operations, and emissions data. The Project Team devoted significant effort to using variables in several GHG and other emissions models that reflected real-world data. Project Team members worked with the executive management and engineering staff of selected facility operators who provided process engineering design data, mass and energy balance, and GHG emissions data based on existing projects/operating facilities for reviewing, vetting, comparing, and contrasting the data.

The California reference waste composition for this project (CalRecycle Residuals Composition for California Mixed Waste MRFs, 2006) was used to prepare independently developed calculations of the emissions and energy output data for each of the operational modules of the Integrated MRF with Conversion Technologies. The Project Team conducted a separate analysis of GHG emissions for the gasification component of the Integrated MRF with Conversion Technologies using U.S. EPA's Waste Reduction Model (WARM) and the same waste composition data assumed for the operating facilities. This separate analysis was performed to cross-check the emissions and energy results based on actual operating facilities data.

A block diagram showing the major operational components of the Integrated MRF with Conversion Technologies modeled in this study is presented below in Figure 2.

Figure 2: Block Diagram of Integrated MRF with Conversion Technology



Note: The boundary of the analysis did not include transport of heat sources (coke) for thermal gasification or compost and slag to off-site receiving facilities

Pre-processing: The pre-processing operation shown above reflects the most modern Integrated MRF with Conversion Technology approach in the European Union, which is designed to recover additional marketable recyclables remaining in the post-recycled MRF residuals feedstock as well as optimize the wet fraction feedstock in preparation for anaerobic digestion and composting, and process the dry fraction for thermal gasification and energy recovery. The front-end process design chosen for the study also considers the California regulatory requirement (in AB 1126) to remove PVC plastic in the process of creating refuse-derived fuel (RDF), minimum fuel values, and maximum moisture content requirements. The "Engineered Municipal Solid Waste" feedstock processing requirements of AB 1126 creates a RDF which has a lower ash content, higher heating value and lower moisture content (for reduction of chlorine thus minimizing the potential for formation of dioxin/furans)

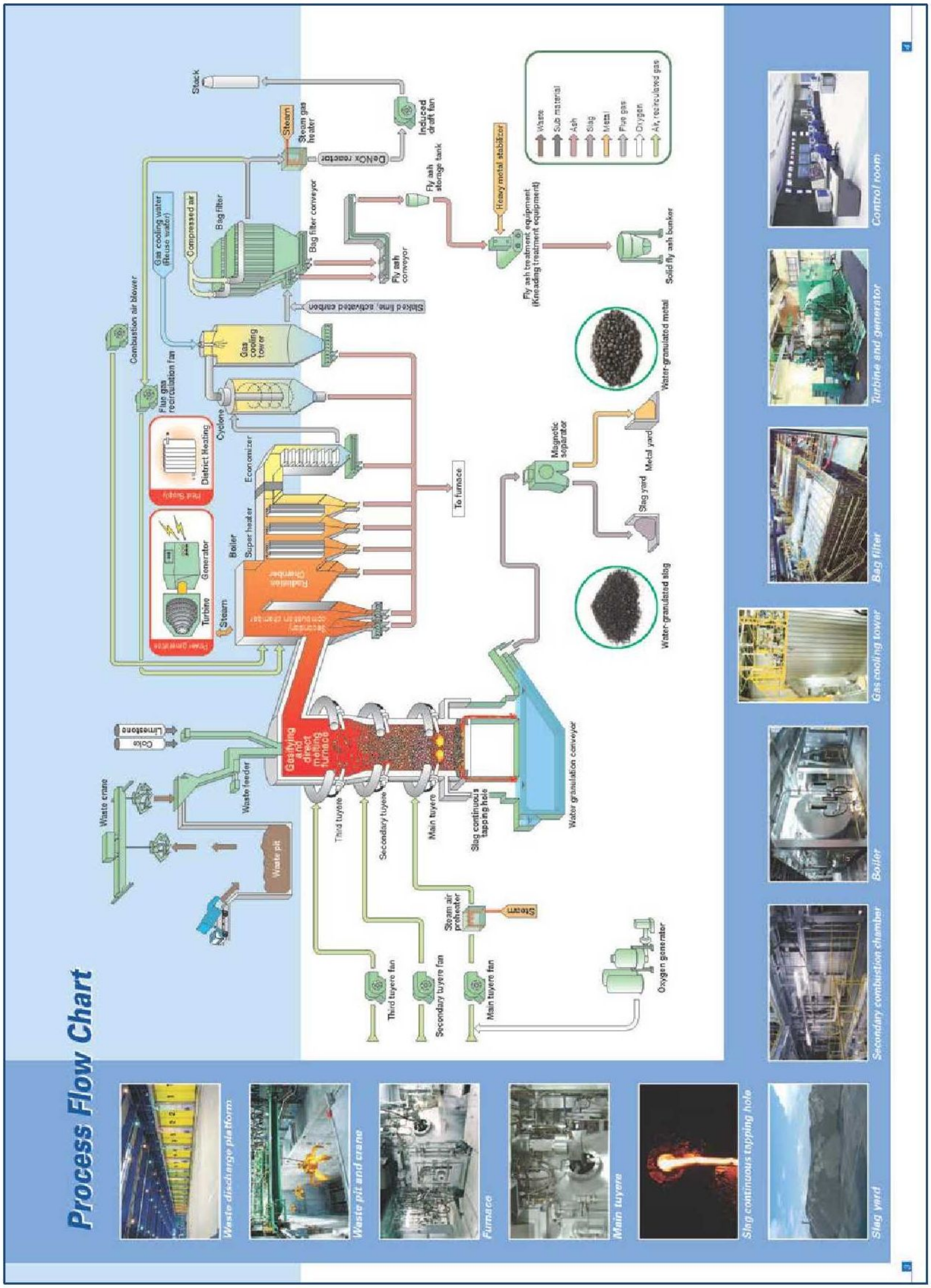
Anaerobic Digestion and Composting: The anaerobic digestion and composting module component is based on a wet anaerobic digestion technology employed at numerous operating facilities in Europe and Asia. The resulting biogas is utilized onsite for the generation of energy via an internal combustion combined heat and power system. In selecting the model anaerobic digestion process for the study, the Project Team reviewed proposed CalRecycle regulations for digestate/compost land application standards.[2] This review helped to select a process that would produce digestate and compost that would meet proposed physical contamination limits, which specifies that compost shall not contain more than 0.1 percent by weight of physical contaminants greater than four millimeters.

Thermal Gasification and Ash Melting: The high temperature thermal gasification and ash melting module component is based on existing market leader thermal gasification technologies in commercial use in Japan (see process flow diagram in Figure 3).

In Japan, the ash from these gasification units is usually melted (vitrified) to produce recyclable byproducts. For this study analysis of GHG emissions, gasification with ash melting technology was chosen because it maximizes diversion from landfill. Although ash melting requires additional energy for the melting, quenching and slag separation process, the resultant vitrified ash can potentially be recycled for use as paving blocks, road base, and other construction materials, with the metal slag also potentially recycled as raw material (e.g., aggregate for concrete blocks, tiles, road base) which are uses approved in Japan. The material specifications would need to be tested in the U.S. for meeting U.S. standards.

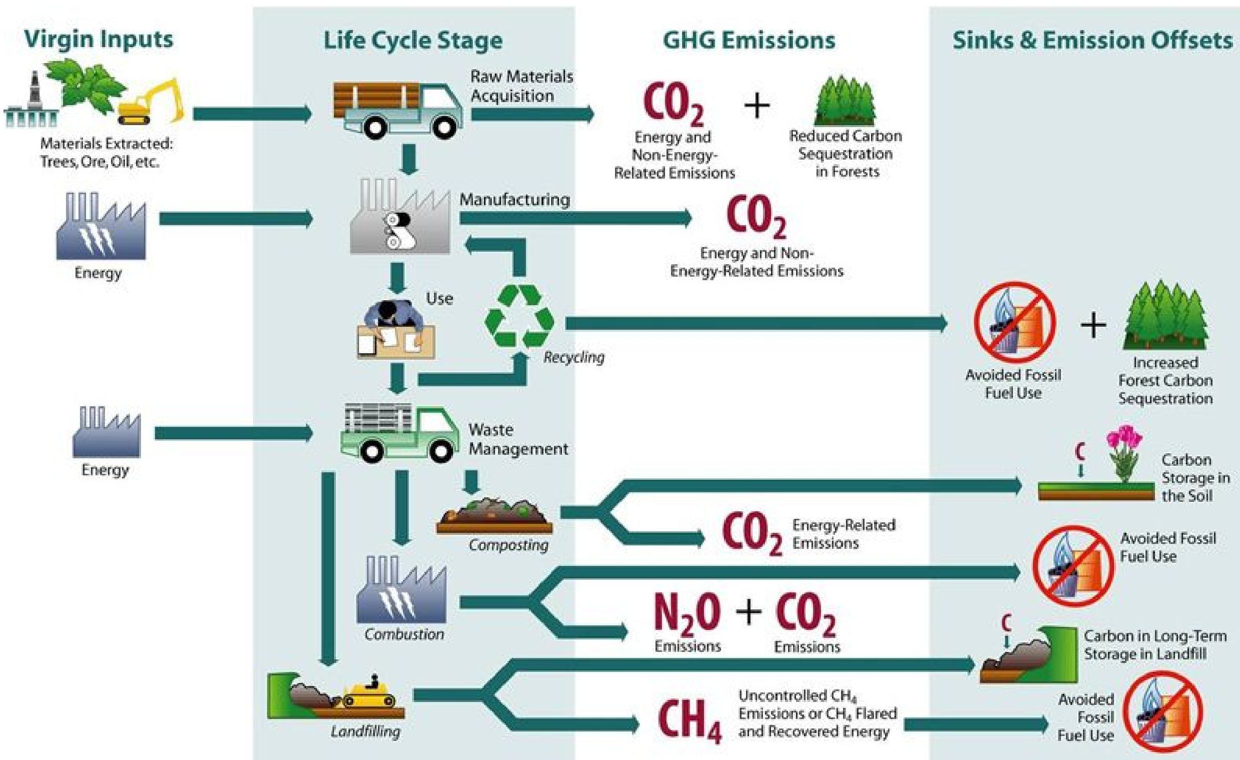
[2] http://www.calrecycle.ca.gov/Laws/Rulemaking/Compost/DraftText3.pdf

Figure 3: Process Flow Chart for High Temperature Gasification and Ash Melting



As discussed above, the primary focus for an Integrated MRF with Conversion Technologies approach is driven by the State of California's focus on GHG emissions reduction from solid waste management systems. The following Figure 4 presents the life cycle stages of material and solid waste management starting with extraction from the earth of virgin materials through material acquisition, manufacturing, human use and management of waste products. For each life cycle stage, Figure 4 shows GHG emissions generation, sinks, and emissions offsets associated with material acquisition, manufacturing, recycling, composting, combustion and landfilling.

Figure 4: Life Cycle of Materials



Source: USEPA, State and Local Climate and Energy Program, Solid Waste & Materials Management

In summary, the study's model Integrated MRF with Conversion Technologies combines proven technologies for individual wet fraction (anaerobic digestion/composting) and dry fraction (thermal gasification) process components, organized to reflect the most modern European Union system approach. The modeled facility technically embodies the new waste management hierarchy and the "MRF First" Policy approach to reduce GHG emissions, optimize highest and best use of materials and maximize landfill diversion.

PART II: DATA SOURCES AND METHODOLOGY

SECTION 2: DATA SOURCES AND CALCULATION METHODOLOGY

Various sources of data and modeling techniques were used to estimate the total GHG emissions (biogenic and non-biogenic sources) for the two scenarios examined in this study.

For the landfill transport and disposal (baseline) scenario, various industry-accepted models were used to calculate GHG emissions for transport (Air Resources Board -developed EMFAC2011 model), landfill operations (CalEEMod), and buried refuse (U.S. EPA LandGEM model), as further discussed in Section 4 and in Appendix 1. The global warming potential (GWP) factor in these models were updated to reflect the most current values (at the time of the analysis in 2013) stated in the IPCC, Fifth Assessment Report, Climate Change 2013, The Physical Science Basis.[3] Avoided emissions calculations (for recovered energy) that reflect California-specific factors for avoided emissions in the various models were also used.[4]

Two widely used GHG emissions modeling tools for comparing waste management options were used for the Alternative Scenario: the U.S. EPA's Waste Reduction Model (WARM) and the *Entreprises pour l'Environment* (EpE) tool. Limitations on these analytical tools are that WARM does not have emissions factors for anaerobic digestion, neither model has emissions factors for gasification and ash melting and neither model could apply the IPCC Fifth Assessment Report GWP factors or California grid-specific emissions factors. To estimate the GHG impacts associated with the avoided electricity-related emissions, the material specific emission factors for the Pacific region utility mix were extracted from the WARM model and calculations were performed via a spreadsheet outside of WARM.

The Project Team used the applicable component parts of the various analytical tools. For gasification, the technology facility operator provided emissions calculations based on the reference dry fraction waste composition (further discussed in Section 3) and on actual plant operation experience from a reference facility in Japan. Information provided by the operating reference facility in Japan was reviewed, assessed, vetted, and compared with the WARM results independently developed by Project Team members (included in Appendix 2). WARM had emissions factor estimators for "incineration" and was used to cross-check vetted emissions calculations for gasification provided by the facility operator.

The assumptions, various data sources, and the models used to calculate the GHG emissions are further discussed in Part III of this study. Detailed calculations for the GHG emissions are provided in the Appendices.

[3] http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_All.pdf
[4] http://cfpub.epa.gov/egridweb/ghg.cfm - eGRID2007 Version 1.1 Year 2005 GHG Annual Output Emission Rates

SECTION 3: COMPOSITION OF POST-RECYCLED RESIDUALS FROM MIXED WASTE MRF

The mixed-waste MRF residuals composition is based on the CalRecycle Statewide Study completed in 2006 for that specific waste composition. This composition reflects a statewide average composition of post-recycled residuals from a mixed waste or "dirty" MRF (after being source separated curb-side) going to landfill disposal.[5]

This composition was selected because it was the latest published statewide data available from CalRecycle at the time the study was initiated in 2013 that represents the waste characterization of "post-recycled" residuals (marketable recyclables recovered in a mixed waste MRF after curb-side source separation), and reflects the State's "MRF First" Policy. CalRecycle recently updated their statewide waste characterization titled 2014 Disposal-Facility-Based Characterization of Solid Waste in California, dated November 4, 2015. With additional pre-processing, recyclables previously missed in curb-side recycling or at the mixed waste MRF can be recovered from the waste stream currently bound for disposal. Table 1 shows the California statewide waste composition study results.

Using the CalRecycle statewide waste composition data, the 1,000 tpd of post-recycled mixed waste MRF residuals composition was further separated into its major fractions to be optimized for further processing. The major fractions include the following:

- Wet fraction ("DC" for digestible component)
- Dry fraction ("RDF" for refuse-derived fuel)
- Landfill (non-processable/non-acceptable materials)
- Rejects (problematic materials)

The wet fraction refers to the organic residuals from the mixed waste MRF, not all of which are digestible. It does not refer to previously source separated materials which are already being composted and/or digested. The dry fraction consists of non-recyclable, non-digestable and non-compostable materials (e.g. plastics, composite paper materials).

In calculating GHG emissions for thermal treatment, the Project Team took into account the statistical variation of the waste composition and calculated average, lower-bound, and upper-bound emissions for GHG (see Appendix 7). The composition by material type and quantity for the major fractions is shown in Table 2.

The detailed composition for each process fraction was developed in conjunction with the process flow shown previously in Figure 2. The composition took into consideration the CalRecycle mixed waste MRF residuals (by material type) composition resulting from the

[5] http://www.calrecycle.ca.gov/Publications/Detail.aspx?PublicationID=1182

additional processing of the mixed waste feedstock as the materials sequentially move from one unit process to the next. The waste stream splits, and the resulting composition, identified by individual material type and quantity in each of the major fractions, is based on the operating experience of actual facilities and equipment manufacturers. This data was used as input to the various models utilized for calculating GHG emissions as further discussed in Part III of this study.

Table 1: CalRecycle Residuals Composition for California Mixed Waste MRFs

Table 18 - Estimated Residual Composition for California MRFs Receiving Mixed Waste, 2005

	Est. Pct.	+/-	Est. Tons
Paper	**33.1%**	**1.8%**	**2,213,130**
Uncoated Corrugated Cardboard	4.3%	0.4%	284,205
Paper Bags/Kraft	0.7%	0.1%	45,834
Newspaper	4.2%	0.5%	278,891
White Ledger	1.8%	0.3%	120,169
Colored Ledger	0.2%	0.0%	13,761
Computer Paper	0.0%	0.0%	1,676
Other Office Paper	2.5%	0.3%	166,522
Magazines/Catalogs	2.5%	0.4%	163,624
Phone Books/Directories	0.2%	0.1%	12,360
Other Misc. Paper	4.7%	0.4%	310,598
Remainder/Composite Paper	12.2%	1.1%	815,491
Glass	**1.9%**	**0.3%**	**128,415**
Clear Glass Bottles & Containers	0.8%	0.2%	54,896
Green Glass Bottles & Containers	0.2%	0.1%	15,722
Brown Glass Bottles & Containers	0.2%	0.1%	11,930
Other Colored Glass Bottles & Containers	0.0%	0.0%	519
Flat Glass	0.1%	0.0%	3,497
Mixed Cullet	0.4%	0.1%	25,861
Remainder/Composite Glass	0.2%	0.1%	15,991
Metal	**5.6%**	**0.8%**	**372,659**
Tin/Steel Cans	1.1%	0.2%	74,031
Major Appliances	0.2%	0.1%	10,799
Used Oil Filters	0.0%	0.0%	305
Other Ferrous	2.0%	0.5%	136,782
Aluminum Cans	0.3%	0.0%	18,331
Other Non-Ferrous	0.7%	0.2%	49,703
Remainder/Composite Metal	1.2%	0.3%	82,706
Electronics	**1.1%**	**0.3%**	**73,259**
Brown Goods	0.3%	0.1%	20,966
Computer-related Electronics	0.4%	0.1%	23,838
Other Small Consumer Electronics	0.4%	0.1%	28,122
TV's & Other CRTs	0.0%	0.0%	333
Plastic	**16.9%**	**1.1%**	**1,127,866**
PETE Bottles	0.7%	0.1%	43,746
Other PETE Containers	0.1%	0.0%	9,710
HDPE Natural Bottles	0.3%	0.1%	19,636
HDPE Colored Bottles	0.3%	0.1%	17,303
HDPE 5-gallon buckets (Food)	0.1%	0.0%	4,852
HDPE 5-gallon buckets (Non-Food)	0.3%	0.1%	21,262
Other HDPE Containers	0.1%	0.0%	6,097
#3-#7 Bottles	0.1%	0.0%	6,863
Other #3-#7 Containers	0.8%	0.1%	53,697
Plastic Trash Bags	1.3%	0.2%	87,248
Grocery/Merch. Bags	1.1%	0.2%	76,432
Non-bag Comm./Ind. Packaging Film	1.8%	0.4%	117,378
Film Products	0.1%	0.1%	8,592
Other Film	3.7%	0.4%	246,411
Durable Plastic Items	1.2%	0.2%	80,524
Remainder/Composite Plastic	4.9%	0.5%	328,115

	Est. Pct.	+/-	Est. Tons
Organic	**27.3%**	**2.4%**	**1,825,548**
Food	10.4%	1.3%	691,353
Leaves and Grass	7.9%	1.9%	530,628
Prunings & Trimmings	1.0%	0.3%	63,914
Branches & Stumps	0.3%	0.1%	22,940
Agricultural Crop	0.0%	0.0%	2,710
Manures	0.0%	0.0%	1,879
Textiles	2.4%	0.4%	163,550
Carpet	0.3%	0.1%	22,798
Remainder/Composite Organics	4.9%	0.7%	325,776
Construction & Demolition	**12.6%**	**2.0%**	**839,302**
Concrete	0.6%	0.2%	41,868
Asphalt Paving	0.0%	0.0%	215
Asphalt Roofing	0.2%	0.1%	12,605
Lumber	3.1%	0.6%	204,749
Treated Wood Waste	1.9%	0.4%	127,948
Gypsum Board	0.8%	0.3%	52,064
Rock, Soil, Fines	3.2%	0.6%	216,690
Remainder/Composite C&D	2.7%	0.8%	183,161
Household Hazardous Waste	**0.4%**	**0.1%**	**25,022**
Paint	0.0%	0.0%	1,232
Vehicle & Equip. Fluids	0.0%	0.0%	0
Used Oil	0.0%	0.0%	459
Batteries	0.3%	0.1%	19,319
Remainder/Composite HHW	0.1%	0.0%	4,012
Special Waste	**0.5%**	**0.4%**	**36,442**
Ash	0.0%	0.0%	1,111
Sewage Solids	0.0%	0.0%	0
Industrial Sludge	0.0%	0.0%	0
Treated Medical Waste	0.0%	0.0%	90
Bulky Items	0.0%	0.0%	0
Tires	0.0%	0.0%	1,566
Remainder/Composite Special Waste	0.5%	0.2%	33,675
Mixed Residue	**0.5%**	**0.2%**	**36,508**
Totals	**100.0%**		**6,678,151**
Sample count:	**120**		

Notes: Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.
Estimated Percentages calculated by weight as the average proportion of each material type to the total residual weight

Source: http://www.calrecycle.ca.gov/WasteChar/WasteStudies.htm#2006MRF

Table 2: Residuals Composition by Material Type and Quantity

Work Days/Year	365	Important Note: Lower and Upper Bounds for Major Materials and Total Are the Sum of Detailed Materials, Not Separately Calculated Bounds.		AVERAGE					UPPER AND LOWER BOUND				
Short Tons/Day	1000			Process Category (Daily Short Tons)					Lower/Upper 90% Bound (Daily Short Tons)				
Material Group	Material	TOTAL PERCENT	TOTAL DAILY TONS	Recyclables	DC	RDF	Landfill	Reject	Recyclables	DC	RDF	Landfill	Reject
Paper		**33.1%**	**331.4**	**4.6**	**49.7**	**277.1**	**0.0**	**0.0**	**4.1 - 5.0**	**44.6 - 54.8**	**248.4 - 305.8**	**0.0 - 0.0**	**0.0 - 0.0**
1	OCC (Recyclable)/Kraft	4.9%	49.4	2.0	7.4	40.0	0.0	0.0	1.8 - 2.1	6.8 - 8.0	36.7 - 43.4	0.0 - 0.0	0.0 - 0.0
2	Newspaper	4.2%	41.8	1.3	6.3	34.2	0.0	0.0	1.1 - 1.4	5.5 - 7.0	30.1 - 38.3	0.0 - 0.0	0.0 - 0.0
3	High Grade Office Paper	4.5%	45.2	1.4	6.8	37.1	0.0	0.0	1.2 - 1.5	6.1 - 7.4	33.6 - 40.6	0.0 - 0.0	0.0 - 0.0
4	Mixed Recyclable Paper	7.3%	72.9	0.0	10.9	61.9	0.0	0.0	0.0 - 0.0	10.1 - 11.8	57.0 - 66.8	0.0 - 0.0	0.0 - 0.0
5	Compostable Paper	8.9%	89.0	0.0	13.4	75.7	0.0	0.0	0.0 - 0.0	11.9 - 14.8	67.7 - 83.6	0.0 - 0.0	0.0 - 0.0
6	Non-Recyclable Paper	3.3%	33.1	0.0	5.0	28.1	0.0	0.0	0.0 - 0.0	4.1 - 5.8	23.3 - 33.0	0.0 - 0.0	0.0 - 0.0
Plastic		**16.9%**	**168.9**	**6.1**	**2.0**	**153.0**	**7.5**	**0.3**	**5.0 - 7.2**	**1.8 - 2.2**	**139.3 - 166.7**	**6.8 - 8.2**	**0.2 - 0.3**
7	#1 PET Bottles/Containers (Deposit)	0.7%	6.6	2.9	0.0	3.6	0.0	0.0	2.5 - 3.4	0.0 - 0.0	3.1 - 4.2	0.0 - 0.0	0.0 - 0.0
8	#1 PET Bottles/Containers (Non-Deposi	0.1%	1.5	0.7	0.0	0.8	0.0	0.0	0.7 - 0.7	0.0 - 0.0	0.8 - 0.8	0.0 - 0.0	0.0 - 0.0
9	#2 HDPE Bottles	0.6%	5.5	2.5	0.0	3.0	0.0	0.0	1.9 - 3.1	0.0 - 0.0	2.3 - 3.8	0.0 - 0.0	0.0 - 0.0
10	Other Bottles/Containers	1.4%	13.9	0.0	0.0	12.2	1.4	0.3	0.0 - 0.0	0.0 - 0.0	11.0 - 13.5	1.2 - 1.5	0.2 - 0.3
11	Plastic Film/Wrap	8.0%	80.3	0.0	2.0	78.3	0.0	0.0	0.0 - 0.0	1.8 - 2.2	72.0 - 84.5	0.0 - 0.0	0.0 - 0.0
12	Other Plastic Products	6.1%	61.2	0.0	0.0	55.1	6.1	0.0	0.0 - 0.0	0.0 - 0.0	50.2 - 59.9	5.6 - 6.7	0.0 - 0.0
Metals		**5.4%**	**54.2**	**37.5**	**0.2**	**5.8**	**10.6**	**0.0**	**29.3 - 45.8**	**0.2 - 0.3**	**4.5 - 7.2**	**8.2 - 12.9**	**0.0 - 0.0**
13	Aluminum Cans (Deposit)	0.3%	2.7	2.1	0.0	0.1	0.5	0.0	2.1 - 2.1	0.0 - 0.0	0.1 - 0.1	0.5 - 0.5	0.0 - 0.0
14	Aluminum Cans (Non-Deposit)	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
15	Tin Cans	1.1%	11.1	8.3	0.0	0.6	2.2	0.0	6.8 - 9.8	0.0 - 0.0	0.5 - 0.7	1.8 - 2.6	0.0 - 0.0
16	Other Ferrous Metals	2.0%	20.5	15.4	0.0	1.0	4.1	0.0	11.6 - 19.1	0.0 - 0.0	0.8 - 1.3	3.1 - 5.1	0.0 - 0.0
17	Other Non-Ferrous Metals	0.7%	7.4	5.6	0.0	0.4	1.5	0.0	4.1 - 7.1	0.0 - 0.0	0.3 - 0.5	1.1 - 1.9	0.0 - 0.0
18	Mixed Metals/Other Materials	1.2%	12.4	6.2	0.2	3.7	2.2	0.0	4.7 - 7.7	0.2 - 0.3	2.8 - 4.6	1.7 - 2.8	0.0 - 0.0
Glass		**1.9%**	**19.2**	**2.2**	**0.2**	**0.0**	**16.8**	**0.0**	**1.6 - 2.9**	**0.1 - 0.2**	**0.0 - 0.0**	**12.6 - 21.0**	**0.0 - 0.0**
19	Glass Bottles/Containers (Deposit)	0.8%	8.2	1.5	0.0	0.0	6.7	0.0	1.1 - 1.8	0.0 - 0.0	0.0 - 0.0	5.1 - 8.4	0.0 - 0.0
20	Glass Bottles/Containers (Non-Deposit)	0.4%	4.2	0.8	0.0	0.0	3.5	0.0	0.5 - 1.0	0.0 - 0.0	0.0 - 0.0	2.3 - 4.6	0.0 - 0.0
21	Other Glass	0.7%	6.8	0.0	0.2	0.0	6.6	0.0	0.0 - 0.0	0.1 - 0.2	0.0 - 0.0	5.2 - 8.0	0.0 - 0.0
Inorganics		**7.6%**	**75.9**	**0.0**	**0.0**	**9.7**	**66.2**	**0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**8.3 - 11.1**	**52.5 - 79.8**	**0.0 - 0.0**
22	Other C&D	4.8%	48.4	0.0	0.0	9.7	38.7	0.0	0.0 - 0.0	0.0 - 0.0	8.3 - 11.1	33.1 - 44.4	0.0 - 0.0
23	Ceramics	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
24	Miscellaneous Inorganics	2.7%	27.4	0.0	0.0	0.0	27.4	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	19.4 - 35.4	0.0 - 0.0
Durables		**0.2%**	**1.6**	**0.0**	**0.0**	**0.0**	**1.6**	**0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**0.6 - 2.6**	**0.0 - 0.0**
25	Electrical/Household Appliances	0.2%	1.6	0.0	0.0	0.0	1.6	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.6 - 2.6	0.0 - 0.0
26	Furniture	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
27	Mattresses	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
Green Waste		**8.9%**	**89.0**	**0.0**	**71.2**	**17.8**	**0.0**	**0.0**	**0.0 - 0.0**	**55.8 - 86.6**	**14.0 - 21.7**	**0.0 - 0.0**	**0.0 - 0.0**
28	Green/Yard Waste	8.9%	89.0	0.0	71.2	17.8	0.0	0.0	0.0 - 0.0	55.8 - 86.6	14.0 - 21.7	0.0 - 0.0	0.0 - 0.0
Wood		**5.3%**	**53.3**	**0.0**	**19.9**	**33.3**	**0.0**	**0.0**	**0.0 - 0.0**	**15.9 - 23.9**	**26.3 - 40.3**	**0.0 - 0.0**	**0.0 - 0.0**
29	Untreated Wood	3.1%	30.7	0.0	12.3	18.4	0.0	0.0	0.0 - 0.0	9.9 - 14.7	14.8 - 22.0	0.0 - 0.0	0.0 - 0.0
30	Treated Wood	1.9%	19.2	0.0	7.7	11.5	0.0	0.0	0.0 - 0.0	6.1 - 9.3	9.1 - 13.9	0.0 - 0.0	0.0 - 0.0
31	Pallets	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
32	Stumps	0.3%	3.4	0.0	0.0	3.4	0.0	0.0	0.0 - 0.0	0.0 - 0.0	2.4 - 4.4	0.0 - 0.0	0.0 - 0.0
Organics		**18.1%**	**180.9**	**0.0**	**159.2**	**21.7**	**0.0**	**0.0**	**0.0 - 0.0**	**137.9 - 180.5**	**18.0 - 25.4**	**0.0 - 0.0**	**0.0 - 0.0**
33	Food	10.4%	103.5	0.0	103.5	0.0	0.0	0.0	0.0 - 0.0	90.5 - 116.5	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
34	Disposable Diapers	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
35	Textiles and Leathers	2.4%	24.5	0.0	9.8	14.7	0.0	0.0	0.0 - 0.0	8.2 - 11.4	12.3 - 17.1	0.0 - 0.0	0.0 - 0.0
36	Rubber	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
37	Carpet	0.3%	3.4	0.0	1.4	2.0	0.0	0.0	0.0 - 0.0	1.0 - 1.8	1.4 - 2.6	0.0 - 0.0	0.0 - 0.0
38	Miscellaneous Organics	4.9%	49.5	0.0	44.5	4.9	0.0	0.0	0.0 - 0.0	38.2 - 50.8	4.2 - 5.6	0.0 - 0.0	0.0 - 0.0
HHW/Special Waste		**1.2%**	**11.8**	**0.0**	**0.0**	**0.0**	**0.0**	**11.8**	**0.0 - 0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**8.9 - 14.6**
39	Pesticides/Herbicides	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
40	Paints/Adhesives/Solvents	0.0%	0.2	0.0	0.0	0.0	0.0	0.2	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.2 - 0.2
41	Household Cleaners	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
42	Automotive Products	0.0%	0.1	0.0	0.0	0.0	0.0	0.1	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.1 - 0.1
43	Other HHW/Special Waste	1.2%	11.5	0.0	0.0	0.0	0.0	11.5	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	8.7 - 14.4
Problem Materials		**1.4%**	**13.9**	**0.0**	**0.0**	**0.0**	**0.0**	**13.9**	**0.0 - 0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**0.0 - 0.0**	**9.9 - 17.9**
44	Batteries	0.3%	2.9	0.0	0.0	0.0	0.0	2.9	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	1.9 - 3.9
45	Lead-Acid Batteries	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
46	CRTs	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
47	Other Computer Equipment	0.4%	3.6	0.0	0.0	0.0	0.0	3.6	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	2.6 - 4.6
48	Cell Phones	0.4%	4.2	0.0	0.0	0.0	0.0	4.2	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	3.2 - 5.2
49	Other Electronics	0.3%	3.1	0.0	0.0	0.0	0.0	3.1	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	2.1 - 4.1
50	Mercury Containing Products	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
51	Sharps	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
TOTAL		**100.0%**	**1,000.0**	**50.4**	**302.5**	**518.4**	**102.7**	**25.9**	**40.1 - 60.8**	**256.4 - 348.6**	**458.8 - 578.1**	**80.9 - 124.6**	**19.1 - 32.8**
	Process Percent			**5.0%**	**30.2%**	**51.8%**	**10.3%**	**2.6%**					

PART III: EMISSIONS ANALYSES AND ASSUMPTIONS

SECTION 4: GHG EMISSIONS ANALYSIS FOR BASELINE SCENARIO – LANDFILL TRANSPORT AND DISPOSAL

Emissions calculated for the landfill transport and disposal operation included three sources of emissions: (1) refuse transportation truck-related emissions; (2) emissions from equipment used in daily landfill disposal operations (e.g., compacting, etc.); and (3) emissions from buried waste. Methodologies for estimating GHG emissions from each source are described below and in more detail in Appendix 1.

Refuse Transportation Truck Emissions

California state and local governments use the Air Resources Board (ARB)-developed EMFAC2011 model to calculate emissions from on-road vehicles. The California Emissions Estimator Model (CalEEMod), developed collectively by air districts throughout California, incorporates EMFAC2011 in its module to calculate emissions from on-road vehicles and off-road equipment. CalEEMod is used as a uniform platform to quantify potential criteria pollutants and GHG emissions associated with construction and operations from various statewide land uses. The model quantifies direct emissions from construction and operations (including vehicle and off-road equipment use), as well as indirect emissions such as GHG emissions from energy use, solid waste disposal, vegetation planting and/or removal, and water use. The CalEEMod model considers future truck fleets with better emissions controls, such as using alternative fuel or low carbon fuel to power refuse transport trucks.

Landfill Disposal Emissions

The CalEEMod model was also used to estimate emissions from landfill operations such as construction of landfill cells and daily cover operations. The model includes future landfill equipment with better emissions controls.

The following assumptions were used in the analysis of emissions from refuse transfer truck trips and landfill operation:

- Project period: 1/1/2014 – 12/31/2038 (25 years)
- Work day: 7 days per week
- Amount of refuse to landfill: 1,000 tons per day
- Average trip distance for refuse (based on average distance to closest out-of-County landfills in Ventura, San Bernardino, Riverside, and Orange counties) and worker vehicles: 47 miles/one way trip
- Number of daily trucks: 45 trucks
- Daily acreage of landfill disturbed: 1 acre
- Equipment used in landfill operations: 1 loader, 1 scraper, 1 water truck, 1 bulldozer, and 2 compactors

Buried Refuse Emissions

The major sources of GHG emissions are the landfill gases generated from decomposition of buried refuse. In this study, the U.S. EPA LandGEM model (v3.02) was used to estimate GHG emissions from the disposal of 1,000 tpd of refuse over a 25-year period. LandGEM is based on a first-order decomposition rate equation to estimate annual gas generation. The model is recommended by the U.S. EPA as documented in the Climate Leader Greenhouse Gas Inventory Protocol "Direct Emissions from Municipal Solid Waste Landfilling, October 2004."

The various input factors for LandGEM were based on values specifically used for local Southern California landfills, not national averages, to better represent the emissions of biogenic and non-biogenic carbon dioxide (CO_2) and methane (CH_4). The GWP factor in the LandGEM model was updated to reflect the most current values (at the time of the analysis in 2013) stated in the IPCC, Fifth Assessment Report. Landfill emissions for the Baseline Scenario were calculated for the 1,000 tpd of post-recycled residuals from a mixed waste MRF disposed for 25 years, plus an additional 100 years to account for the long-term decomposition of the buried waste due to a low decay factor in Southern California's arid weather conditions. The decay factor is influenced by the amount of moisture/water in refuse when buried which is affected by rainfall (low for Southern California) during disposal operations.

The following assumptions were used in the analysis:

- Project period: 1/1/2014 – 12/31/2138 (125 years)
- Methane generation rate (k): 0.020 year-1, based on a Southern California case
- Potential methane generation capacity (Lo): 100 m3/Mg (USEPA and CARB GHG inventory methodologies default value)
- Non-methane organic compounds (NMOC) concentration: 600 ppmv as Hexane
- Methane content: 50% v/v
- Landfill cap methane oxidation rate: 10%
- Landfill gas capture efficiency: 83% (CARB default value)

Assumptions for input factors to LandGEM can vary for every landfill depending on site specific conditions for type and composition of waste and landfill gas system efficiency. An analysis of a second LFG-to-energy scenario using a higher methane generation capacity (L_o) of 114 m3/Mg (site specific value) and a lower landfill gas capture efficiency of 70% was conducted to assess the model sensitivity of estimated GHG emissions. The results showed a total of net emissions of approximately 3.88 million metric tons of CO_2 equivalent, whereas, the Baseline Scenario analysis was estimated to generate 1.64 million metric tons of CO_2 equivalent. The use of a higher Lo and a lower gas capture efficiency contributed to a much higher estimate of overall GHG emissions. Detailed data of the second analysis, landfill with LFG-to-energy, can be found in Appendix 1.

The analysis also included two simulated scenarios for GHG emissions:

- Scenario one: Landfill with cap and flare
- Scenario two: Landfill with cap and LFG-to-energy facility, which was assumed to be 7.65 MW capacity (see Appendix C of Appendix 1 for emissions factor assumptions)

The results of the Baseline Scenario GHG emissions analysis are presented in Part IV of this study (scenario two) and in Appendix 1.

SECTION 5: GHG EMISSIONS ANALYSIS FOR ALTERNATIVE SCENARIO – INTEGRATED MRF WITH CONVERSION TECHNOLOGIES

Overview of GHG Emissions Modeling

A combination of models and actual facility processing engineering data was utilized to calculate the GHG emissions for the Integrated MRF with Conversion Technologies. The Entreprises pour l'Environment "Protocol for the Quantification of Greenhouse Gases Emissions from Waste Management Activities", Version 4.0 – June 2010 (EpE), and the U.S. EPA's Waste Reduction Model WARM were utilized. Actual facility emissions data and process engineering modeling from a commercially operating thermal gasification facility were also utilized. This approach was necessary because no single GHG emissions calculation model was able to address all of the GHG emissions of the various components of the study's model Integrated MRF with Conversion Technologies.

The WARM model does not calculate GHG emissions for "preprocessing" or mechanical and biological pre-treatment nor does it have the capability of calculating the GHG emissions for anaerobic digestion or thermal processing by gasification. The EpE model has a module for the calculation of GHG emissions for "preprocessing" and a module for the calculation of GHG emissions for anaerobic digestion. Both models had GHG calculation modules for incineration, but no modules for GHG emissions calculation for thermal process by gasification and ash melting.

In order to enable the calculation of GHG emissions for all of the components which are part of the study's Integrated MRF with Conversion Technologies, it was necessary to deconstruct the WARM model and EpE model and utilize the individual GHG emissions modules for each of the operational components of the Integrated MRF with Conversion Technologies and then compile the individual operational components. Updated GWP factors were substituted for factors which had not been updated in the models.

In order to calculate the GHG emissions for the thermal gasification processing component of the study's Integrated MRF with Conversion Technologies, the reference California post-recycled mixed waste MRF residual composition data was used as the feedstock composition in a proprietary process engineering model from an existing commercial scale operating gasification reference facility.

This technical approach enabled the project team to calculate the GHG emissions of the various components of the Integrated MRF with Conversion Technologies on a feedstock specific basis (for California), and when combined with the transportation and landfill emissions calculations gave a reasonable estimate of the overall GHG emissions for purposes of comparing the Baseline and Alternative Scenarios.

Pre-Processing MRF, Anaerobic Digestion, and Composting Emissions

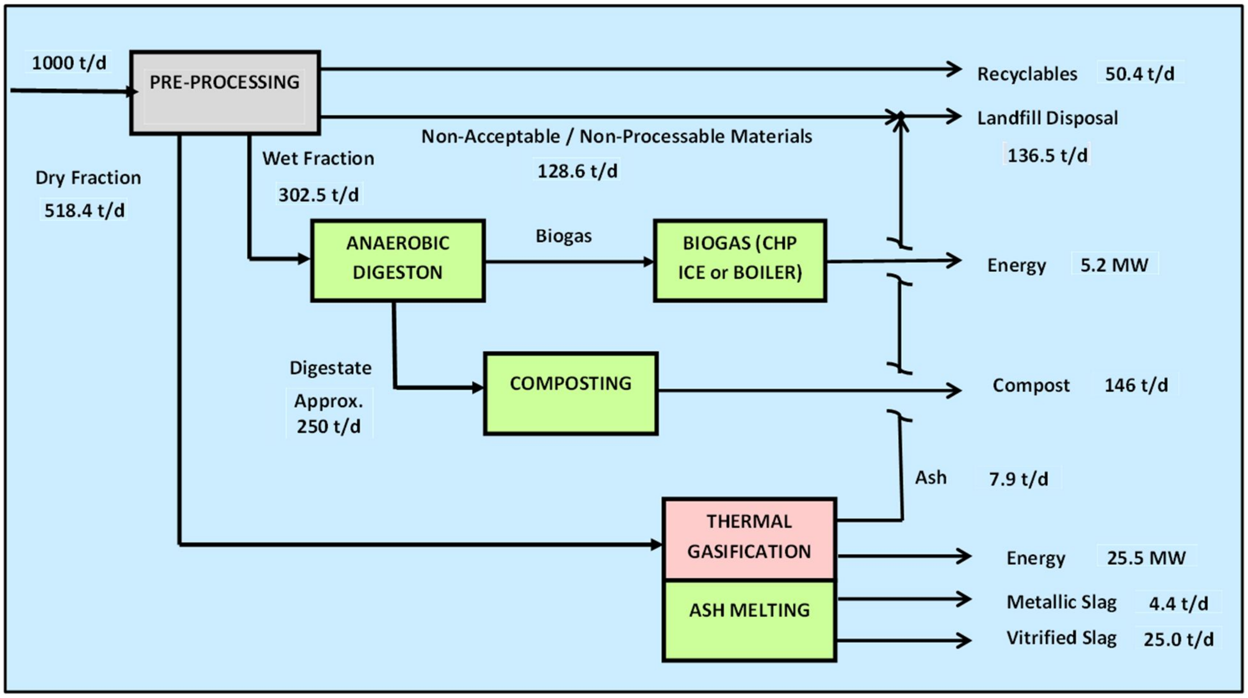
For the mechanical and biological process emissions calculations, a European-based commercial facility provided a full process flow diagram detailing the unit process equipment and the additional MRF processing of 1,000 tpd of post-recycled mixed waste MRF residuals based on the CalRecycle statewide composition. The specific MRF pre-processing unit equipment and process flow diagrams are included in Appendices 3 and 4. Project Team members reviewed and vetted this process flow diagram and concluded it best fit the study's model design, met current regulatory processing requirements, and proposed compost and digestate land application standards.

The front end pre-processing MRF was modeled to illustrate the recovery of additional recyclables from the mixed waste MRF residuals, remove non-processable materials, and separate the mixed waste stream into a wet fraction and a dry fraction. The readily digestible organic materials are concentrated in the wet fraction. The wet fraction was modeled to be further processed to remove inorganic materials and other non-readily digestible materials and potential contaminants that are further processed to become the feedstock for the anaerobic digestion process. The anaerobic digestion process selected for the study analysis is a traditional, wet low solids (12% to 15% solids) anaerobic digestion fermentation technology (with concrete tanks).

The dry fraction (along with the non-digestible materials from the wet fraction) was modeled to become the feedstock for the thermal gasification process. Digestate from the anaerobic digestion process is composted aerobically and assumed to be land-applied in Scenario 1 and gasified in Scenario 2. A second scenario was evaluated assuming no market for land application of compost. Scenario 1 is used in the study results presented in Section 7 and the results assuming Scenario 2 are included in Appendix 7. Scenario 2 is an option in which additional energy from the digestate is extracted. This scenario was provided as an alternative to the digestate to compost because the integrated waste management hierarchy places the compost option at a higher preferred waste management option. The ash from the thermal gasification process is assumed to be melted into a glassy slag for potential beneficial use. Metal is assumed to be recovered for recycling. A small amount of fly ash would be generated and may potentially be used to manufacture concrete (or disposed). Markets for these recyclables exist in Japan, and the specifications would have to meet standards in the U.S. for use as recyclable products.

For this study, the model process mass balance for the incoming 1,000 tpd of post-recycled mixed waste MRF residuals, and its allocation into wet and dry fractions in tpd, is shown in Figure 5 below.

Figure 5: Mass Balance of Integrated MRF with Conversion Technologies



Note: Mass balance presents general mass flow of tons of mixed waste MRF residuals material into system and resulting tonnage to disposal, recyclables, compost and slag. Mass Balance does not show input tons of coke, process water, chemicals, supplemental chemicals for emissions control and control of viscosity of slag, etc.

A summary of the EpE modeling results for the pre-processing MRF, anaerobic digestion, and composting processes are presented below in Table 3 as well as in Part IV of this study and in Appendix 5.

Table 3. Summary of the EpE Modeling Results for MRF Pre-Processing, Anaerobic Digestion and Composting (GHG emissions in MTCO2E)

Process	Total Emissions	Biogenic Emissions	Non-Biogenic Emissions	Avoided Emissions	Net Emissions (biogenic and non-biogenic)	Net Emissions (only non-biogenic emissions)
MRF pre-processing	0	-	-	1,646,938	(1,646,938)	(1,646,938)
Anaerobic Digestion (Digestate to Composting)	842,815	740,338	102,477	563,389	279,426	(460,912)
Composting of Digestate	342,436	177,942	164,493	9,667	332,768	154,826

Thermal Gasification Emissions

The dry fraction waste composition resulting from the pre-processing MRF was provided to the gasification facility operators and process design engineers to calculate the potential GHG emissions, recycled metal/slag, and energy, based on current operational RDF gasification facilities (summary of gasification technology and calculations included in Appendix 6). The gasification technology selected for comparison purposes was used, in part, due to the availability of very detailed mass, energy and emission data. It should be noted that the heat source for the gasifier is coke and coke combustion emissions are included in the GHG calculations. The use of other heat sources (i.e., wood biomass as charcoal) and air pollution control equipment that would have to meet South Coast Air Quality Management District (SCAQMD) requirements for a facility in Los Angeles County would likely result in lower GHG emissions.

The dry fraction waste composition makeup was separately reviewed by the Project Team using WARM (v12, February 2012) GHG model to provide an independent cross-check of the gasification facility operator's calculations of GHG emissions.

WARM accepts specific material categories, which did not always correspond directly to the RDF composition categories. To input the data, the RDF composition categories were assigned to WARM material categories listed in Table 2. For combustion, WARM accounts for GHG emissions generated by the waste management practice as well as the avoided electricity-related emissions resulting from electricity generated by the facility. WARM contains two options for estimating the avoided electricity-related emissions – a national average mix of electric generation or a state-specific mix. The California mix of electricity generation was used for this analysis. Facility operation was assumed at full capacity, 365 days per year for 25 years.

Since the main purpose of WARM is to allow for comparing various waste management options, it requires input of a Baseline and an Alternative Scenario. The Baseline Scenario (landfilling) was not utilized for the results presented in this study, but was required input for WARM. The reason it was not used for the Baseline Scenario is that the LandGEM model allows for customized variable input specific to Southern California and the WARM model does not allow for year-to-year variable calculations. The GHG emissions information used in this analysis corresponds to the WARM-calculated value for Total GHG Emissions from Alternative MSW Generation and Management.

For the purposes of this study, the following emissions definitions are used:

Direct Emissions – Emissions directly related to solid waste management activities. In this study, direct emissions are further divided into biogenic and non-biogenic [CO_2] emissions.

Biogenic [CO_2] Emissions – Emissions resulting from production, harvest, combustion, digestion, fermentation, decomposition, and processing of biologically based materials or biomass, such as combustion of biogas collected from biological decomposition of waste in landfills or combustion of the biological fraction of municipal solid waste or biosolids. Biogenic [CO_2] emissions are carbon neutral and have zero GHG impact.

Non-Biogenic [CO_2] Emissions – Emissions that are not considered biogenic CO_2 emissions, such as emissions from combustion of fossil fuels, of materials of fossil fuel origin (e.g., plastics) and from other non-combustion processes, such as fugitive methane emissions from landfill operation or oil and gas production. Methane emissions are not carbon neutral and regardless of source (biogenic or non-biogenic), are considered non-biogenic [CO_2] emissions in this study.

Indirect Emissions – Emissions from purchased electricity, heat, or steam.

Avoided Emissions – Emissions avoided due to displacing purchase of power generated by fossil-fuel combustion or from emissions avoided by recycling (e.g., reduction in emissions associated with processing virgin materials)

Total Emissions = biogenic + non-biogenic

Net Emissions = total emissions – avoided emissions

The net GHG emissions results calculated in this study are based on non-biogenic emissions (i.e., fugitive methane emissions from landfills and emissions from combustion of fossil fuels) pursuant to the Intergovernmental Panel on Climate Change (IPCC) guidelines, and industry accepted GHG models such as EPA Waste Reduction Model (WARM), European Union's EpE model and California Air Resources Board models. Biogenic emissions are not included in the study conclusions, as these emissions naturally cycle through the atmosphere by processes such as photosynthesis, and are therefore carbon neutral and do not impact GHG emissions.

The daily RDF to be gasified was input to WARM for each scenario and the results calculated. It should be noted that WARM only provides an emissions value for an incinerator. The WARM-calculated results are presented in Table 4 that provides results assuming anaerobic digestion digestate is not gasified but aerobically composted and land applied (due to that use being higher on the integrated waste management hierarchy). A second scenario analyzed for anaerobic digestion digestate being gasified (assuming no market availability for compost/land application) is included in Appendix 2. Scenario 2 provides additional GHG emission reduction due to additional offset of fossil fuels with energy extracted from the digestate. The results for the WARM estimated net GHG emissions for thermal gasification were compared to the reference facility data modeling results.

Table 4: Comparison of Reference Operating Facility and WARM Estimated Net GHG Emissions for Thermal Gasification, MTCO2E Over 25 Years

Table 4: DRY FRACTION ONLY TO GASIFICATION (Anaerobic Digestion Digestate Composted / Land Applied)						
Source	**Total Emissions**	**Biogenic Emissions**	**Non-Biogenic Emissions**	**Avoided Emissions**	**Net Emissions, Total**	**Net Emissions, Non-Biogenic**
Reference Operating Facility	7,728,236	4,537,816	2,987,587	1,668,485	6,059,751	1,521,935
WARM	8,178,161	4,019,707	4,158,454	2,726,834	5,451,327	1,431,620

After cross-checking the results, the Project Team determined that the reference gasification facility operator's emissions calculations were within an acceptable comparison range compared with the WARM results. Since the facility's calculations are based on actual plant operations, the Project Team used this data in the comparative analysis, as it most closely reflects the gasification technology assumed for this study (see results comparison and discussion in Part IV of this study). All of the reference operating gasification facility calculations are included in Appendix 6.

An additional preliminary emissions study using CalRecycle's defined feedstock was completed using operating data from another commercial facility in Europe for modeling the emissions that would result from 1,000 tpd being processed at an integrated MRF that includes recycling, anaerobic digestion, composting, and incineration. That study resulted in net negative emissions for direct emissions minus avoided emissions for an integrated MRF with recycling and conversion technologies and is available upon request.

An expanded summary table of all the GHG emissions calculations developed for this study is presented in Appendix 7.

SECTION 6: SUMMARY OF OTHER POLLUTANTS

In California, local air quality management districts or air pollution control districts are responsible for air quality in their respective jurisdictional areas. The study scenarios are assumed to be located in Los Angeles County, which is under the jurisdiction of the SCAQMD. SCAQMD's responsibilities include monitoring air pollution and promulgating rules and regulations that limit and permit the emissions of certain air pollutants. This study air emissions analysis included the following subset of pollutants regulated by SCAQMD: GHG, SO_2, NO_x, dioxins, and furans. Particulate matter (PM) pollutants were also considered but PM data was not available for each of the processes analyzed in this study comparative analysis. Appendix 1 includes PM calculations for the Baseline Scenario landfill transport and operations.

Landfill Transport and Operations

Emissions of criteria air pollutants and dioxins/furans from refuse transfer trucks, landfill operations, and flare or LFG-to-energy were calculated for the two landfill scenarios and landfilling of residuals from post-Integrated MRF with Conversion Technologies (included in Appendix 1). The results are summarized below in Table 5.

Table 5: Other Air Pollutant Emissions for the Baseline Scenario

[Treatment of 1,000 Tons per Day (for 25 Years) of Post-Recycled MRF Residuals
Emissions in metric tons (Years 2014 to 2138)]

TRANSPORTATION AND LANDFILL OPERATIONS (1,000 TPD)	**NO_x**	**SO_2**	**Dioxin/Furan**
Transportation to Landfill (25-yr Landfill Operation)	93	0.3	Not Available
Landfill Operations (with cap/flare) including transportation related emissions	255	45	1.72E-06
Landfill Operations (with cap/LFG-to-energy) including transportation related emissions	266	22	1.27E-06
LANDFILL OF POST-INTEGRATED MRF WITH CT RESIDUALS (136 TPD)	**NO_x**	**SO_2**	**Dioxin/Furan**
Transportation to Landfill (25-yr Landfill Operation)	12	0	Not Available
Landfill Operations (with cap/flare) including transportation related emissions	12	0	3.93E-09

Conversion Technology Facility

SO_2, NO_x, and dioxin/furan emissions are a function of the type of gasification and combustion processes that will be used, as well as the composition of the RDF. In lieu of estimating emissions for a specific type of gasification and combustion process, emissions information from various confidential vendor proposals and actual operating facilities was collected, reviewed, and used to calculate emissions estimates (four U.S. Demonstration Facilities and three Japanese Facilities), as shown in Tables 6 and 7. The four US Demonstration Facilities were projects that explored the use of gasification to process various feedstock sources and reflect companies that provided information in the context of remaining confidential to retain their process as proprietary. It should be noted that there is a wide variation in the values for these facilities used for comparison due to the different: 1) types of gasification technologies used, 2) capacities of the facilities, 3) air pollution control devices applied, and 4) feedstocks.

Table 6: Stack Test Data / Expected Emissions – U.S. EPA Typical Units

Pollutant	Units	Tokyo, Japan Facility	US Demo Facility 1	US Demo Facility 2	US Demo Facility 3	Chiba, Japan Facility	US Demo Facility 4	Japanese Reference Facility
NO_x (as NO_2)	ppm @ 7% O_2	7.8	6	12	11	5.2	92.6	57.7
SO_2	ppm @ 7% O_2	1.6	3	12	3	0.26	9.7	1.5
Dioxin/furan	ng/dscm @ 7% O_2	0.030	NA	2.2	NA	0.0007	NA	0.0050

NOTES:
NA = Not Available
ppm = parts per million, dry volume basis
d = dry
s = standard (20ºC – 68ºF, 1atm)
The USEPA currently regulates dioxin furan emissions from MWCs on a total mass basis rather than a TEQ basis. While there is no exact conversion factor between TEQ and total mass, EPA indicates that the 40 CFR Part 60, Subpart Eb limit of 13 ng/dscm total mass value corresponds to 0.1 to 0.3 ng/dscm TEQ. For purposes of this analysis, an average value of 0.2 ng/dscm TEQ corresponding to 13 ng/dscm total mass was used.
Where applicable, the ng/dscm values for NO_x and SO_2 were converted to ppm values using conversion factors from 40 CFR Part 60, Appendix A, Method 19.

Table 7: Stack Test Data / Expected Emissions – Mass in Metric Tons / 25 Years of Operation

Pollutant	Tokyo, Japan Facility	US Demo Facility 1	US Demo Facility 2	US Demo Facility 3	Chiba, Japan Facility	US Demo Facility 4	Japanese Reference Facility
NO_x (as NO_2)	441	339	678	622	294	5235	3261
SO_2	126	236	943	236	20	762	120
Dioxin/furan	8.87E-08	n/a	6.50E-05	n/a	2.07E-08	n/a	1.48E-07

The emissions information used was based on volume, parts per million dry volume (ppmdv) corrected to seven percent oxygen and nanograms per dry standard cubic meter ng/dscm corrected to seven percent oxygen). For this analysis, these concentration values were converted to mass emissions values. This was done using the concentration value, the anticipated RDF heat content (BTU/lb), and Equation 19-1 and the Fd factor for MSW combustion from Table 19-2 of 40 CFR Part 60, Appendix A-7, Method 19. Using the total stack flow for digestate to land application (composting) to calculate emissions amounts in metric tons from ppm, the results are shown above in Table 7 for comparison purposes.

Based on the four factors discussed above, the Japanese Reference Facility was judged to be the most representative of the type of facility being analyzed in this study. Tables 8 and 9 on the following pages show the emissions calculation method, using the Japanese Reference Facility emissions factors, for the two dry fraction scenarios: Scenario 1- anaerobic digestion digestate composted aerobically and land applied (not gasified); and Scenario 2 - anaerobic digestion digestate gasified. The Japanese Reference Facility was also used for the GHG analysis results presented in Table 4.

TABLE 8: SO_2, NO_x, Dioxin/Furan, and GHG Emissions
Scenario 1 - Anaerobic Digestion Digestate Land Applied

LA County
CT White Paper
Gasification Emission Calculations
Digestate to Land Application

Gasifier RDF Throughput:	519	tpd	Anaergia - "20131218_LA_County_-_BFD_(Scenario_2_-_Cake_to_Composting).pdf"
	4,735,875	tons over 25 year period	Based on 365 days per year operation
RDF Heat Content:	17.80	MJ/kg	JFE - "LQ1092_WB_A23_A000-001_MASS_BALANCE_r2.pdf"
	7659	Btu/lb	Calculated
Total Heat Input:	7950	MMBtu/day	Calculated
RDF F_d:	9570	dscf/MMBtu	40 CFR Part 60, Appendix A-7, Table 19-2, factor for MSW
Exhaust Flow:	114,395,087	dscf per day @ 7% O2	Calculated

					Emissions over 25 years of operation		
Pollutant	Emission Factors		lb/day*	lb/ton RDF	tons	lbs	metric tons
NOx	57.7	ppm @ 7% O2	788	1.52	3595		3261
SO2	1.5	ppm @ 7% O2	29.0	0.056	132.1		120
Dioxin/Furan	0.005	ng/dscm @ 7% O2	3.58E-08	6.90E-11		3.27E-04	1.48E-07
			metric tons/day	metric ton/ton RDF			
Net GHG as CO2e	WARM Output		157	0.302			1,431,620
Avoided GHG as CO2e	Calculated using WARM Avoided Pacific Utility Emissions		299	0.576			2,726,834
Nonbiogenic GHG as CO2e	Net GHG Plus Avoided GHG						4,158,454
Biogenic GHG as CO2e	Obtained from JFE Biogenic Calculations						4,019,707
Gross GHG as CO2e	Nonbiogenic Plus Biogenic						8,178,161

NOTES:
F_d = Volume of combustion components per unit of heat content, dry basis.
ppm = parts per million, dry volume basis
d = dry
s = standard (20°C - 68°F, 1 atm).
The GHG emissions estimated by WARM include only anthropogenic emissions of carbon dioxide.

* Calculated using conversion factors obtained from 40 CFR Part 60, Appendix A-7, Table 19-1.

TABLE 9: SO_2, NO_x, Dioxin/Furan, and GHG Emissions
Scenario 2 – Anaerobic Digestion Digestate Gasified

LA County
CT White Paper
Gasification Emission Calculations
Digestate to Gasifier

Gasifier RDF Throughput:	589	tpd	Anaergia - "20131213_LA_County_-_BFD_(Scenario_1_-_Cake_to_RDF).pdf"
	5,374,625	tons over 25 year period	Based on 365 days per year operation
RDF Heat Content:	17.00	MJ/kg	JFE - "LQ1092_WB_A23_A000-001_MASS_BALANCE_r2.pdf"
	7315	Btu/lb	Calculated
Total Heat Input:	8617	MMBtu/day	Calculated
RDF F_d:	9570	dscf/MMBtu	40 CFR Part 60, Appendix A-7, Table 19-2, factor for MSW
Exhaust Flow:	123,989,305	dscf per day @ 7% O2	Calculated

					Emissions over 25 years of operation		
Pollutant	Emission Factors		lb/day*	lb/ton RDF	tons	lbs	metric tons
NOx	57.7	ppm @ 7% O2	854	1.45	3896		3535
SO2	1.5	ppm @ 7% O2	31.4	0.053	143.2		130
Dioxin/Furan	0.005	ng/dscm @ 7% O2	3.88E-08	6.59E-11		3.54E-04	1.61E-07
			metric tons/day	metric ton/ton RDF			
Net GHG as CO2e	WARM Output		133	0.226			1,215,826
Avoided GHG as CO2e	Calculated using WARM Avoided Pacific Utility Emissions		327	0.555			2,981,608
Nonbiogenic GHG as CO2e	Net GHG Plus Avoided GHG						4,197,434
Biogenic GHG as CO2e	Obtained from JFE Biogenic Calculations						5,165,959
Gross GHG as CO2e	Nonbiogenic Plus Biogenic						9,363,393

NOTES:
F_d = Volume of combustion components per unit of heat content, dry basis.
ppm = parts per million, dry volume basis
d = dry
s = standard (20°C - 68°F, 1 atm).
The GHG emissions estimated by WARM include only anthropogenic emissions of carbon dioxide.

* Calculated using conversion factors obtained from 40 CFR Part 60, Appendix A-7, Table 19-1.

Summary of Other Pollutants

Table 10 compares the additional air pollutants (NO_x, SO_2, dioxins and furans) analyzed for the landfill transport and operations scenario and the gasification conversion technology reference facility.

Table 10: Comparison of Other Air Pollutant Emissions for Baseline and Alternative Scenarios

[Treatment of 1,000 Tons per Day (for 25 Years) of Post-Recycled MRF Residuals
Emissions in metric tons (Years 2014 to 2138)]

BASELINE SCENARIO: TRANSPORTATION AND LANDFILL OPERATIONS	NO_x	SO_2	Dioxin/Furan
Transportation to Landfill (25-yr Landfill Operation)	93	0.3	Not Available
Landfill Operations (with cap/flare) including transportation related emissions	255	45	1.72E-06
Landfill Operations (with cap/LFG-to-energy) including transportation related emissions	266	22	1.27E-06
ALTERNATIVE SCENARIO: INTEGRATED MRF WITH CONVERSION TECHNOLOGIES	**NO_x**	**SO_2**	**Dioxin/Furan**
TOTAL OF INTEGRATED MRF AND CONVERSION TECHNOLOGIES COMPONENTS			
Japanese Reference Facility – Digestate Land Applied	3261	120	1.48E-07
LANDFILL OF POST INTEGRATED MRF RESIDUALS (136 TPD)			
Transportation to Landfill (25-yr Landfill Operations)	12	0	Not Available
Landfill Operations (with cap/flare) including transportation related emissions	12	0	3.93E-09

The dry fraction only to gasification scenario (assumes Scenario 1 - anaerobic digestion digestate land applied or composted) was used for the conversion technology comparison.

The NO_x and SO_2 comparison shows higher emissions for the Alternative Scenario than the Baseline Scenario, while dioxin and furan emissions were lower for the Alternative Scenario than the Baseline Scenario. It should be noted that a facility in Los Angeles County would need to meet strict SCAQMD advanced air pollution control and permit requirements which would likely result in lower emissions than that calculated for the Japanese reference facility. For example, the reference facility assumes electricity generation through combustion in an internal combustion engine which may not be permitted by SCAQMD and a coke-fired furnace would likely not be permitted. Wood biomass as charcoal may be used instead of coke which would reduce emissions.

PART IV: RESULTS AND CONCLUSIONS

SECTION 7: SUMMARY RESULTS OF GHG EMISSIONS FOR THE WASTE MANAGEMENT SCENARIOS

This section summarizes the results of the study analysis of GHG emissions and other criteria pollutants for two waste management scenarios. The Baseline Scenario evaluated the 125-year cumulative GHG emissions for transport and disposal of 1,000 tpd (for 25 years) of post-recycled residuals from a mixed waste MRF to a landfill with a cap, a landfill gas collection system, and a LFG-to-energy facility (standard for most landfills in Southern California). The results include GHG emissions for the Baseline Scenario of landfill gas generation from the buried waste over a period of 125 years to account for GHG emissions continuing to be generated from decomposing waste due to low decay factors in arid Southern California weather conditions. The Alternative Scenario evaluated sending the 1,000 tpd (for 25 years) of post-recycled residuals from a mixed waste MRF to an Integrated MRF with Conversion Technologies.

Since the single largest source of GHG emissions from an Integrated MRF with Conversion Technologies is from the thermal gasification component, significant effort was expended to review these emissions calculations and to cross-check results based on operating facilities using a separate WARM analytical model. The WARM-calculated results are presented in Table 11 (included in Section 5 as Table 4, and duplicated below for ease of reference) for thermal gasification of the dry fraction under the scenario of the anaerobic digestion digestate being composted aerobically and land applied, not gasified. These results were compared with the reference facility data modeling results.

Table 11: Comparison of Reference Operating Facility and WARM Estimated Net GHG Emissions for Thermal Gasification, MTCO$_2$E Over 25 Years

(Identified in Section 5 as Table 4)

DRY FRACTION ONLY TO GASIFICATION (Anaerobic Digestion Digestate Land Applied / Composted)						
Source	**Total Emissions**	**Biogenic Emissions**	**Non-Biogenic Emissions**	**Avoided Emissions**	**Net Emissions, Total**	**Net Emissions, Non-Biogenic**
Reference Operating Facility	7,728,236	4,537,816	2,987,587	1,668,485	6,059,751	1,521,935
WARM	8,178,161	4,019,707	4,158,454	2,726,834	5,451,327	1,431,620

Definitions:

Direct Emissions – Emissions directly related to solid waste management activities. In this comparative study, direct emissions are further divided into biogenic and non-biogenic [CO_2] emissions.

Biogenic [CO_2] Emissions – Emissions resulting from production, harvest, combustion, digestion, fermentation, decomposition, and processing of biologically based materials or biomass, such as combustion of biogas collected from biological decomposition of waste in landfills or combustion of the biological fraction of municipal solid waste or biosolids. Biogenic [CO_2] emissions are carbon neutral and have zero GHG impact.

Non-Biogenic [CO_2] Emissions – Emissions that are not considered biogenic CO_2 emissions, such as emissions from combustion of fossil fuels, of materials of fossil fuel origin (e.g., plastics) and from other non-combustion processes, such as fugitive methane emissions from landfill operation or oil and gas production. Methane emissions are not carbon neutral and regardless of source (biogenic or non-biogenic), are considered non-biogenic [CO_2] emissions in this study.

Indirect emissions: emissions from purchased electricity, heat or steam.
Avoided emissions: emissions avoided due to power generation (replacing fossil fuels) or from emissions avoided by recycling (e.g., energy savings)
Total emissions = biogenic + non-biogenic emission
Net emissions total = total emissions – avoided emissions

Expanded GHG emissions calculations using various databases were used to cross-check emissions data from operating facilities. A comprehensive summary is included in Appendix 7.

The GHG emissions model used to cross-check the gasification and ash melting emissions indicated that the operating facilities-based calculations are within the range of values projected by the Project Team's WARM analysis. The operating facilities' data is used for the comparative analysis summarized in Table 12 as it models the emissions based on a California-specific waste composition, is more reflective of the model facility being analyzed for this study (including gasification and ash melting), and is based on actual facility operations.

Table 12: Comparative Greenhouse Gas Emissions for Years 2014 to 2138 for the Treatment of 1,000 Tons per Day (for 25 Years) of Post-Recycled MRF Residuals (in metric tons of carbon dioxide equivalent, $MTCO_2E$)

SCENARIO	EMISSIONS (Years 2014 TO 2138): 125 Years						
BASELINE SCENARIO: POST RECYCLED RESIDUAL TO LANDFILL (1000 TPD)	**TOTAL EMISSIONS**	**BIOGENIC EMISSIONS**	**NON-BIOGENIC EMISSIONS**	**INDIRECT EMISSIONS**	**AVOIDED EMISSIONS**	**NET EMISSIONS (biogenic and non-biogenic)**	**NET EMISSIONS (only non-biogenic emissions)**
TOTAL OF TRANSPORTATION AND LANDFILL OPERATONS EMISSIONS (Cap / LFG-to-Energy)	**5,357,275**	**2,479,735**	**2,877,540**	**0**	**1,241,000**	**4,116,275**	**1,636,540**
Transportation to Landfill (25-yr Landfill Operation) (EMFAC2011)	25,946	-	25,946			25,946	25,946
Landfill Operation (with cap/LFG-to-energy) (CalEEMod, LandGEM) Lo = 100, Capture rate = 83%	5,331,329	2,479,735	2,851,594		1,241,000	4,090,329	1,610,594
ALTERNATIVE SCENARIO: INTEGRATED MRF WITH CONVERSION TECHNOLOGY	**TOTAL EMISSIONS**	**BIOGENIC EMISSIONS**	**NON-BIOGENIC EMISSIONS**	**INDIRECT EMISSIONS**	**AVOIDED EMISSIONS**	**NET EMISSIONS (biogenic and non-biogenic)**	**NET EMISSIONS (only non-biogenic emissions)**
TOTAL OF INTEGRATED MRF AND CONVERSION TECHNOLOGY COMPONENTS	**8,931,770**	**5,462,299**	**3,266,635**	**202,835**	**4,135,493**	**4,796,277**	**(666,022)**
MRF Preprocessing (Anaergia EpE) [a]	0	-	-	-	1,646,938	(1,646,938)	(1,646,938)
Anaerobic Digestion (Digestate to Composting) (EpE) [a]	842,815	740,338	102,477	-	563,389	279,426	(460,912)
Composting of Digestate (Anaergia EpE) [a]	342,435	177,942	164,493	-	9,667	332,768	154,826
RDF (Average) Gasification and Ash Melting	7,728,236	4,537,816	2,987,584	202,835	1,668,485	6,059,751	1,521,935
RDF, Slag and Metal Recycling from Ash Melting Process (Average) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	247,014	(247,014)	(247,014)
Landfill of Post Integrated MRF Residuals							
Transportation to Landfill (25-yr Landfill Operation) (EMFAC2011)	4,404		4,404			4,404	4,404
Landfill Operation (with cap/flare) (CalEEMod, LandGEM)	13,880	6,202	7,678			13,880	7,678

Definitions:

Direct Emissions - Emissions directly related to solid waste management activities such as at a landfill site. In this comparative study, direct emissions are further divided into biogenic and non-biogenic [CO_2] emissions.

Biogenic [CO_2] Emissions – Emissions resulting from production, harvest, combustion, digestion, fermentation, decomposition, and processing of biologically based materials or biomass, such as combustion of biogas collected from biological decomposition of waste in landfills or combustion of the biological fraction of municipal solid waste or biosolids. Biogenic [CO_2] emissions are carbon neutral and has zero GHG impact.

Non-Biogenic [CO_2] Emissions – Emissions that are not considered as biogenic CO_2 emissions, such as emissions from combustion of fossil fuels, of materials of fossil fuel origin (e.g., plastics) and from other non-combustion processes, such as fugitive methane emissions from landfill operation or oil and gas production. Methane emissions is not carbon neutral, regardless of its source, biogenic or non-biogenic, it is considered as non-biogenic [CO_2] emission in this study .

Indirect Emissions – Emissions from purchased electricity, heat, or steam

Avoided Emissions – Emissions avoided due to power generation (replacing fossil fuels) or from emissions avoided by recycling (e.g., energy savings)

Total Emissions = Direct (Biogenic + Non-Biogenic) + Indirect Emissions

Net Emissions = Total Emissions – Avoided Emissions

a. All Source 2 Emissions, all Avoided Emissions and Scope 1 Natural Gas Emissions were derived from factors which were CO2 Equivalent factors, rather than factors for CO2, CH4 and N2O individually, so these numbers could not be updated to Global Warming Potentials based on the 5th Assessment Report or modified to California Grid numbers. Only Scope 1 Emissions were updated.

b. Landfill numbers are based on US EPA WARM Model which could not be updated to Fifth Assessment Report GWP factors, and Biogenic could not be separated from Non-Biogenic. Pacific Region was used for calculations.

It should be noted that the gasification reference facility GHG emissions are likely higher than would be for a facility in Southern California which would likely require the use of a heat source other than coke and would have to comply with strict SCAQMD air pollution control requirements. Technologies that do not include an ash melting process to form metal slag for recycling potential would also have a lower emission profile.

Over the 125-year period, the Baseline Scenario of hauling 1,000 tpd (for 25 years of disposal) to a landfill, with a cover cap and recovery of LFG-to-energy, results in net GHG emissions of 1.64 million $MTCO_2E$ as shown in Table 12. The Alternative Scenario shows a net *avoided* GHG emissions amount of (0.67) million $MTCO_2E$. For the purposes of this study, "avoided emissions" is the amount of GHG emissions avoided due to power generation (replacing fossil fuels) and recycling (energy savings).

For Table 12, the total emissions, not accounting for avoided emissions, for the Alternative Scenario is significantly higher than the Baseline Scenario primarily due to the biogenic emissions. The biogenic emissions are much higher for the Alternative Scenario due to the gasification process which converts biogenic components of RDF (e.g. wood, paper, leather, branches, and other naturally occurring organics) to carbon dioxide and water. The non-biogenic emissions are similar for both scenarios (representing fugitive methane emissions from landfills and carbon dioxide from the gasification process). Indirect emissions are accounted for in the gasification and ash melting process but not for the MRF preprocessing and anaerobic digestion process because they are accounted for as part of the parasitic loading in the anaerobic digestion process module.

The most significant difference between the two scenarios is that the avoided emissions are much greater for the Alternative Scenario. This is due to the energy generated from anaerobic digestion and gasification, which would replace fossil fuels, as well as the additional Integrated MRF recycling in the Alternative Scenario. The avoided emissions in the Baseline Scenario are due to LFG-to-energy replacing the use of fossil fuels.

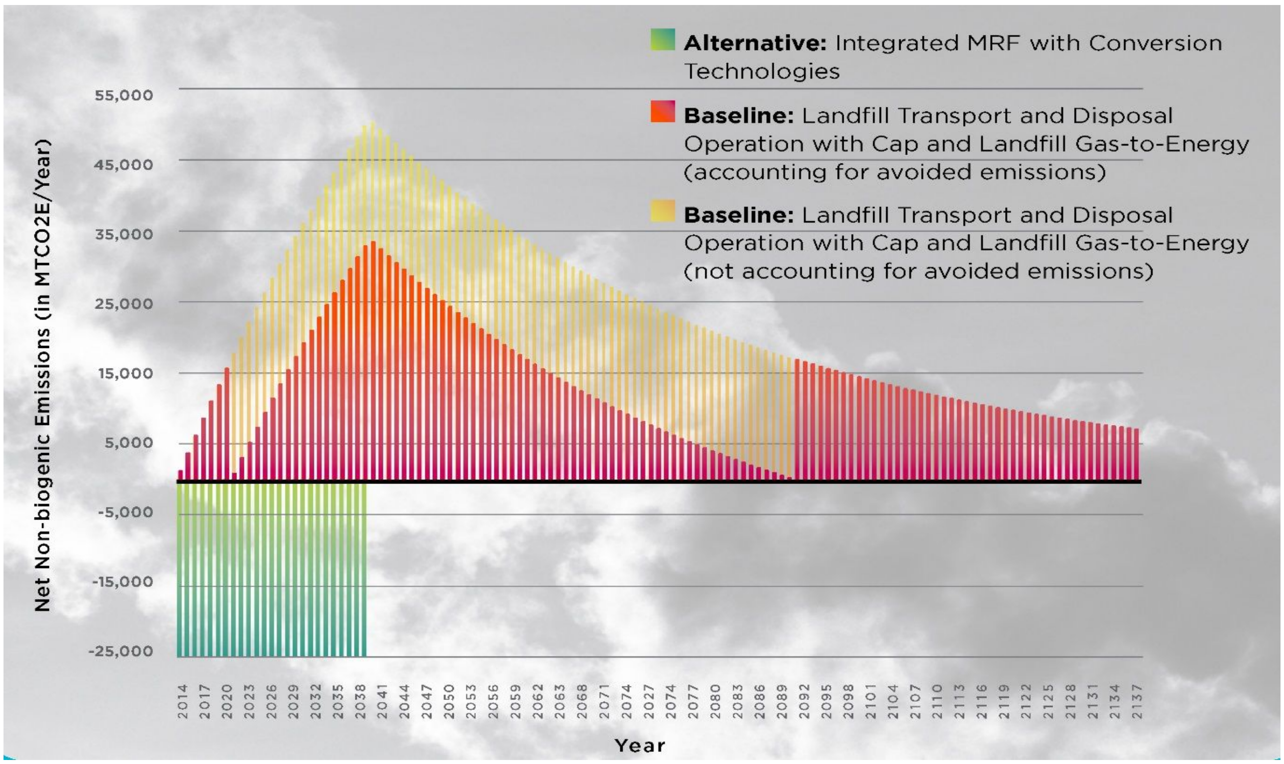
The GHG emissions of the transport and disposal of post Integrated MRF with Conversion Technologies residuals (136.5 tpd) was analyzed assuming a landfill with a cap and flare (residuals have very low organic content and thus low landfill gas generation from those residuals is not sufficient for LFG-to-energy). Those emissions are insignificant (12,082 $MTCO_2E$) and would be lower if a cap and LFG-to-energy facility was assumed. It should also be noted that a portion of the residuals is E-waste and special waste, which would likely have longer travel distances to appropriate receiving facilities so would have higher transport emissions but would also result in reduced disposal emissions at the landfill. These factors are not on a scale to have a material effect on the emissions for the Alternative Scenario results.

The analysis boundary did not include transport of compost and slag (175.4 tpd) to receiving facilities that is anticipated to be on the same order of magnitude as transport of post Integrated

MRF with Conversion Technologies residuals (136.5 tpd) to a distant landfill (4,404 $MTCO_2E$) which is not on a scale to have a material effect on the analysis results.

Figure 6 below illustrates graphically the results of the study analysis with 1.64 million $MTCO_2E$ net GHG emissions for the Baseline Scenario and (.67) million $MTCO_2E$ net GHG emissions for the Alternative Scenario. In southern California, most landfills are equipped with LFG-to-energy facilities.

Figure 6: Net Non-Biogenic GHG Emissions Over Time for Baseline and Alternative Scenarios



Although not the main focus of this study, other pollutants were also evaluated herein, including NO_x, SO_2 and dioxins/furans. The results found that NO_x and SO_2 emissions were higher while dioxins/furans emissions were lower for the Alternative Scenario as compared with the Baseline Scenario. Advanced air pollution control equipment such as selective catalytic reduction, non-selective catalytic reduction, dry scrubbers, and other best available control equipment may be feasible to lower these emissions. However, the feasibility of these controls would be part of the permitting, engineering and design for each specific project.

The model Integrated MRF with Conversion Technologies, analyzed herein, would result in recovering additional recyclables, compost, and energy from the anaerobic digestion and thermal gasification processes and in recovered slag and metal, which could potentially be beneficially used. It was compared to traditional transport and disposal of waste at a modern sanitary landfill that converts landfill gas to energy.

This study concludes that an Integrated MRF with Conversion Technologies comprised of a combination of proven technologies will achieve a net reduction in cumulative GHG emissions as compared to landfill transport and disposal due to higher avoided emissions for energy generation replacing fossil fuels, and energy savings from additional recycling.

APPENDICES

1. Tetra Tech White Paper of LandGEM Landfill Emissions Analysis
2. HDR WARM Analysis and Air Emissions Estimates
3. MRF Preprocessing and Anaerobic Digestion Process Flow Diagrams (Digestate to RDF)
4. MRF Preprocessing and Anaerobic Digestion Process Flow Diagrams (Digestate to Composting)
5. EpE Model Output for Integrated MRF with Conversion Technology
6. Gasifying and Direct Melting Calculations (based on operating facility)
   Gasification Emissions Summary Calculations (based on operating facility)
   Avoided GHG Emissions from Recycled Slag and Metal Calculations
7. Expanded Emissions Calculations Table for Various Scenarios
8. Peer Reviewer Comments and Responses

Acknowledgement:

Process design and process flow data, mass and energy balance data, and emission calculations based on existing operating facilities which served as reference models were provided by Anaergia (Carlsbad, California) and JFE Engineering Corporation (Yokohama, Japan), and were vetted by members of the Project Team based on California waste composition.

APPENDIX 1

Tetra Tech White Paper of LandGEM Landfill Emissions Analysis

WHITE PAPER

COMPARISON ANALYSIS OF AIR EMISSIONS FROM AN INTEGRATED CONVERSION TECHNOLOGY WITH PRE-PROCESSING FACILITY VS DIRECT TRANSPORT TO A LANDFILL

1. INTRODUCTION

The Los Angeles County Department of Public Works has commissioned a study comparing air emissions for a post-recycled mixed waste material recovery facility (MRF) residue sent to an integrated MRF with conversion technologies that converts waste to energy and compost at a location near the source where the waste is processed to transport of the post-recycled MRF residuals to a sanitary landfill. Implementing an integrated MRF with conversion technology project reduces the amount of waste buried in the landfill and reduces vehicle trips to haul waste to the landfill.

Tetra Tech conducted this analysis to determine the air emissions for the transport and disposal of waste at a landfill component of the White Paper study. The air emissions analysis was based on a fixed amount of post-recycled MRF residual waste (1,000 tons per day) being exported to an out-of-county landfill location and the transport and disposal of residual waste from the integrated MRF with conversion technology facility. It evaluates air emissions from waste truck transportation and waste buried in a landfill, or baseline emissions.

2. TARGET AIR POLLUTANTS

In California, local air quality management districts or air pollution control districts are responsible for air quality in their respective judicial areas. The proposed project site is located in Los Angeles County, which is under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). The mission of the SCAQMD is to attain and maintain the federal National Ambient Air Quality Standards (NAAQS) and the California Ambient Air Quality Standards (CAAQS), and to ensure air pollutants do not pose a nuisance or significant public health risks. SCAQMD's responsibilities include monitoring of air pollution and the promulgating Rules and Regulations. The State of California Air Resources Board (CARB) has established additional standards for criteria pollutants that are generally more stringent than the NAAQS. Air quality impacts would be significant if they exceed these standards or contribute to non-conformance.

Current NAAQS and CAAQS standards are set for sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), fine particulate matter equal to or less than 10 microns in size (PM_{10}), fine particulate matter equal to or less than 2.5 microns in size ($PM_{2.5}$), lead (Pb), and greenhouse gases (GHGs). Reactive organic gases (ROG) react with nitrogen oxides under sunlight to form O_3. Therefore, ROG is an air pollutant regulated by the SCAQMD.

The air emissions analysis for this study focused on the emissions of NO_x, SO_2, and GHGs.

3. DESCRIPTION OF EMISSION SOURCES

Air emissions associated with the project are related to emissions that would occur during post-recycled residue transportation from a mixed waste MRF to an out-of-county landfill (assumed average travel distance of 47 miles per one way trip, based on average distance to closest landfills in Ventura, Orange, Riverside and San Bernardino counties to a location of an existing mixed waste MRF in LA County), and subsequent refuse handling, refuse burial process, and gas generated from waste buried in the landfill.

The principal source of air pollutants during refuse transportation is the air emissions from operating 45 refuse transfer trailer trucks.

At the landfill, equipment such as tractors, bulldozers, rollers, graders, compactors, and excavators are used to handle the refuse, construct landfill cells, build refuse cover, and move soil. Combustion of fuel to operate the equipment also generates air emissions. Furthermore, soil-moving activities could cause dust emissions. Once the refuse is buried, anaerobic decomposition of the organic portion of the refuse generates landfill gas. Landfill gas consists of methane and carbon dioxides. Flares that are commonly used to control landfill gas produce other air pollutants. Vehicles used by landfill workers to commute to landfill also emit air pollutants. Commuter trip emissions were estimated for both landfill and the integrated MRF. Normally, a landfill will operate 6 days a week, and an integrated MRF with conversion technology will operate 7 days a week. For comparison purposes, a 7-day a week work schedule was used for both cases.

Figure 1 shows schematics of various emission sources in a landfill operation, and types of air emissions are listed in Table 1.

4. EMISSION QUANTIFICATION METHODOLOGY

There are a number of methodologies and models available to assess air emissions from the project. Table 1 provides the models used to determine emissions for this project. Following is the description of each model used in this study.

Landfill Operation Emissions

Emissions from landfill operation such as construction of landfill cells were estimated based on an air emission modeling software program - California Emissions Estimator Model (CalEEMod) [Ref. 1]. This model was developed collectively by air districts throughout California. CalEEMod is used as a uniform platform to quantify potential criteria pollutants and GHG emissions associated with construction and operation from a variety of statewide land uses. The model contains data specific to each California air basin. CalEEMod uses the 2006 Intergovernmental Panel on Climate Change (IPCC) model to calculate GHG emissions from landfill operations. This 2006 IPCC model is also recommended by the CARB [Ref. 2].

Refuse Transportation Truck Emissions

To meet the NAAQS and CAAQS, California state and local governments use the CARB-developed EMFAC2011 model to calculate emissions from on-road vehicles [Ref. 3]. CalEEMod incorporates the EMFAC2011 in its module to calculate emissions from on-road vehicles. As mentioned earlier, CalEEMod uses the 2006 Intergovernmental Panel on Climate Change (IPCC) model to calculate GHG emissions from on-road vehicles.

Both EMFAC and CalEEMod emission models take into account future truck fleet and off-road equipment with better emission control, such as using natural gas to power refuse trucks.

Buried Refuse Emissions

The major sources of GHG are the landfill gas generated from decomposition of buried refuses. The widely used GHG reporting protocol defines two types of GHG emissions:

- Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity.
- Indirect GHG emissions are emissions that are resulted from activities of the reporting entity, but occurred at sources owned or controlled by another entity, for example, GHG emissions associated with consumption of purchased electricity.

In this study, the USEPA LandGEM model (v3.02) was used to estimate GHG from the buried refuse. LandGEM is based on a first-order decomposition rate equation to estimate annual gas generations [Ref. 4]. The model is recommended by the USEPA as documented in the Climate Leader Greenhouse Gas Inventory Protocol "Direct Emissions from Municipal Solid Waste Landfilling October 2004" [Ref. 5]

It should be noted that carbon dioxide emissions from MSW landfills are not considered contributing to global climate change because the carbon was contained in recently living biomass (i.e., is biogenic) and the same carbon dioxide would be emitted as a result of the natural decomposition of the organic waste materials if they were not buried in the landfill. This assumption is consistent with the international greenhouse gas protocols [Ref. 6].

For this project, the carbon dioxide emissions from biogenic sources calculated from LandGEM were added to the total GHG carbon dioxide equivalent. This project intends to compare GHGs emissions from two processes; therefore total GHGs should be used whether it is a biogenic or non-biogenic source.

5. EMISSIONS MODEL SETUP, INPUT AND ASSUMPTIONS

Table 2 provides the inputs to the emission models. The model settings are fit to the specific features of this project. Following sections provide these specific features:

5.1 Refuse Transportation Trucks

Based on 1,000 tons per day of refuse transported from the integrated MRF to an out-of-county landfill and waste hauling capacity of 22 tons per transfer truck, the types and numbers of trucks and the travelled distances per truck were estimated and used in the model to calculate emissions.

A second analysis was performed for the integrated MRF with conversion technology facility to evaluate the transport of 136 tons per day of post-recycled residue, including 128 tons of post-recycled residue and 8 tons of ash from the gasification process, from a mixed waste MRF that is non-processible or non-acceptable for pre-processing.

5.2 Landfill Construction Equipment

The types and quantities of landfill equipment were estimated based on 1,000 tons per day of refuse deposited in the landfill. It is assumed that the equipment is operated simultaneously at 8 hours per day.

5.3 Landfill Cell Construction

It is assumed that about one acre of land is disturbed daily. Disturbance of land produces dust emissions. The proposed Project would be subject to the SCAQMD Rules 403 (Fugitive Dust). The purpose of Rule 403 is to reduce man-made fugitive dust. Rule 403 requires implementing control measures to prevent, reduce, or mitigate fugitive dust emissions and includes a performance standard that prohibits visible emissions from crossing any property line. Dust control measures, such as water application on dry soil and reduced vehicles travelling on unpaved roads, are standard mitigation techniques. The project will be required to comply with Rule 403. Implementing the dust suppression techniques specified in Rule 403 can reduce the fugitive dust generation (and thus the PM_{10} component) by 50 percent or more. Therefore, the estimation of fugitive dust emissions during project assumes Rule 403 compliant.

5.4 Greenhouse Gases from Buried Wastes

Landfill gas consists of 50% methane and 50% carbon dioxide. Both gases are classified as GHGs. To calculate fugitive emissions from the decomposition of buried waste in the landfills, the USEPA LandGEM model was used. There are two important input parameters to LandGEM model: decay factor (k), and potential methane generation capacity (L_o).

LandGEM is based on a first-order decay model. It assumes that a fixed fraction of the waste available at any moment will degrade. The amount that degrades over a given amount of time is determined by a "k" factor, which determines how fast the waste decays based on the amount of moisture present in the landfill. The k value used in the study was obtained from the US EPA and varied based on the estimated annual rainfall rates occurring at the landfill location. This model also assumes that the carbon degraded is converted into equal amounts of CO_2 and CH_4. Based on the arid conditions of the Southern California, and the average rainfall of less than 20 inches per year for both 1990 and 2007, a k value of 0.02 $year^{-1}$ was used [Ref. 7].

The potential methane generation capacity, L_o, depends only on the type and composition of waste placed in the landfill. The higher the cellulose contents of the waste are, the higher the value of L_o. A L_o value of 100 cubic meters per Megagrams (m^3/Mg) from an actual landfill operation was used.

The 1996 EPA Standards of Performance for New Stationary Sources (NSPS) and Guidelines for Control of Existing Sources and the recently published National Emission Standards for Hazardous Air Pollutants (NESHAP) require large municipal landfills to collect and combust landfill gas (LFG) to reduce non-methane organic compound (NMOC aka ROG) emissions. A large landfill is defined as having a design capacity of at least 2.5 million metric tons and 2.5 million cubic meters and a calculated or measured uncontrolled NMOC emission rate of at least 50 metric tons (Megagrams) per year.

Landfill operators are using flares or energy recovery devices, including reciprocating engines, gas turbines or microturbine, and boilers, to meet these gas destruction standards and convert the LFG energy to electricity.

In addition to gas destruction requirements, NSPS and NESHAP require gas collection systems be designed and operated properly. Gas collection systems are required for all areas of the landfill, and the operator is required to conduct monthly monitoring at each collection well, and monitoring of surface methane gas emissions to ensure that the collection system is operated properly and is reducing fugitive emissions. Smaller MSW landfills are not required to control emissions per the NSPS or NESHAP but can still greatly reduce emissions of NMOC by collecting and combusting LFG for energy recovery or in a flare.

For comparison purposes that reflect common practice in today's landfill operations, emissions from a landfill with a landfill gas collection and a flare; and, with a landfill gas to energy system, were conducted in this study.

<u>Case 1 – The landfill has a gas collection system and flaring.</u>

The top soil of a landfill is a dynamic mixing zone for air and landfill gas. Methane passing through the landfill cover can be oxidized by aerobic bacteria. The process leads to generation of CO_2 and water:

$$CH_4 + 2O_2 = CO_2 + 2H_2O \qquad \text{Equation 1}$$

Landfill methane emissions from sites without active LFG recovery systems are equal to the methane gas generation less the amount of methane gas oxidized in the landfill cover zone. A ten percent reduction of methane gas generated was used to account for the oxidation factor.

In this scenario, it is assumed that the landfill has an active gas collection system and there is a flare system to reduce methane gas emissions.

USEPA estimates that about 60 to 90 percent of methane emitted from the landfill is captured in a landfill gas collection system [Ref. 8]. For this study, 83 percent methane capture rate was used, which results in 17 percent of methane emitted as fugitive. Combustion of the captured 70 percent of methane gas in the flare produces other air pollutants, including NO_x, CO, CO_2 and SO_x.

Assuming the flare has a complete combustion, the resultant emissions of ROG, NO_x, CO and SO_x are considered insignificant. The CO_2 emissions are estimated based on the stoichiometric ratio as shown in the Equation 1 above.

Case 2 – The landfill has a gas collection system and a LFG-to-Energy System

In this scenario, it is assumed that the landfill has an active gas collection system and there is LFG to energy conversion technology, such as internal combustion engines, gas turbine or microturbines, to convert the LFG energy to electricity. Combustion of LFG collected to generate electricity produces other air pollutants, including NO_x, CO, CO_2 and SO_x.

Furthermore, energy produced from LFG avoids the use of non-renewable resources, such as natural gas, oil and coal. This avoids greenhouse gas emissions from fossil fuel combustion in a conventional power plant. The EPA landfill energy benefits model was used to estimate the avoided GHG emissions [Ref. 9]. Input to the model requires an estimate of electrical generation rate. The electrical generation rate was estimated by converting the amount of LFG generated based on the LandGEM model output and using the LFG heat content value.

For these analyses, the landfill operation period receiving daily incoming wastes is assumed to be 25 years, from 2014 to 2038. For landfill gas generation, the project period is assumed to be 2014-2138, a total of 125 years. This is due to the fact that landfill gas generation will continue after the landfill stops receiving incoming waste and the decay factor is low in arid Southern California weather conditions.

5.5 Air Emissions for Residual Refuse from Integrated MRF to Landfill

Analysis was also conducted to determine air emissions for transporting and landfilling of 136 tons per day of pre-processed refuse from the Integrated MRF to a landfill. The analysis is performed using the same models as shown in Table 1. The input parameters used in the models are similar, except:

- The number of trucks is reduced to 6 truck trips per day to transport 136 tons of refuse to the landfill.
- Landfill equipment operating hours are 1 hour per day to handle 136 tons of refuse.
- The pre-processed refuse has substantially lower organic contents. A low k value of 0.003 $year^{-1}$ and a L_o value of 6.2 m^3/Mg were used.
- Since the pre-processed refuse has substantially lower organic content and landfill gas generation rate is minimal, therefore, it is assumed that no energy is recovered from the refuse.

For comparison purpose, additional calculations for GHG emissions were performed. Table 3a and 3b summarize the emissions profile for the 1,000 tons per day transportation and landfill using Lo of 100 m^3/Mg and 83% landfill gas capture rate, for cap-and-flare and landfill gas to energy, respectively. Table 3c and 3d summarize the emissions profile for the 1,000 tons per day transportation and landfill using Lo of 114 m^3/Mg and 70% landfill gas capture rate, for cap-and-flare and landfill gas to energy, respectively. Table 4a and 4b summarizes the emissions profile for landfill transport, disposal, and flaring of 136 tons per day transportation and landfill with landfill gas capture rate of 83% and 70%, respectively.

6. RESULT SUMMARY

GHG Emissions

The results show higher GHG emissions for flaring. Appendix A provides the CalEEMod output files. Appendix B provides the LandGEM output file. Appendix C provides the USEPA landfill energy benefits model file.

It should be noted that new global warming potential (GWP) of 34 for methane and 298 for nitrous oxide (N_2O) were used in the analysis.

The summary table below shows GHG emissions for landfill operations with cap and flare and with cap and landfill gas to energy; and landfilling of post-integrated MRF residuals. Key findings are:

- The total GHG emissions of 5.4 million metric tons CO2E for landfill with a flare and landfill gas-to-energy.
- The main difference is the emissions of 1.9 million metric tons CO2E that can be avoided by combusting collected landfill gas to generate electricity instead of using fossil fuels.
- As expected, the emissions from landfilling of post-integrated MRF residuals only represents a very small fraction (approximately 0.3%) of the emissions from the baseline landfill transport and operations.

COMPARATIVE GREENHOUSE GAS EMISSIONS FOR YEARS 2014 TO 2138 FOR THE TREATMENT OF 1000 TON PER DAY (FOR 25 YEARS) OF POST RECYCLED MRF RESIDUAL (in metric tons of carbon dioxide equivalent, MTCO2E)							
SCENARIO	**EMISSIONS (Years 2014 TO 2138): 125 Years**						
LANDFILL OPERATION - POST RECYCLED RESIDUAL TO LANDFILL (1000 TPD)	**TOTAL EMISSIONS**	**GROSS EMISSIONS**	**BIOGENIC EMISSIONS**	**NON-BIOGENIC EMISSIONS**	**AVOIDED EMISSIONS**	**NET EMISSIONS (biogenic and non-biogenic)**	**NET EMISSIONS (only non-biogenic emissions)**
Total of Transportation and Landfill Operations Emissions (Cap/Flare)	**5,357,275**	**2,479,735**	**2,877,540**	**0**	**0**	**5,357,275**	**2,877,540**
Total of Transportation and Landfill Operations Emissions (Cap/LFG-to-Energy)	**5,357,275**	**2,479,735**	**2,877,540**	**0**	**1,870,000**	**3,487,275**	**1,007,540**
LANDFILLING OF POST INTEGRATED MRF RESIDUALS (136 TPD)							
Total of Transportation and Landfill Operation (with cap/flare) (EMFAC2011, CalEEMod, LandGEM)	**18,284**	**18,284**	**6,202**	**12,082**	**-**	**18.,284**	**12,082**

Emissions of Other Air Pollutants

Additionally, emissions of criteria air pollutants and dioxins/furans from refuse transfer trucks, landfill operation, and flare or landfill gas to energy, were calculated for the two landfill scenarios and landfilling of post-integrated MRF residuals. The results are shown in the Table below.

COMPARATIVE AIR POLLUTANT EMISSIONS FOR YEARS 2014 TO 2154 FOR THE TREATMENT OF 1000 TON PER DAY (FOR 25 YEARS) OF POST RECYCLED MRF RESIDUAL (in metric tons , MT) EMISSIONS (Years 2014 TO 2138)					
TRANSPORTATION AND LANDFILL OPERATONS EMISSIONS (1,000 TPD)	NO_x	CO	SO_2	PM	Dioxin/Furan
Transportation to Landfill (25-yr Landfill Operation) (EMFAC2011)	93	97	0.3	35,399	Not Available
Landfill Operation (with cap/flare) (CalEEMod, LandGEM) including transportation related emissions	255	286	45	35,460	1.72E-06
Landfill Operation (with cap/LFG-to-energy) (CalEEMod, LandGEM) including transportation related emissions	261	126	22	35,409	1.27E-06
LANDFILLING OF POST INTEGRATED MRF RESIDUALS (136 TPD)					
Transportation to Landfill (25-yr Landfill Operation) (EMFAC2011)	12	16	0	5,138	Not Available
Landfill Operation (with cap/flare) (CalEEMod, LandGEM) including transportation related emissions	12	17	0	5,139	2.99E-09

Key findings are:

- Particulate matter is the major pollutant of all criteria air pollutants with an emission amount of 35 metric tons during the course of the project.
- The major contributor of particulate matter is the fugitive dust from landfill operations.

Figure 1. Emissions Sources

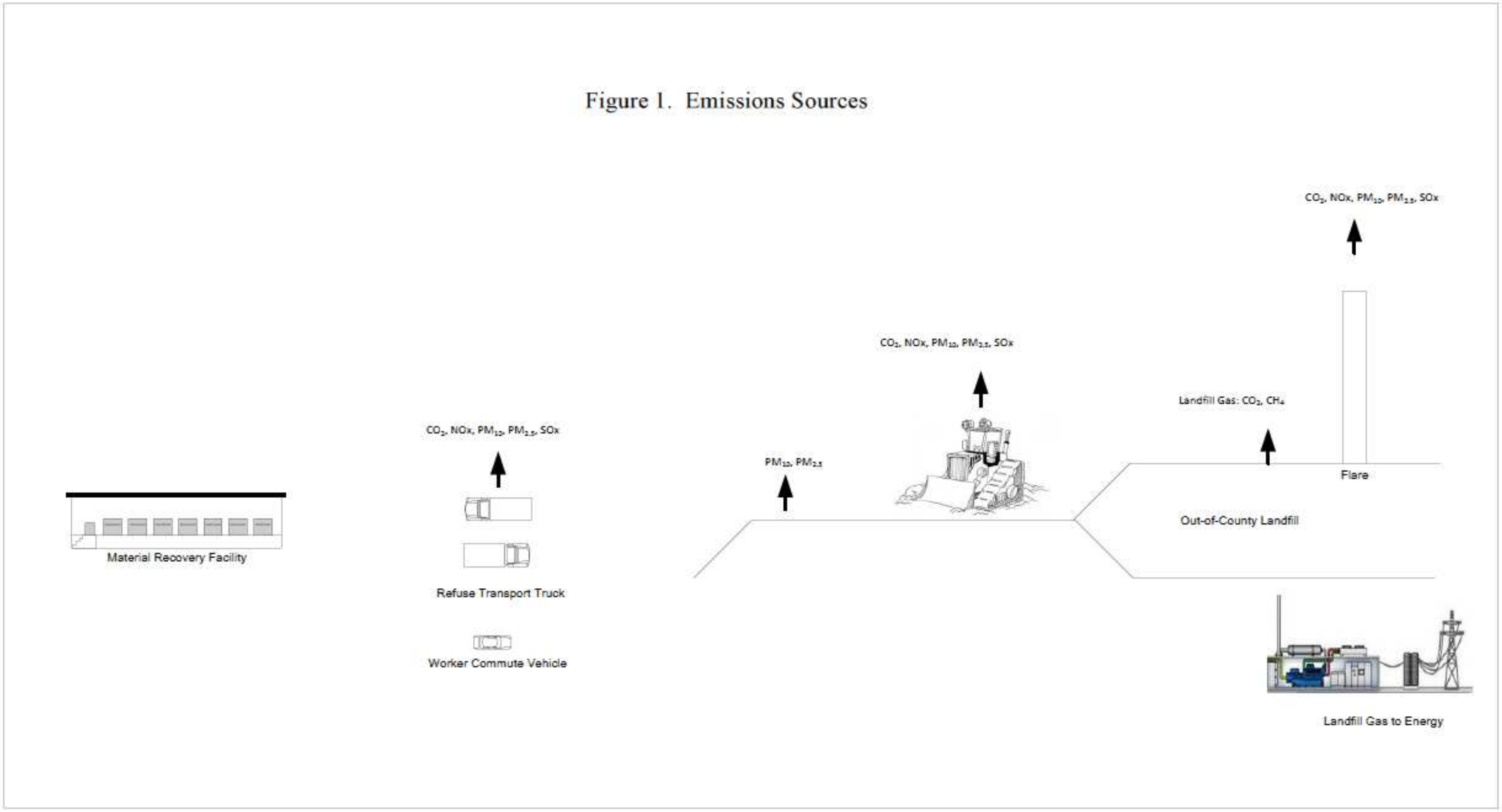


Table 1. Emissions Sources and Model Used

Emissions Sources	**Emissions Processes**	**Air Pollutants**	**Emission Quantification Models**
Refuse transfer trucks	Diesel fuel combustion in refuse truck engine	CO, CO_2, NO_x, ROG, PM_{10}, $PM_{2.5}$, SO_x, GHGs	CalEEMod, EMFAC2011, IPCC
Landfill cell Construction	Grading and compacting of soil	PM_{10}, $PM_{2.5}$	CalEEMod
Landfill equipment	Diesel fuel combustion landfill equipment engine	CO, CO_2, NO_x, ROG, PM_{10}, $PM_{2.5}$, SO_x, GHGs	CalEEMod, IPCC
Landfill worker commuting	Fuel combustion in vehicles	CO, CO_2, NO_x, ROG, PM_{10}, $PM_{2.5}$, SO_x	CalEEMod, EMFAC201, IPCC
Buried refuse	Landfill gas generation	GHGs (CO_2, CH_4,)	LandGEM, USEPA LFG Energy Model

Table 2. Model Input

Data Input	Values / Assumptions
Start Date	1/1/2014
End Date	12/31/2038
Duration (Work Days)	7 days/week
Refuse Transport to Landfill, tons/day	1,000
Average refuse hauling distance, miles/one way trip	47
Refuse Truck Gross Vehicle Weight (GVWR) / Gross Combined Vehicle Weight (GCWR), lbs	34,000/80,000
Numbers of Daily Trucks	45
Refuse Truck Hauling Capacity, tons/truck	22
Refuse Truck Class	Heavy-Heavy Duty Truck
Daily Acreage Disturbed	1
Numbers of Workers	10
Worker Commute Distance, miles	47
Worker Vehicle Type	Light-Duty Mix
Energy Use	None
Waste Usage	None
Wastewater Generation	None

Equipment Mix	Numbers
Hydraulic Excavator	0
Tractor	0
Loader	1
Scraper	1
Cranes	0
Water Truck	1
Grader	0
Paver	0
Compactor	2
Bulldozer	1

Table 3a. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions from Buried Refuse (Landfill Cap and flare) [b]					
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CH4	CO2 from Flare (Biogenic)	CO2 from Flare (biogenic)	CO2 from landfill (biogenic)	Non-biogenic CO2 from CH4	CO2e (Include CO2 from Flare and Bio Source)- Gross emissions
Year	tons/yr										MT/yr					tons/yr	tons/yr	MT/yr	MT/yr	MT/yr	MT/yr
2014	1.13	8.27	5.07	0.01	1,275.12	0.42	1,275.55	139.60	0.42	140.03	0.00	1,055.60	1,055.60	0.09	0.00	0	0	0	0	0	0
2015	1.06	7.59	4.85	0.01	1,275.12	0.38	1,275.51	139.60	0.38	139.99	0.00	1,052.85	1,052.85	0.09	0.00	82.1	1,101.7	999	1,201	2,531	4,731.7
2016	1.00	6.96	4.68	0.01	1,278.54	0.35	1,278.89	139.94	0.34	140.29	0.00	1,053.64	1,053.64	0.08	0.00	162.5	2,181.5	1,979	2,379	5,012	9,369.7
2017	0.93	6.35	4.50	0.01	1,275.12	0.31	1,275.43	139.60	0.31	139.91	0.00	1,048.18	1,048.18	0.08	0.00	241.3	3,240.0	2,939	3,533	7,443	13,915.8
2018	0.87	5.80	4.35	0.01	1,275.12	0.27	1,275.40	139.60	0.27	139.88	0.00	1,045.72	1,045.72	0.07	0.00	318.6	4,277.5	3,881	4,665	9,827	18,371.9
2019	0.82	5.29	4.22	0.01	1,275.12	0.24	1,275.37	139.60	0.24	139.85	0.00	1,043.41	1,043.41	0.07	0.00	394.3	5,294.5	4,803	5,774	12,163	22,739.8
2020	0.77	4.84	4.12	0.01	1,278.54	0.22	1,278.76	139.94	0.22	140.16	0.00	1,044.11	1,044.11	0.06	0.00	468.6	6,291.4	5,707	6,861	14,453	27,021.2
2021	0.72	4.40	4.01	0.01	1,275.12	0.19	1,275.32	139.60	0.19	139.79	0.00	1,039.89	1,039.89	0.06	0.00	541.4	7,268.5	6,594	7,926	16,698	31,217.8
2022	0.69	4.02	3.93	0.01	1,275.12	0.17	1,275.30	139.60	0.17	139.77	0.00	1,038.04	1,038.04	0.06	0.00	612.7	8,226.2	7,463	8,971	18,898	35,331.4
2023	0.66	3.68	3.85	0.01	1,275.12	0.15	1,275.28	139.60	0.15	139.75	0.00	1,036.32	1,036.32	0.05	0.00	682.6	9,165.0	8,314	9,995	21,055	39,363.4
2024	0.63	3.38	3.80	0.01	1,278.54	0.14	1,278.68	139.94	0.14	140.08	0.00	1,037.62	1,037.62	0.05	0.00	751.1	10,085.2	9,149	10,998	23,168	43,315.7
2025	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	818.3	10,987.2	9,967	11,982	25,241	47,189.6
2026	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	884.2	11,871.3	10,769	12,946	27,272	50,986.9
2027	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	948.7	12,737.9	11,556	13,891	29,262	54,709.0
2028	0.60	3.11	3.74	0.01	1,278.54	0.12	1,278.67	139.94	0.12	140.07	0.00	1,036.16	1,036.16	0.05	0.00	1012.0	13,587.4	12,326	14,817	31,214	58,357.3
2029	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1074.0	14,420.0	13,082	15,725	33,127	61,933.5
2030	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1134.8	15,236.1	13,822	16,615	35,002	65,438.8
2031	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1194.4	16,036.1	14,548	17,488	36,839	68,874.7
2032	0.51	2.10	3.54	0.01	1,278.54	0.07	1,278.62	139.94	0.07	140.02	0.00	1,030.94	1,030.94	0.04	0.00	1252.8	16,820.3	15,259	18,343	38,641	72,242.5
2033	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1310.0	17,588.9	15,956	19,181	40,406	75,543.7
2034	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1366.1	18,342.3	16,640	20,003	42,137	78,779.5
2035	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1421.1	19,080.7	17,310	20,808	43,834	81,951.3
2036	0.46	1.59	3.43	0.01	1,278.54	0.05	1,278.59	139.94	0.05	139.99	0.00	1,029.42	1,029.42	0.04	0.00	1475.0	19,804.6	17,966	21,597	45,497	85,060.2
2037	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1527.9	20,514.1	18,610	22,371	47,127	88,107.6
2038	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1579.7	21,209.6	19,241	23,129	48,724	91,094.6
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1630.5	21,891.3	19,859	23,873	50,290	94,022.5
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1598.2	21,457.8	19,466	23,400	49,294	92,160.7
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1566.5	21,032.9	19,081	22,937	48,318	90,335.8
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1535.5	20,616.4	18,703	22,483	47,362	88,547.1
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1505.1	20,208.2	18,333	22,037	46,424	86,793.7
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1475.3	19,808.1	17,970	21,601	45,505	85,075.1
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1446.1	19,415.8	17,614	21,173	44,603	83,390.5
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1417.5	19,031.4	17,265	20,754	43,720	81,739.2
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1389.4	18,654.5	16,923	20,343	42,855	80,120.7
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1361.9	18,285.1	16,588	19,940	42,006	78,534.2
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1334.9	17,923.1	16,260	19,545	41,174	76,979.1
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1308.5	17,568.2	15,938	19,158	40,359	75,454.8
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1282.6	17,220.3	15,622	18,779	39,560	73,960.7
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1257.2	16,879.3	15,313	18,407	38,776	72,496.2
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1232.3	16,545.1	15,009	18,043	38,009	71,060.7
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1207.9	16,217.5	14,712	17,685	37,256	69,653.6
2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1184.0	15,896.3	14,421	17,335	36,518	68,274.3
2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1160.5	15,581.6	14,135	16,992	35,795	66,922.4
2057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1137.5	15,273.0	13,855	16,655	35,086	65,597.3
2058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1115.0	14,970.6	13,581	16,326	34,392	64,298.4
2059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1092.9	14,674.2	13,312	16,002	33,711	63,025.2
2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1071.3	14,383.6	13,049	15,686	33,043	61,777.2
2061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1050.1	14,098.8	12,790	15,375	32,389	60,553.9
2062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1029.3	13,819.6	12,537	15,071	31,747	59,354.9
2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1008.9	13,546.0	12,289	14,772	31,119	58,179.6
2064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	988.9	13,277.7	12,045	14,480	30,503	57,027.5
2065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	969.3	13,014.8	11,807	14,193	29,899	55,898.3
2066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	950.1	12,757.1	11,573	13,912	29,307	54,791.4
2067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	931.3	12,504.5	11,344	13,636	28,726	53,706.5
2068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	912.9	12,256.9	11,119	13,366	28,157	52,643.0
2069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	894.8	12,014.2	10,899	13,102	27,600	51,600.6
2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	877.1	11,776.3	10,683	12,842	27,053	50,578.9
2071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	859.7	11,543.1	10,472	12,588	26,518	49,577.4
2072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	842.7	11,314.5	10,264	12,339	25,993	48,595.7
2073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	826.0	11,090.5	10,061	12,094	25,478	47,633.4
2074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	809.7	10,870.9	9,862	11,855	24,973	46,690.2
2075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	793.6	10,655.6	9,667	11,620	24,479	45,765.7
2076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	777.9	10,444.6	9,475	11,390	23,994	44,859.4
2077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	762.5	10,237.8	9,288	11,165	23,519	43,971.2
2078	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	747.4	10,035.1	9,104	10,943	23,053	43,100.5
2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	732.6	9,836.4	8,923	10,727	22,597	42,247.0
2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	718.1	9,641.6	8,747	10,514	22,149	41,410.5
2081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	703.9	9,450.7	8,574	10,306	21,711	40,590.5

Table 3a. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]															GHG Emissions from Buried Refuse (Landfill Cap and flare) [b]					
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CH4	CO2 from Flare (Biogenic)	CO2 from Flare (biogenic)	CO2 from landfill (biogenic)	Non-biogenic CO2 from CH4	CO2e (Include CO2 from Flare and Bio Source)- Gross emissions
Year	tons/yr										MT/yr					tons/yr	tons/yr	MT/yr	MT/yr	MT/yr	MT/yr
2082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.9	9,263.6	8,404	10,102	21,281	39,786.8
2083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	676.3	9,080.1	8,237	9,902	20,860	38,998.9
2084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	662.9	8,900.3	8,074	9,706	20,446	38,226.7
2085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649.8	8,724.1	7,914	9,514	20,042	37,469.8
2086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	636.9	8,551.3	7,758	9,325	19,645	36,727.8
2087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	624.3	8,382.0	7,604	9,141	19,256	36,000.5
2088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	611.9	8,216.0	7,453	8,960	18,874	35,287.7
2089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	599.8	8,053.4	7,306	8,782	18,501	34,588.9
2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	587.9	7,893.9	7,161	8,608	18,134	33,904.0
2091	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	576.3	7,737.6	7,019	8,438	17,775	33,232.7
2092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	564.9	7,584.4	6,880	8,271	17,423	32,574.6
2093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	553.7	7,434.2	6,744	8,107	17,078	31,929.6
2094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	542.7	7,287.0	6,611	7,947	16,740	31,297.4
2095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	532.0	7,142.7	6,480	7,789	16,409	30,677.6
2096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	521.5	7,001.2	6,351	7,635	16,084	30,070.2
2097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	511.1	6,862.6	6,226	7,484	15,765	29,474.8
2098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	501.0	6,726.7	6,102	7,336	15,453	28,891.1
2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	491.1	6,593.5	5,982	7,190	15,147	28,319.0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	481.4	6,463.0	5,863	7,048	14,847	27,758.3
2101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	471.8	6,335.0	5,747	6,908	14,553	27,208.6
2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	462.5	6,209.6	5,633	6,772	14,265	26,669.9
2103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	453.3	6,086.6	5,522	6,638	13,983	26,141.8
2104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	444.4	5,966.1	5,412	6,506	13,706	25,624.1
2105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	435.6	5,847.9	5,305	6,377	13,434	25,116.7
2106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	426.9	5,732.1	5,200	6,251	13,168	24,619.4
2107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	418.5	5,618.6	5,097	6,127	12,908	24,131.9
2108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	410.2	5,507.4	4,996	6,006	12,652	23,654.0
2109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	402.1	5,398.3	4,897	5,887	12,401	23,185.7
2110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	394.1	5,291.4	4,800	5,770	12,156	22,726.6
2111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	386.3	5,186.7	4,705	5,656	11,915	22,276.5
2112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	378.7	5,083.9	4,612	5,544	11,679	21,835.4
2113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	371.2	4,983.3	4,521	5,434	11,448	21,403.1
2114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	363.8	4,884.6	4,431	5,327	11,221	20,979.3
2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	356.6	4,787.9	4,343	5,221	10,999	20,563.8
2116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	349.5	4,693.1	4,257	5,118	10,781	20,156.6
2117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342.6	4,600.1	4,173	5,017	10,568	19,757.5
2118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	335.8	4,509.1	4,091	4,917	10,359	19,366.3
2119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	329.2	4,419.8	4,010	4,820	10,153	18,982.8
2120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	322.7	4,332.3	3,930	4,724	9,952	18,606.9
2121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	316.3	4,246.5	3,852	4,631	9,755	18,238.5
2122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	310.0	4,162.4	3,776	4,539	9,562	17,877.3
2123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	303.9	4,080.0	3,701	4,449	9,373	17,523.3
2124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	297.9	3,999.2	3,628	4,361	9,187	17,176.4
2125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	292.0	3,920.0	3,556	4,275	9,005	16,836.2
2126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	286.2	3,842.4	3,486	4,190	8,827	16,502.9
2127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	280.5	3,766.3	3,417	4,107	8,652	16,176.1
2128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	275.0	3,691.7	3,349	4,026	8,481	15,855.8
2129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	269.5	3,618.6	3,283	3,946	8,313	15,541.8
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	264.2	3,547.0	3,218	3,868	8,148	15,234.1
2131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	258.9	3,476.7	3,154	3,791	7,987	14,932.4
2132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253.8	3,407.9	3,092	3,716	7,829	14,636.7
2133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	248.8	3,340.4	3,030	3,643	7,674	14,346.9
2134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	243.9	3,274.2	2,970	3,571	7,522	14,062.8
2135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	239.0	3,209.4	2,912	3,500	7,373	13,784.4
2136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234.3	3,145.9	2,854	3,431	7,227	13,511.4
2137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	229.7	3,083.6	2,797	3,363	7,084	13,243.9
2138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225.1	3,022.5	2,742	3,296	6,944	12,981.6

Notes

a Output from CalEEMod model runs: (1) CO2e is calculated based on Methane Global Warming Potential of 21

b Output from LandGEM runs based on: (1) Lo = 100 M^3/Mg, k = 0.02 $year^{-1}$, (2) Methane Global Warming Potential of 34, (3) cap capture efficiency of 83%, and (4) methane oxidation rate of 10%.

CO2e onsite emissions are the non-captured methane. CO2e avoided emissions are output from EPA Landfill Benefit Model using landfill captured and converted into electricity from 7.65 Megawatt engine

CO2e net emissions are the difference between CO2e onsite and CO2e avoided

Table 3b. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions (LFG to Energy) [b]				
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2 from Combustion in Energy Generator	CO2e (Include CO2 from Energy Generator and Bio Source)	CO2e (avoided)- 0.65868 lb/kwh CAeGrid	CO2e (Net)
Year	tons/yr										MT/yr						tons/yr	tons/yr	MT/yr	MT/yr	MT/yr
2014	1.13	8.27	5.07	0.01	1,275.12	0.42	1,275.55	139.60	0.42	140.03	0.00	1,055.60	1,055.60	0.09	0.00	1,057.57	0	0	0	0	0
2015	1.06	7.59	4.85	0.01	1,275.12	0.38	1,275.51	139.60	0.38	139.99	0.00	1,052.85	1,052.85	0.09	0.00	1,054.70	82.1	1,101.7	4,731.7	17,000	0.0
2016	1.00	6.96	4.68	0.01	1,278.54	0.35	1,278.89	139.94	0.34	140.29	0.00	1,053.64	1,053.64	0.08	0.00	1,055.38	162.5	2,181.5	9,369.7	17,000	0.0
2017	0.93	6.35	4.50	0.01	1,275.12	0.31	1,275.43	139.60	0.31	139.91	0.00	1,048.18	1,048.18	0.08	0.00	1,049.81	241.3	3,240.0	13,915.8	17,000	0.0
2018	0.87	5.80	4.35	0.01	1,275.12	0.27	1,275.40	139.60	0.27	139.88	0.00	1,045.72	1,045.72	0.07	0.00	1,047.24	318.6	4,277.5	18,371.9	17,000	1,371.9
2019	0.82	5.29	4.22	0.01	1,275.12	0.24	1,275.37	139.60	0.24	139.85	0.00	1,043.41	1,043.41	0.07	0.00	1,044.83	394.3	5,294.5	22,739.8	17,000	5,739.8
2020	0.77	4.84	4.12	0.01	1,278.54	0.22	1,278.76	139.94	0.22	140.16	0.00	1,044.11	1,044.11	0.06	0.00	1,045.46	468.6	6,291.4	27,021.2	17,000	10,021.2
2021	0.72	4.40	4.01	0.01	1,275.12	0.19	1,275.32	139.60	0.19	139.79	0.00	1,039.89	1,039.89	0.06	0.00	1,041.14	541.4	7,268.5	31,217.8	17,000	14,217.8
2022	0.69	4.02	3.93	0.01	1,275.12	0.17	1,275.30	139.60	0.17	139.77	0.00	1,038.04	1,038.04	0.06	0.00	1,039.24	612.7	8,226.2	35,331.4	17,000	18,331.4
2023	0.66	3.68	3.85	0.01	1,275.12	0.15	1,275.28	139.60	0.15	139.75	0.00	1,036.32	1,036.32	0.05	0.00	1,037.46	682.6	9,165.0	39,363.4	17,000	22,363.4
2024	0.63	3.38	3.80	0.01	1,278.54	0.14	1,278.68	139.94	0.14	140.08	0.00	1,037.62	1,037.62	0.05	0.00	1,038.71	751.1	10,085.2	43,315.7	17,000	26,315.7
2025	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	818.3	10,987.2	47,189.6	17,000	30,189.6
2026	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	884.2	11,871.3	50,986.9	17,000	33,986.9
2027	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	948.7	12,737.9	54,709.0	17,000	37,709.0
2028	0.60	3.11	3.74	0.01	1,278.54	0.12	1,278.67	139.94	0.12	140.07	0.00	1,036.16	1,036.16	0.05	0.00	1,037.21	1,012.0	13,587.4	58,357.3	17,000	41,357.3
2029	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1,074.0	14,420.0	61,933.5	17,000	44,933.5
2030	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	1,134.8	15,236.1	65,438.8	17,000	48,438.8
2031	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	1,194.4	16,036.1	68,874.7	17,000	51,874.7
2032	0.51	2.10	3.54	0.01	1,278.54	0.07	1,278.62	139.94	0.07	140.02	0.00	1,030.94	1,030.94	0.04	0.00	1,031.81	1,252.8	16,820.3	72,242.5	17,000	55,242.5
2033	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	1,310.0	17,588.9	75,543.7	17,000	58,543.7
2034	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	1,366.1	18,342.3	78,779.5	17,000	61,779.5
2035	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	1,421.1	19,080.7	81,951.3	17,000	64,951.3
2036	0.46	1.59	3.43	0.01	1,278.54	0.05	1,278.59	139.94	0.05	139.99	0.00	1,029.42	1,029.42	0.04	0.00	1,030.21	1,475.0	19,804.6	85,060.2	17,000	68,060.2
2037	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	1,527.9	20,514.1	88,107.6	17,000	71,107.6
2038	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	1,579.7	21,209.6	91,094.6	17,000	74,094.6
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,630.5	21,891.3	94,022.5	17,000	77,022.5
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,598.2	21,457.8	92,160.7	17,000	75,160.7
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,566.5	21,032.9	90,335.8	17,000	73,335.8
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,535.5	20,616.4	88,547.1	17,000	71,547.1
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,505.1	20,208.2	86,793.7	17,000	69,793.7
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,475.3	19,808.1	85,075.1	17,000	68,075.1
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,446.1	19,415.8	83,390.5	17,000	66,390.5
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,417.5	19,031.4	81,739.2	17,000	64,739.2
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,389.4	18,654.5	80,120.7	17,000	63,120.7
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361.9	18,285.1	78,534.2	17,000	61,534.2
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,334.9	17,923.1	76,979.1	17,000	59,979.1
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,308.5	17,568.2	75,454.8	17,000	58,454.8
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,282.6	17,220.3	73,960.7	17,000	56,960.7
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,257.2	16,879.3	72,496.2	17,000	55,496.2
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,232.3	16,545.1	71,060.7	17,000	54,060.7
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,207.9	16,217.5	69,653.6	17,000	52,653.6
2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,184.0	15,896.3	68,274.3	17,000	51,274.3
2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,160.5	15,581.6	66,922.4	17,000	49,922.4
2057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,137.5	15,273.0	65,597.3	17,000	48,597.3
2058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,115.0	14,970.6	64,298.4	17,000	47,298.4
2059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,092.9	14,674.2	63,025.2	17,000	46,025.2
2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,071.3	14,383.6	61,777.2	17,000	44,777.2
2061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,050.1	14,098.8	60,553.9	17,000	43,553.9
2062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,029.3	13,819.6	59,354.9	17,000	42,354.9
2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,008.9	13,546.0	58,179.6	17,000	41,179.6
2064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	988.9	13,277.7	57,027.5	17,000	40,027.5
2065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	969.3	13,014.8	55,898.3	17,000	38,898.3
2066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	950.1	12,757.1	54,791.4	17,000	37,791.4
2067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	931.3	12,504.5	53,706.5	17,000	36,706.5
2068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	912.9	12,256.9	52,643.0	17,000	35,643.0
2069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	894.8	12,014.2	51,600.6	17,000	34,600.6
2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	877.1	11,776.3	50,578.9	17,000	33,578.9
2071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	859.7	11,543.1	49,577.4	17,000	32,577.4
2072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	842.7	11,314.5	48,595.7	17,000	31,595.7
2073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	826.0	11,090.5	47,633.4	17,000	30,633.4
2074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	809.7	10,870.9	46,690.2	17,000	29,690.2
2075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	793.6	10,655.6	45,765.7	17,000	28,765.7
2076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	777.9	10,444.6	44,859.4	17,000	27,859.4
2077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	762.5	10,237.8	43,971.2	17,000	26,971.2
2078	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	747.4	10,035.1	43,100.5	17,000	26,100.5
2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	732.6	9,836.4	42,247.0	17,000	25,247.0
2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	718.1	9,641.6	41,410.5	17,000	24,410.5
2081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	703.9	9,450.7	40,590.5	17,000	23,590.5
2082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.9	9,263.6	39,786.8	17,000	22,786.8
2083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	676.3	9,080.1	38,998.9	17,000	21,998.9
2084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	662.9	8,900.3	38,226.7	17,000	21,226.7

Table 3b. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions (LFG to Energy) [b]				
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2 from Combustion in Energy Generator	CO2e (Include CO2 from Energy Generator and Bio Source)	CO2e (avoided)- 0.65868 lb/kwh CAeGrid	CO2e (Net)
Year	tons/yr										MT/yr						tons/yr	tons/yr	MT/yr	MT/yr	MT/yr
2085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649.8	8,724.1	37,469.8	17,000	20,469.8
2086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	636.9	8,551.3	36,727.8	17,000	19,727.8
2087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	624.3	8,382.0	36,000.5	17,000	19,000.5
2088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	611.9	8,216.0	35,287.7	17,000	18,287.7
2089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	599.8	8,053.4	34,588.9	17,000	17,588.9
2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	587.9	7,893.9	33,904.0	17,000	16,904.0
2091	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	576.3	7,737.6	33,232.7	17,000	16,232.7
2092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	564.9	7,584.4	32,574.6	17,000	15,574.6
2093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	553.7	7,434.2	31,929.6	17,000	14,929.6
2094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	542.7	7,287.0	31,297.4	17,000	14,297.4
2095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	532.0	7,142.7	30,677.6	17,000	13,677.6
2096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	521.5	7,001.2	30,070.2	17,000	13,070.2
2097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	511.1	6,862.6	29,474.8	17,000	12,474.8
2098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	501.0	6,726.7	28,891.1	17,000	11,891.1
2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	491.1	6,593.5	28,319.0	17,000	11,319.0
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	481.4	6,463.0	27,758.3	17,000	10,758.3
2101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	471.8	6,335.0	27,208.6	17,000	10,208.6
2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	462.5	6,209.6	26,669.9	17,000	9,669.9
2103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	453.3	6,086.6	26,141.8	17,000	9,141.8
2104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	444.4	5,966.1	25,624.1	17,000	8,624.1
2105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	435.6	5,847.9	25,116.7	17,000	8,116.7
2106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	426.9	5,732.1	24,619.4	17,000	7,619.4
2107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	418.5	5,618.6	24,131.9	17,000	7,131.9
2108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	410.2	5,507.4	23,654.0	17,000	6,654.0
2109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	402.1	5,398.3	23,185.7	17,000	6,185.7
2110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	394.1	5,291.4	22,726.6	17,000	5,726.6
2111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	386.3	5,186.7	22,276.5	17,000	5,276.5
2112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	378.7	5,083.9	21,835.4	17,000	4,835.4
2113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	371.2	4,983.3	21,403.1	17,000	4,403.1
2114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	363.8	4,884.6	20,979.3	17,000	3,979.3
2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	356.6	4,787.9	20,563.8	17,000	3,563.8
2116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	349.5	4,693.1	20,156.6	17,000	3,156.6
2117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	342.6	4,600.1	19,757.5	17,000	2,757.5
2118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	335.8	4,509.1	19,366.3	17,000	2,366.3
2119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	329.2	4,419.8	18,982.8	17,000	1,982.8
2120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	322.7	4,332.3	18,606.9	17,000	1,606.9
2121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	316.3	4,246.5	18,238.5	17,000	1,238.5
2122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	310.0	4,162.4	17,877.3	17,000	877.3
2123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	303.9	4,080.0	17,523.3	17,000	523.3
2124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	297.9	3,999.2	17,176.4	17,000	176.4
2125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	292.0	3,920.0	16,836.2	17,000	0.0
2126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	286.2	3,842.4	16,502.9	17,000	0.0
2127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	280.5	3,766.3	16,176.1	17,000	0.0
2128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	275.0	3,691.7	15,855.8	17,000	0.0
2129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	269.5	3,618.6	15,541.8	17,000	0.0
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	264.2	3,547.0	15,234.1	17,000	0.0
2131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	258.9	3,476.7	14,932.4	17,000	0.0
2132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	253.8	3,407.9	14,636.7	17,000	0.0
2133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	248.8	3,340.4	14,346.9	17,000	0.0
2134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	243.9	3,274.2	14,062.8	17,000	0.0
2135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	239.0	3,209.4	13,784.4	17,000	0.0
2136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	234.3	3,145.9	13,511.4	17,000	0.0
2137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	229.7	3,083.6	13,243.9	17,000	0.0
2138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	225.1	3,022.5	12,981.6	17,000	0.0

Notes

a Output from CalEEMod model runs: (1) CO2e is calculated based on Methane Global Warming Potential of 21

b Output from LandGEM runs based on: (1) Lo = 100 M^3/Mg, k = 0.02 $year^{-1}$, (2) Methane Global Warming Potential of 34, (3) cap capture efficiency of 83%, and (4) methane oxidation rate of 10%.

CO2e onsite emissions are the non-captured methane. CO2e avoided emissions are output from EPA Landfill Benefit Model using landfill captured and converted into electricity from 7.65 Megawatt engine

CO2e net emissions are the difference between CO2e onsite and CO2e avoided

Table 3c. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions from Buried Refuse (Landfill Cap and flare) [c]					
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2 from Flare (Biogenic)	CO2 from Flare (biogenic)	CO2 from landfill (biogenic)	Non-biogenic CO2 from CH4	CO2e (Include CO2 from Flare and Bio Source)- Gross emissions
Year	tons/yr										MT/yr						tons/yr	tons/yr	MT/yr	MT/yr	MT/yr	MT/yr
2014	1.13	8.27	5.07	0.01	1,275.12	0.42	1,275.55	139.60	0.42	140.03	0.00	1,055.60	1,055.60	0.09	0.00	1,057.57	0	0	0	0	0	0
2015	1.06	7.59	4.85	0.01	1,275.12	0.38	1,275.51	139.60	0.38	139.99	0.00	1,052.85	1,052.85	0.09	0.00	1,054.70	165.1	1,059.2	961	1,370	5,091	7,422.0
2016	1.00	6.96	4.68	0.01	1,278.54	0.35	1,278.89	139.94	0.34	140.29	0.00	1,053.64	1,053.64	0.08	0.00	1,055.38	326.9	2,097.4	1,903	2,712	10,082	14,697.0
2017	0.93	6.35	4.50	0.01	1,275.12	0.31	1,275.43	139.60	0.31	139.91	0.00	1,048.18	1,048.18	0.08	0.00	1,049.81	485.5	3,115.1	2,826	4,028	14,974	21,827.9
2018	0.87	5.80	4.35	0.01	1,275.12	0.27	1,275.40	139.60	0.27	139.88	0.00	1,045.72	1,045.72	0.07	0.00	1,047.24	640.9	4,112.6	3,731	5,318	19,769	28,817.7
2019	0.82	5.29	4.22	0.01	1,275.12	0.24	1,275.37	139.60	0.24	139.85	0.00	1,043.41	1,043.41	0.07	0.00	1,044.83	793.3	5,090.4	4,618	6,582	24,469	35,669.0
2020	0.77	4.84	4.12	0.01	1,278.54	0.22	1,278.76	139.94	0.22	140.16	0.00	1,044.11	1,044.11	0.06	0.00	1,045.46	942.7	6,048.8	5,487	7,821	29,076	42,384.7
2021	0.72	4.40	4.01	0.01	1,275.12	0.19	1,275.32	139.60	0.19	139.79	0.00	1,039.89	1,039.89	0.06	0.00	1,041.14	1089.1	6,988.2	6,340	9,036	33,592	48,967.4
2022	0.69	4.02	3.93	0.01	1,275.12	0.17	1,275.30	139.60	0.17	139.77	0.00	1,038.04	1,038.04	0.06	0.00	1,039.24	1232.6	7,909.1	7,175	10,227	38,018	55,419.8
2023	0.66	3.68	3.85	0.01	1,275.12	0.15	1,275.28	139.60	0.15	139.75	0.00	1,036.32	1,036.32	0.05	0.00	1,037.46	1373.2	8,811.7	7,994	11,394	42,357	61,744.3
2024	0.63	3.38	3.80	0.01	1,278.54	0.14	1,278.68	139.94	0.14	140.08	0.00	1,037.62	1,037.62	0.05	0.00	1,038.71	1511.1	9,696.4	8,796	12,538	46,609	67,943.7
2025	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1646.3	10,563.6	9,583	13,659	50,778	74,020.3
2026	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1778.7	11,413.6	10,354	14,758	54,864	79,976.6
2027	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1908.6	12,246.8	11,110	15,836	58,869	85,814.9
2028	0.60	3.11	3.74	0.01	1,278.54	0.12	1,278.67	139.94	0.12	140.07	0.00	1,036.16	1,036.16	0.05	0.00	1,037.21	2035.9	13,063.5	11,851	16,892	62,795	91,537.6
2029	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	2160.6	13,864.0	12,577	17,927	66,643	97,147.0
2030	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2282.9	14,648.7	13,289	18,941	70,415	102,645.4
2031	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2402.8	15,417.8	13,987	19,936	74,112	108,034.8
2032	0.51	2.10	3.54	0.01	1,278.54	0.07	1,278.62	139.94	0.07	140.02	0.00	1,030.94	1,030.94	0.04	0.00	1,031.81	2520.3	16,171.8	14,671	20,911	77,736	113,317.6
2033	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2635.4	16,910.7	15,341	21,866	81,288	118,495.7
2034	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2748.3	17,635.1	15,998	22,803	84,770	123,571.3
2035	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	2859.0	18,345.1	16,642	23,721	88,183	128,546.4
2036	0.46	1.59	3.43	0.01	1,278.54	0.05	1,278.59	139.94	0.05	139.99	0.00	1,029.42	1,029.42	0.04	0.00	1,030.21	2967.4	19,041.0	17,274	24,621	91,528	133,423.0
2037	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	3073.7	19,723.2	17,893	25,503	94,807	138,203.0
2038	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	3178.0	20,391.9	18,499	26,367	98,022	142,888.4
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3280.1	21,047.3	19,094	27,215	101,172	147,481.0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3215.1	20,630.5	18,716	26,676	99,169	144,560.6
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3151.5	20,222.0	18,345	26,148	97,205	141,698.1
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3089.1	19,821.6	17,982	25,630	95,280	138,892.3
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3027.9	19,429.1	17,626	25,123	93,394	136,142.1
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2968.0	19,044.4	17,277	24,625	91,544	133,446.3
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2909.2	18,667.3	16,935	24,138	89,732	130,803.9
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2851.6	18,297.6	16,599	23,660	87,955	128,213.8
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2795.1	17,935.3	16,271	23,191	86,213	125,675.0
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2739.8	17,580.2	15,948	22,732	84,506	123,186.4
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2685.5	17,232.1	15,633	22,282	82,833	120,747.2
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2632.3	16,890.8	15,323	21,841	81,193	118,356.2
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2580.2	16,556.4	15,020	21,408	79,585	116,012.6
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2529.1	16,228.5	14,722	20,984	78,009	113,715.4
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2479.0	15,907.2	14,431	20,569	76,464	111,463.7
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2430.0	15,592.2	14,145	20,161	74,950	109,256.6
2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2381.8	15,283.5	13,865	19,762	73,466	107,093.2
2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2334.7	14,980.8	13,590	19,371	72,011	104,972.6
2057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2288.4	14,684.2	13,321	18,987	70,585	102,894.0
2058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2243.1	14,393.4	13,057	18,611	69,188	100,856.5
2059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2198.7	14,108.4	12,799	18,243	67,818	98,859.4
2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2155.2	13,829.0	12,546	17,882	66,475	96,901.9
2061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2112.5	13,555.2	12,297	17,527	65,159	94,983.1
2062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2070.7	13,286.8	12,054	17,180	63,868	93,102.3
2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2029.7	13,023.7	11,815	16,840	62,604	91,258.8
2064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1989.5	12,765.8	11,581	16,507	61,364	89,451.7
2065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1950.1	12,513.0	11,352	16,180	60,149	87,680.5
2066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1911.5	12,265.3	11,127	15,859	58,958	85,944.3
2067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1873.6	12,022.4	10,907	15,545	57,790	84,242.5
2068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1836.5	11,784.3	10,691	15,238	56,646	82,574.3
2069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1800.2	11,551.0	10,479	14,936	55,524	80,939.3
2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1764.5	11,322.3	10,271	14,640	54,425	79,336.6
2071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1729.6	11,098.1	10,068	14,350	53,347	77,765.6
2072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1695.3	10,878.3	9,869	14,066	52,291	76,225.7
2073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1661.8	10,662.9	9,673	13,788	51,256	74,716.4
2074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1628.8	10,451.8	9,482	13,515	50,241	73,236.9
2075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1596.6	10,244.8	9,294	13,247	49,246	71,786.7
2076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1565.0	10,042.0	9,110	12,985	48,271	70,365.2
2077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1534.0	9,843.1	8,930	12,728	47,315	68,971.9
2078	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1503.6	9,648.2	8,753	12,476	46,378	67,606.2
2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1473.8	9,457.2	8,579	12,228	45,460	66,267.5
2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1444.7	9,269.9	8,410	11,986	44,559	64,955.3
2081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1416.1	9,086.3	8,243	11,749	43,677	63,669.1
2082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1388.0	8,906.4	8,080	11,516	42,812	62,408.3
2083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1360.5	8,730.1	7,920	11,288	41,964	61,172.6
2084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1333.6	8,557.2	7,763	11,065	41,134	59,961.3
2085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1307.2	8,387.7	7,609	10,846	40,319	58,774.0
2086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1281.3	8,221.7	7,459	10,631	39,521	57,610.2
2087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1255.9	8,058.9	7,311	10,420	38,738	56,469.4
2088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1231.1	7,899.3	7,166	10,214	37,971	55,351.2
2089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1206.7	7,742.9	7,024	10,012	37,219	54,255.2
2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1182.8	7,589.5	6,885	9,814	36,482	53,180.9
2091	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1159.4	7,439.3	6,749	9,619	35,760	52,127.8
2092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1136.4	7,292.0	6,615	9,429	35,052	51,095.6
2093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1113.9	7,147.6	6,484	9,242	34,358	50,083.9
2094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1091.8	7,006.0	6,356	9,059	33,677	49,092.1

Table 3c. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions from Buried Refuse (Landfill Cap and flare) [c]					
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2 from Flare (Biogenic)	CO2 from Flare (biogenic)	CO2 from landfill (biogenic)	Non-biogenic CO2 from CH4	CO2e (Include CO2 from Flare and Bio Source)- Gross emissions
Year	tons/yr										MT/yr						tons/yr	tons/yr	MT/yr	MT/yr	MT/yr	MT/yr
2095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1070.2	6,867.3	6,230	8,880	33,010	48,120.1
2096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1049.0	6,731.3	6,107	8,704	32,357	47,167.2
2097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1028.3	6,598.0	5,986	8,532	31,716	46,233.2
2098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1007.9	6,467.4	5,867	8,363	31,088	45,317.8
2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	987.9	6,339.3	5,751	8,197	30,472	44,420.4
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	968.4	6,213.8	5,637	8,035	29,869	43,540.8
2101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	949.2	6,090.8	5,525	7,876	29,278	42,678.7
2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	930.4	5,970.1	5,416	7,720	28,698	41,833.6
2103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	912.0	5,851.9	5,309	7,567	28,130	41,005.2
2104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	893.9	5,736.1	5,204	7,417	27,573	40,193.2
2105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	876.2	5,622.5	5,101	7,270	27,027	39,397.4
2106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	858.9	5,511.1	5,000	7,126	26,492	38,617.2
2107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	841.9	5,402.0	4,901	6,985	25,967	37,852.6
2108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	825.2	5,295.0	4,804	6,847	25,453	37,103.0
2109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.9	5,190.2	4,708	6,711	24,949	36,368.4
2110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	792.8	5,087.4	4,615	6,578	24,455	35,648.2
2111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	777.1	4,986.7	4,524	6,448	23,971	34,942.3
2112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	761.8	4,887.9	4,434	6,320	23,496	34,250.4
2113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	746.7	4,791.2	4,346	6,195	23,031	33,572.2
2114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	731.9	4,696.3	4,260	6,072	22,575	32,907.4
2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	717.4	4,603.3	4,176	5,952	22,128	32,255.8
2116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	703.2	4,512.1	4,093	5,834	21,689	31,617.1
2117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.3	4,422.8	4,012	5,719	21,260	30,991.1
2118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	675.6	4,335.2	3,933	5,606	20,839	30,377.4
2119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	662.2	4,249.4	3,855	5,495	20,426	29,775.9
2120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649.1	4,165.2	3,779	5,386	20,022	29,186.3
2121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	636.3	4,082.8	3,704	5,279	19,625	28,608.4
2122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	623.7	4,001.9	3,630	5,175	19,237	28,041.9
2123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	611.3	3,922.7	3,559	5,072	18,856	27,486.6
2124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	599.2	3,845.0	3,488	4,972	18,482	26,942.3
2125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	587.4	3,768.9	3,419	4,873	18,117	26,408.8
2126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	575.7	3,694.2	3,351	4,777	17,758	25,885.9
2127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	564.3	3,621.1	3,285	4,682	17,406	25,373.3
2128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	553.1	3,549.4	3,220	4,589	17,061	24,870.9
2129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	542.2	3,479.1	3,156	4,499	16,724	24,378.4
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	531.5	3,410.2	3,094	4,410	16,393	23,895.7
2131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	520.9	3,342.7	3,032	4,322	16,068	23,422.5
2132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	510.6	3,276.5	2,972	4,237	15,750	22,958.7
2133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500.5	3,211.6	2,914	4,153	15,438	22,504.1
2134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	490.6	3,148.0	2,856	4,071	15,132	22,058.5
2135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480.9	3,085.7	2,799	3,990	14,833	21,621.7
2136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	471.4	3,024.6	2,744	3,911	14,539	21,193.6
2137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	462.0	2,964.7	2,690	3,833	14,251	20,773.9
2138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	452.9	2,906.0	2,636	3,758	13,969	20,362.6

Notes

a Output from CalEEMod model runs: (1) CO2e is calculated based on Methane Global Warming Potential of 21

b Output from LandGEM runs based on: (1) Lo = 114 M^3/Mg, k = 0.02 $year^{-1}$, (2) Methane Global Warming Potential of 34, (3) methane oxidation rate of 10%, and (4) capture efficiency of 70%.

CO2e onsite emissions are the non-captured methane. CO2e avoided emissions are output from EPA Landfill Benefit Model using landfill captured and converted into electricity from 7.65 Megawatt engine

CO2e net emissions are the difference between CO2e onsite and CO2e avoided

Table 3d. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions (LFG to Energy) [d]				
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2 from Combustion in Energy Generator	CO2e (Include CO2 from Energy Generator and Bio Source)	CO2e (avoided)- 0.65868 lb/kwh CAeGrid	CO2e (Net)
Year	tons/yr										MT/yr						tons/yr	tons/yr	MT/yr	MT/yr	MT/yr
2014	1.13	8.27	5.07	0.01	1,275.12	0.42	1,275.55	139.60	0.42	140.03	0.00	1,055.60	1,055.60	0.09	0.00	1,057.57	0	0	0	0	0
2015	1.06	7.59	4.85	0.01	1,275.12	0.38	1,275.51	139.60	0.38	139.99	0.00	1,052.85	1,052.85	0.09	0.00	1,054.70	165.1	1,059.2	7,422.0	17,000	0.0
2016	1.00	6.96	4.68	0.01	1,278.54	0.35	1,278.89	139.94	0.34	140.29	0.00	1,053.64	1,053.64	0.08	0.00	1,055.38	326.9	2,097.4	14,697.0	17,000	0.0
2017	0.93	6.35	4.50	0.01	1,275.12	0.31	1,275.43	139.60	0.31	139.91	0.00	1,048.18	1,048.18	0.08	0.00	1,049.81	485.5	3,115.1	21,827.9	17,000	4,827.9
2018	0.87	5.80	4.35	0.01	1,275.12	0.27	1,275.40	139.60	0.27	139.88	0.00	1,045.72	1,045.72	0.07	0.00	1,047.24	640.9	4,112.6	28,817.7	17,000	11,817.7
2019	0.82	5.29	4.22	0.01	1,275.12	0.24	1,275.37	139.60	0.24	139.85	0.00	1,043.41	1,043.41	0.07	0.00	1,044.83	793.3	5,090.4	35,669.0	17,000	18,669.0
2020	0.77	4.84	4.12	0.01	1,278.54	0.22	1,278.76	139.94	0.22	140.16	0.00	1,044.11	1,044.11	0.06	0.00	1,045.46	942.7	6,048.8	42,384.7	17,000	25,384.7
2021	0.72	4.40	4.01	0.01	1,275.12	0.19	1,275.32	139.60	0.19	139.79	0.00	1,039.89	1,039.89	0.06	0.00	1,041.14	1,089.1	6,988.2	48,967.4	17,000	31,967.4
2022	0.69	4.02	3.93	0.01	1,275.12	0.17	1,275.30	139.60	0.17	139.77	0.00	1,038.04	1,038.04	0.06	0.00	1,039.24	1,232.6	7,909.1	55,419.8	17,000	38,419.8
2023	0.66	3.68	3.85	0.01	1,275.12	0.15	1,275.28	139.60	0.15	139.75	0.00	1,036.32	1,036.32	0.05	0.00	1,037.46	1,373.2	8,811.7	61,744.3	17,000	44,744.3
2024	0.63	3.38	3.80	0.01	1,278.54	0.14	1,278.68	139.94	0.14	140.08	0.00	1,037.62	1,037.62	0.05	0.00	1,038.71	1,511.1	9,696.4	67,943.7	17,000	50,943.7
2025	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1,646.3	10,563.6	74,020.3	17,000	57,020.3
2026	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1,778.7	11,413.6	79,976.6	17,000	62,976.6
2027	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	1,908.6	12,246.8	85,814.9	17,000	68,814.9
2028	0.60	3.11	3.74	0.01	1,278.54	0.12	1,278.67	139.94	0.12	140.07	0.00	1,036.16	1,036.16	0.05	0.00	1,037.21	2,035.9	13,063.5	91,537.6	17,000	74,537.6
2029	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38	2,160.6	13,864.0	97,147.0	17,000	80,147.0
2030	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2,282.9	14,648.7	102,645.4	17,000	85,645.4
2031	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2,402.8	15,417.8	108,034.8	17,000	91,034.8
2032	0.51	2.10	3.54	0.01	1,278.54	0.07	1,278.62	139.94	0.07	140.02	0.00	1,030.94	1,030.94	0.04	0.00	1,031.81	2,520.3	16,171.8	113,317.6	17,000	96,317.6
2033	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2,635.4	16,910.7	118,495.7	17,000	101,495.7
2034	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99	2,748.3	17,635.1	123,571.3	17,000	106,571.3
2035	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	2,859.0	18,345.1	128,546.4	17,000	111,546.4
2036	0.46	1.59	3.43	0.01	1,278.54	0.05	1,278.59	139.94	0.05	139.99	0.00	1,029.42	1,029.42	0.04	0.00	1,030.21	2,967.4	19,041.0	133,423.0	17,000	116,423.0
2037	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	3,073.7	19,723.2	138,203.0	17,000	121,203.0
2038	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40	3,178.0	20,391.9	142,888.4	17,000	125,888.4
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,280.1	21,047.3	147,481.0	17,000	130,481.0
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,215.1	20,630.5	144,560.6	17,000	127,560.6
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,151.5	20,222.0	141,698.1	17,000	124,698.1
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,089.1	19,821.6	138,892.3	17,000	121,892.3
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,027.9	19,429.1	136,142.1	17,000	119,142.1
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,968.0	19,044.4	133,446.3	17,000	116,446.3
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,909.2	18,667.3	130,803.9	17,000	113,803.9
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,851.6	18,297.6	128,213.8	17,000	111,213.8
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,795.1	17,935.3	125,675.0	17,000	108,675.0
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,739.8	17,580.2	123,186.4	17,000	106,186.4
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,685.5	17,232.1	120,747.2	17,000	103,747.2
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,632.3	16,890.8	118,356.2	17,000	101,356.2
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,580.2	16,556.4	116,012.6	17,000	99,012.6
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,529.1	16,228.5	113,715.4	17,000	96,715.4
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,479.0	15,907.2	111,463.7	17,000	94,463.7
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,430.0	15,592.2	109,256.6	17,000	92,256.6
2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,381.8	15,283.5	107,093.2	17,000	90,093.2
2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,334.7	14,980.8	104,972.6	17,000	87,972.6
2057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,288.4	14,684.2	102,894.0	17,000	85,894.0
2058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,243.1	14,393.4	100,856.5	17,000	83,856.5
2059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,198.7	14,108.4	98,859.4	17,000	81,859.4
2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,155.2	13,829.0	96,901.9	17,000	79,901.9
2061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,112.5	13,555.2	94,983.1	17,000	77,983.1
2062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,070.7	13,286.8	93,102.3	17,000	76,102.3
2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,029.7	13,023.7	91,258.8	17,000	74,258.8
2064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,989.5	12,765.8	89,451.7	17,000	72,451.7
2065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,950.1	12,513.0	87,680.5	17,000	70,680.5
2066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,911.5	12,265.3	85,944.3	17,000	68,944.3
2067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,873.6	12,022.4	84,242.5	17,000	67,242.5
2068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,836.5	11,784.3	82,574.3	17,000	65,574.3
2069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,800.2	11,551.0	80,939.3	17,000	63,939.3
2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,764.5	11,322.3	79,336.6	17,000	62,336.6
2071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,729.6	11,098.1	77,765.6	17,000	60,765.6
2072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,695.3	10,878.3	76,225.7	17,000	59,225.7
2073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,661.8	10,662.9	74,716.4	17,000	57,716.4
2074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,628.8	10,451.8	73,236.9	17,000	56,236.9
2075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,596.6	10,244.8	71,786.7	17,000	54,786.7
2076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,565.0	10,042.0	70,365.2	17,000	53,365.2
2077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,534.0	9,843.1	68,971.9	17,000	51,971.9
2078	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,503.6	9,648.2	67,606.2	17,000	50,606.2
2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,473.8	9,457.2	66,267.5	17,000	49,267.5
2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,444.7	9,269.9	64,955.3	17,000	47,955.3
2081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,416.1	9,086.3	63,669.1	17,000	46,669.1
2082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,388.0	8,906.4	62,408.3	17,000	45,408.3
2083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,360.5	8,730.1	61,172.6	17,000	44,172.6
2084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,333.6	8,557.2	59,961.3	17,000	42,961.3
2085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,307.2	8,387.7	58,774.0	17,000	41,774.0
2086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,281.3	8,221.7	57,610.2	17,000	40,610.2
2087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,255.9	8,058.9	56,469.4	17,000	39,469.4
2088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,231.1	7,899.3	55,351.2	17,000	38,351.2
2089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,206.7	7,742.9	54,255.2	17,000	37,255.2
2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,182.8	7,589.5	53,180.9	17,000	36,180.9
2091	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,159.4	7,439.3	52,127.8	17,000	35,127.8
2092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,136.4	7,292.0	51,095.6	17,000	34,095.6

Table 3d. Baseline Emissions Summary for Transporting and Landfilling of 1,000 Tons per Day of Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute [a]																GHG Emissions (LFG to Energy) [d]				
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio-CO2	Nbio-CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2 from Combustion in Energy Generator	CO2e (Include CO2 from Energy Generator and Bio Source)	CO2e (avoided)- 0.65868 lb/kwh CAeGrid	CO2e (Net)
Year	tons/yr										MT/yr						tons/yr	tons/yr	MT/yr	MT/yr	MT/yr
2093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,113.9	7,147.6	50,083.9	17,000	33,083.9
2094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,091.8	7,006.0	49,092.1	17,000	32,092.1
2095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,070.2	6,867.3	48,120.1	17,000	31,120.1
2096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,049.0	6,731.3	47,167.2	17,000	30,167.2
2097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,028.3	6,598.0	46,233.2	17,000	29,233.2
2098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,007.9	6,467.4	45,317.8	17,000	28,317.8
2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	987.9	6,339.3	44,420.4	17,000	27,420.4
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	968.4	6,213.8	43,540.8	17,000	26,540.8
2101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	949.2	6,090.8	42,678.7	17,000	25,678.7
2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	930.4	5,970.1	41,833.6	17,000	24,833.6
2103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	912.0	5,851.9	41,005.2	17,000	24,005.2
2104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	893.9	5,736.1	40,193.2	17,000	23,193.2
2105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	876.2	5,622.5	39,397.4	17,000	22,397.4
2106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	858.9	5,511.1	38,617.2	17,000	21,617.2
2107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	841.9	5,402.0	37,852.6	17,000	20,852.6
2108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	825.2	5,295.0	37,103.0	17,000	20,103.0
2109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	808.9	5,190.2	36,368.4	17,000	19,368.4
2110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	792.8	5,087.4	35,648.2	17,000	18,648.2
2111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	777.1	4,986.7	34,942.3	17,000	17,942.3
2112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	761.8	4,887.9	34,250.4	17,000	17,250.4
2113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	746.7	4,791.2	33,572.2	17,000	16,572.2
2114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	731.9	4,696.3	32,907.4	17,000	15,907.4
2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	717.4	4,603.3	32,255.8	17,000	15,255.8
2116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	703.2	4,512.1	31,617.1	17,000	14,617.1
2117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	689.3	4,422.8	30,991.1	17,000	13,991.1
2118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	675.6	4,335.2	30,377.4	17,000	13,377.4
2119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	662.2	4,249.4	29,775.9	17,000	12,775.9
2120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649.1	4,165.2	29,186.3	17,000	12,186.3
2121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	636.3	4,082.8	28,608.4	17,000	11,608.4
2122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	623.7	4,001.9	28,041.9	17,000	11,041.9
2123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	611.3	3,922.7	27,486.6	17,000	10,486.6
2124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	599.2	3,845.0	26,942.3	17,000	9,942.3
2125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	587.4	3,768.9	26,408.8	17,000	9,408.8
2126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	575.7	3,694.2	25,885.9	17,000	8,885.9
2127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	564.3	3,621.1	25,373.3	17,000	8,373.3
2128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	553.1	3,549.4	24,870.9	17,000	7,870.9
2129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	542.2	3,479.1	24,378.4	17,000	7,378.4
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	531.5	3,410.2	23,895.7	17,000	6,895.7
2131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	520.9	3,342.7	23,422.5	17,000	6,422.5
2132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	510.6	3,276.5	22,958.7	17,000	5,958.7
2133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500.5	3,211.6	22,504.1	17,000	5,504.1
2134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	490.6	3,148.0	22,058.5	17,000	5,058.5
2135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	480.9	3,085.7	21,621.7	17,000	4,621.7
2136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	471.4	3,024.6	21,193.6	17,000	4,193.6
2137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	462.0	2,964.7	20,773.9	17,000	3,773.9
2138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	452.9	2,906.0	20,362.6	17,000	3,362.6

Notes

a Output from CalEEMod model runs: (1) CO2e is calculated based on Methane Global Warming Potential of 21

b Output from LandGEM runs based on: (1) Lo = 114 M^3/Mg, k = 0.02 $year^{-1}$, (2) Methane Global Warming Potential of 34, (3) methane oxidation rate of 10%, and (4) capture efficiency of 70%.

CO2e onsite emissions are the non-captured methane. CO2e avoided emissions are output from EPA Landfill Benefit Model using landfill captured and converted into electricity from 7.65 Megawatt engine

CO2e net emissions are the difference between CO2e onsite and CO2e avoided

Table 4a. Emissions Summary for Transporting and Landfilling of 136 Tons per Day of Pre-processed Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute[a]																GHG Emissions from Buried Refuse (Landfill Cap and flare)[b]			
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2	CO2 from Flare	CO2e (Include CO2 from Flare)
Year	tons/yr										MT/yr						tons/yr	tons/yr	tons/yr	MT/yr
2014	0.17	1.06	0.94	0	186.18	0.06	186.23	19.18	0.06	19.24	0	186.57	186.57	0.01	0	186.88	0	0	0	0
2015	0.16	0.97	0.89	0	186.18	0.05	186.23	19.18	0.05	19.23	0	185.05	185.05	0.01	0	185.34	0.1	2.9	1.2	5.83
2016	0.15	0.89	0.85	0	186.68	0.05	186.73	19.23	0.05	19.28	0	184.39	184.39	0.01	0	184.66	0.2	5.7	2.4	11.64
2017	0.14	0.82	0.8	0	186.18	0.04	186.22	19.18	0.04	19.22	0	182.45	182.45	0.01	0	182.71	0.3	8.6	3.5	17.44
2018	0.13	0.75	0.76	0	186.18	0.04	186.21	19.18	0.04	19.22	0	181.08	181.08	0.01	0	181.32	0.4	11.4	4.7	23.22
2019	0.12	0.68	0.73	0	186.18	0.03	186.21	19.18	0.03	19.21	0	179.8	179.8	0.01	0	180.02	0.5	14.3	5.9	28.98
2020	0.11	0.62	0.71	0	186.68	0.03	186.71	19.23	0.03	19.26	0	179.09	179.09	0.01	0	179.3	0.6	17.1	7.1	34.72
2021	0.11	0.57	0.68	0	186.18	0.03	186.2	19.18	0.03	19.21	0	177.84	177.84	0.01	0	178.04	0.7	19.9	8.2	40.45
2022	0.1	0.52	0.66	0	186.18	0.02	186.2	19.18	0.02	19.2	0	176.82	176.82	0.01	0	177.01	0.8	22.7	9.4	46.16
2023	0.1	0.47	0.64	0	186.18	0.02	186.2	19.18	0.02	19.2	0	175.86	175.86	0.01	0	176.04	0.9	25.5	10.5	51.85
2024	0.09	0.44	0.63	0	186.68	0.02	186.7	19.23	0.02	19.25	0	175.49	175.49	0.01	0	175.66	1.0	28.3	11.7	57.53
2025	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	1.1	31.1	12.8	63.19
2026	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	1.2	33.9	14.0	68.83
2027	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	1.3	36.7	15.1	74.46
2028	0.09	0.4	0.61	0	186.68	0.02	186.7	19.23	0.02	19.25	0	174.68	174.68	0.01	0	174.84	1.4	39.4	16.3	80.06
2029	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	1.5	42.2	17.4	85.65
2030	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	1.6	44.9	18.5	91.23
2031	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	1.7	47.7	19.7	96.79
2032	0.07	0.27	0.56	0	186.68	0.01	186.7	19.23	0.01	19.24	0	171.78	171.78	0.01	0	171.91	1.8	50.4	20.8	102.33
2033	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	1.9	53.1	21.9	107.85
2034	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	2.0	55.8	23.0	113.36
2035	0.07	0.21	0.53	0	186.18	0.01	186.19	19.18	0.01	19.19	0	170.47	170.47	0.01	0	170.59	2.1	58.5	24.1	118.85
2036	0.07	0.21	0.53	0	186.68	0.01	186.69	19.23	0.01	19.24	0	170.93	170.93	0.01	0	171.06	2.2	61.2	25.2	124.33
2037	0.07	0.21	0.53	0	186.18	0.01	186.19	19.18	0.01	19.19	0	170.47	170.47	0.01	0	170.59	2.3	63.9	26.4	129.78
2038	0.07	0.21	0.53	0	186.18	0.01	186.19	19.18	0.01	19.19	0	170.47	170.47	0.01	0	170.59	2.4	66.6	27.5	135.23
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	69.3	28.6	140.65
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	69.1	28.5	140.23
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	68.9	28.4	139.81
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	68.7	28.3	139.39
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	68.5	28.2	138.98
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	68.2	28.1	138.56
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	68.0	28.1	138.14
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	67.8	28.0	137.73
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	67.6	27.9	137.32
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.5	67.4	27.8	136.91
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	67.2	27.7	136.50
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	67.0	27.6	136.09
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	66.8	27.6	135.68
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	66.6	27.5	135.27
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	66.4	27.4	134.87
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	66.2	27.3	134.46
2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	66.0	27.2	134.06
2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	65.8	27.1	133.66
2057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	65.6	27.1	133.26
2058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	65.4	27.0	132.86
2059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	65.2	26.9	132.46
2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	65.0	26.8	132.07
2061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	64.9	26.7	131.67
2062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.4	64.7	26.7	131.28
2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	64.5	26.6	130.88
2064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	64.3	26.5	130.49
2065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	64.1	26.4	130.10
2066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	63.9	26.3	129.71
2067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	63.7	26.3	129.32
2068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	63.5	26.2	128.93
2069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	63.3	26.1	128.55
2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	63.1	26.0	128.16
2071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	62.9	25.9	127.78
2072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	62.7	25.9	127.40
2073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	62.6	25.8	127.01
2074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	62.4	25.7	126.63
2075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	62.2	25.6	126.25
2076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	62.0	25.6	125.88
2077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.3	61.8	25.5	125.50
2078	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	61.6	25.4	125.12
2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	61.4	25.3	124.75
2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	61.3	25.3	124.37
2081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	61.1	25.2	124.00
2082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	60.9	25.1	123.63

Table 4a. Emissions Summary for Transporting and Landfilling of 136 Tons per Day of Pre-processed Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute[a]																GHG Emissions from Buried Refuse (Landfill Cap and flare)[b]			
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2	CO2 from Flare	CO2e (Include CO2 from Flare)
Year	tons/yr										MT/yr						tons/yr	tons/yr	tons/yr	MT/yr
2083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	60.7	25.0	123.26
2084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	60.5	25.0	122.89
2085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	60.3	24.9	122.52
2086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	60.2	24.8	122.16
2087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	60.0	24.7	121.79
2088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	59.8	24.7	121.42
2089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	59.6	24.6	121.06
2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	59.4	24.5	120.70
2091	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	59.3	24.4	120.34
2092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.2	59.1	24.4	119.98
2093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	58.9	24.3	119.62
2094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	58.7	24.2	119.26
2095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	58.6	24.1	118.90
2096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	58.4	24.1	118.55
2097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	58.2	24.0	118.19
2098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	58.0	23.9	117.84
2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	57.9	23.9	117.48
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	57.7	23.8	117.13
2101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	57.5	23.7	116.78
2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	57.3	23.6	116.43
2103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	57.2	23.6	116.08
2104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	57.0	23.5	115.73
2105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	56.8	23.4	115.39
2106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	56.7	23.4	115.04
2107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	56.5	23.3	114.70
2108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.1	56.3	23.2	114.35
2109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	56.2	23.2	114.01
2110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	56.0	23.1	113.67
2111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	55.8	23.0	113.33
2112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	55.7	22.9	112.99
2113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	55.5	22.9	112.65
2114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	55.3	22.8	112.31
2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	55.2	22.7	111.98
2116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	55.0	22.7	111.64
2117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	54.8	22.6	111.31
2118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	54.7	22.5	110.97
2119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	54.5	22.5	110.64
2120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	54.3	22.4	110.31
2121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	54.2	22.3	109.98
2122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	54.0	22.3	109.65
2123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	53.8	22.2	109.32
2124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.0	53.7	22.1	108.99
2125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	53.5	22.1	108.67
2126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	53.4	22.0	108.34
2127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	53.2	21.9	108.02
2128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	53.0	21.9	107.69
2129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	52.9	21.8	107.37
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	52.7	21.7	107.05
2131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	52.6	21.7	106.73
2132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	52.4	21.6	106.41
2133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	52.3	21.5	106.09
2134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	52.1	21.5	105.77
2135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	51.9	21.4	105.46
2136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	51.8	21.4	105.14
2137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	51.6	21.3	104.83
2138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	51.5	21.2	104.51

Note

a Output from CalEEMod model runs: (1) CO2e is calculated based on Methane Global Warming Potential of 21

b Output from LandGEM runs based on: (1) Lo = 6.2 M^3/Mg, k = 0.003 $year^{-1}$, (2) Methane Global Warming Potential of 34, (3) cap capture efficiency of 83%.

Table 4b. Emissions Summary for Transporting and Landfilling of 136 Tons per Day of Pro-processed Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute[a]																GHG Emissions from Buried Refuse (Landfill Cap and flare)[b]			
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2	CO2 from Flare	CO2e (Include CO2 from Flare)
Year	tons/yr										MT/yr						tons/yr	tons/yr	tons/yr	MT/yr
2014	0.17	1.06	0.94	0	186.18	0.06	186.23	19.18	0.06	19.24	0	186.57	186.57	0.01	0	186.88	0	0	0	0
2015	0.16	0.97	0.89	0	186.18	0.05	186.23	19.18	0.05	19.23	0	185.05	185.05	0.01	0	185.34	0.2	2.9	1.2	8.30
2016	0.15	0.89	0.85	0	186.68	0.05	186.73	19.23	0.05	19.28	0	184.39	184.39	0.01	0	184.66	0.4	5.7	2.4	16.57
2017	0.14	0.82	0.8	0	186.18	0.04	186.22	19.18	0.04	19.22	0	182.45	182.45	0.01	0	182.71	0.6	8.6	3.5	24.82
2018	0.13	0.75	0.76	0	186.18	0.04	186.21	19.18	0.04	19.22	0	181.08	181.08	0.01	0	181.32	0.7	11.4	4.7	33.04
2019	0.12	0.68	0.73	0	186.18	0.03	186.21	19.18	0.03	19.21	0	179.8	179.8	0.01	0	180.02	0.9	14.3	5.9	41.24
2020	0.11	0.62	0.71	0	186.68	0.03	186.71	19.23	0.03	19.26	0	179.09	179.09	0.01	0	179.3	1.1	17.1	7.1	49.41
2021	0.11	0.57	0.68	0	186.18	0.03	186.2	19.18	0.03	19.21	0	177.84	177.84	0.01	0	178.04	1.3	19.9	8.2	57.56
2022	0.1	0.52	0.66	0	186.18	0.02	186.2	19.18	0.02	19.2	0	176.82	176.82	0.01	0	177.01	1.5	22.7	9.4	65.69
2023	0.1	0.47	0.64	0	186.18	0.02	186.2	19.18	0.02	19.2	0	175.86	175.86	0.01	0	176.04	1.6	25.5	10.5	73.79
2024	0.09	0.44	0.63	0	186.68	0.02	186.7	19.23	0.02	19.25	0	175.49	175.49	0.01	0	175.66	1.8	28.3	11.7	81.87
2025	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	2.0	31.1	12.8	89.92
2026	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	2.2	33.9	14.0	97.95
2027	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	2.4	36.7	15.1	105.95
2028	0.09	0.4	0.61	0	186.68	0.02	186.7	19.23	0.02	19.25	0	174.68	174.68	0.01	0	174.84	2.5	39.4	16.3	113.93
2029	0.09	0.4	0.61	0	186.18	0.02	186.2	19.18	0.02	19.2	0	174.2	174.2	0.01	0	174.36	2.7	42.2	17.4	121.89
2030	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	2.9	44.9	18.5	129.82
2031	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	3.1	47.7	19.7	137.73
2032	0.07	0.27	0.56	0	186.68	0.01	186.7	19.23	0.01	19.24	0	171.78	171.78	0.01	0	171.91	3.2	50.4	20.8	145.61
2033	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	3.4	53.1	21.9	153.48
2034	0.07	0.27	0.56	0	186.18	0.01	186.19	19.18	0.01	19.19	0	171.31	171.31	0.01	0	171.44	3.6	55.8	23.0	161.31
2035	0.07	0.21	0.53	0	186.18	0.01	186.19	19.18	0.01	19.19	0	170.47	170.47	0.01	0	170.59	3.8	58.5	24.1	169.13
2036	0.07	0.21	0.53	0	186.68	0.01	186.69	19.23	0.01	19.24	0	170.93	170.93	0.01	0	171.06	3.9	61.2	25.2	176.92
2037	0.07	0.21	0.53	0	186.18	0.01	186.19	19.18	0.01	19.19	0	170.47	170.47	0.01	0	170.59	4.1	63.9	26.4	184.69
2038	0.07	0.21	0.53	0	186.18	0.01	186.19	19.18	0.01	19.19	0	170.47	170.47	0.01	0	170.59	4.3	66.6	27.5	192.43
2039	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.5	69.3	28.6	200.15
2040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	69.1	28.5	199.55
2041	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	68.9	28.4	198.95
2042	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	68.7	28.3	198.36
2043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	68.5	28.2	197.76
2044	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	68.2	28.1	197.17
2045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	68.0	28.1	196.58
2046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.4	67.8	28.0	195.99
2047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	67.6	27.9	195.40
2048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	67.4	27.8	194.82
2049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	67.2	27.7	194.24
2050	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	67.0	27.6	193.65
2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	66.8	27.6	193.07
2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	66.6	27.5	192.50
2053	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	66.4	27.4	191.92
2054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.3	66.2	27.3	191.34
2055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	66.0	27.2	190.77
2056	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	65.8	27.1	190.20
2057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	65.6	27.1	189.63
2058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	65.4	27.0	189.06
2059	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	65.2	26.9	188.50
2060	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	65.0	26.8	187.93
2061	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	64.9	26.7	187.37
2062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.2	64.7	26.7	186.81
2063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	64.5	26.6	186.25
2064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	64.3	26.5	185.69
2065	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	64.1	26.4	185.13
2066	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	63.9	26.3	184.58
2067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	63.7	26.3	184.03
2068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	63.5	26.2	183.47
2069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	63.3	26.1	182.92
2070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.1	63.1	26.0	182.38
2071	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	62.9	25.9	181.83
2072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	62.7	25.9	181.29
2073	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	62.6	25.8	180.74
2074	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	62.4	25.7	180.20
2075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	62.2	25.6	179.66
2076	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	62.0	25.6	179.12
2077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	61.8	25.5	178.59
2078	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.0	61.6	25.4	178.05
2079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	61.4	25.3	177.52
2080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	61.3	25.3	176.99
2081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	61.1	25.2	176.46
2082	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	60.9	25.1	175.93

Table 4b. Emissions Summary for Transporting and Landfilling of 136 Tons per Day of Pro-processed Refuse

Year/Pollutants	Total Emissions from Landfill Operation including refuse trucks, landfill equipment, worker commute[a]																GHG Emissions from Buried Refuse (Landfill Cap and flare)[b]			
	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e	CH4	CO2	CO2 from Flare	CO2e (Include CO2 from Flare)
Year	tons/yr										MT/yr						tons/yr	tons/yr	tons/yr	MT/yr
2083	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	60.7	25.0	175.40
2084	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	60.5	25.0	174.88
2085	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	60.3	24.9	174.35
2086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	60.2	24.8	173.83
2087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.9	60.0	24.7	173.31
2088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	59.8	24.7	172.79
2089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	59.6	24.6	172.27
2090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	59.4	24.5	171.76
2091	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	59.3	24.4	171.24
2092	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	59.1	24.4	170.73
2093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	58.9	24.3	170.22
2094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	58.7	24.2	169.71
2095	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	58.6	24.1	169.20
2096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8	58.4	24.1	168.69
2097	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	58.2	24.0	168.19
2098	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	58.0	23.9	167.68
2099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	57.9	23.9	167.18
2100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	57.7	23.8	166.68
2101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	57.5	23.7	166.18
2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	57.3	23.6	165.68
2103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	57.2	23.6	165.19
2104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	57.0	23.5	164.69
2105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.7	56.8	23.4	164.20
2106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	56.7	23.4	163.71
2107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	56.5	23.3	163.22
2108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	56.3	23.2	162.73
2109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	56.2	23.2	162.24
2110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	56.0	23.1	161.75
2111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	55.8	23.0	161.27
2112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	55.7	22.9	160.79
2113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	55.5	22.9	160.30
2114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.6	55.3	22.8	159.82
2115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	55.2	22.7	159.35
2116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	55.0	22.7	158.87
2117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	54.8	22.6	158.39
2118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	54.7	22.5	157.92
2119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	54.5	22.5	157.44
2120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	54.3	22.4	156.97
2121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	54.2	22.3	156.50
2122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	54.0	22.3	156.03
2123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.5	53.8	22.2	155.57
2124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	53.7	22.1	155.10
2125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	53.5	22.1	154.64
2126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	53.4	22.0	154.17
2127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	53.2	21.9	153.71
2128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	53.0	21.9	153.25
2129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	52.9	21.8	152.79
2130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	52.7	21.7	152.33
2131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	52.6	21.7	151.88
2132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	52.4	21.6	151.42
2133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.4	52.3	21.5	150.97
2134	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	52.1	21.5	150.52
2135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	51.9	21.4	150.07
2136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	51.8	21.4	149.62
2137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	51.6	21.3	149.17
2138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.3	51.5	21.2	148.72
Notes															2014-2138	4400	439	6836	2819	19751

a Output from CalEEMod model runs: (1) CO2e is calculated based on Methane Global Warming Potential of 21

b Output from LandGEM runs based on: (1) Lo = 6.2 M^3/Mg, k = 0.003 $year^{-1}$, (2) Methane Global Warming Potential of 34, (3) methane oxidation rate of 10%, and (4) capture rate of 70%.

REFERENCES

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4. LandGEM, http://www.epa.gov/ttn/chief/software/
5. The Climate Leaders Greenhouse Gas Inventory Protocol "Direct Emissions from Stationary Combustion Sources", Climate Leaders, USEPA, October 2004.
6. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste, http://www.ipcc-nggip.iges.or.jp/public/2006gl/
7. Rainfall records, http://cdec.water.ca.gov/cgi-progs/precip/PRECIPOUT.1990
8. USEPA Landfill Methane Outreach Program, www.epa.gov/lmop/basic-info.
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ABBREVIATION

CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards (CAAQS)
CalEEMod	California Emissions Estimator Model
CARB	California Air Resources Board
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
EPA	Environmental Protection Agency
H_2S	Hydrogen sulfide
NAAQS	National Ambient Air Quality Standards
N_2O	Nitrous oxide
NO_2	Nitrogen dioxide
O_3	Ozone
Pb	Lead
PM_{10}	Fine particulate matter equal to or less than 10 microns
$PM_{2.5}$	Fine particulate matter equal to or less than 2.5 microns
SO_2	Sulfur dioxide
TACs	Toxic air contaminants
TSP	Total suspended particulate

APPENDIX A

CALEEMOD FILES

CalEEMod Version: CalEEMod.2011.1.1 Date: 12/26/2013

White Paper

South Coast AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	2178	1000sqft

1.2 Other Project Characteristics

Urbanization Urban

Climate Zone 11

Wind Speed (m/s) 2.2

Precipitation Freq (Days) 31

Utility Company Southern California Edison

1.3 User Entered Comments

Project Characteristics -

Land Use -

Construction Phase - Landfill operation continuous grading

Off-road Equipment - 2-Loader (front-end), 1-Scrapper, 1-Rubber Tired Dozer, 2 Other Construction Equipment (compactors), 1 off-road highway truck (water truck)

Trips and VMT - 1,000 tons/day hauled to landfill, 22 tons/truck, daily truck trips = 45, 47 miles/trip

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.13	8.27	5.07	0.01	1,275.12	0.42	1,275.55	139.60	0.42	140.03	0.00	1,055.60	1,055.60	0.09	0.00	1,057.57
2015	1.06	7.59	4.85	0.01	1,275.12	0.38	1,275.51	139.60	0.38	139.99	0.00	1,052.85	1,052.85	0.09	0.00	1,054.70
2016	1.00	6.96	4.68	0.01	1,278.54	0.35	1,278.89	139.94	0.34	140.29	0.00	1,053.64	1,053.64	0.08	0.00	1,055.38

2017	0.93	6.35	4.50	0.01	1,275.12	0.31	1,275.43	139.60	0.31	139.91	0.00	1,048.18	1,048.18	0.08	0.00	1,049.81
2018	0.87	5.80	4.35	0.01	1,275.12	0.27	1,275.40	139.60	0.27	139.88	0.00	1,045.72	1,045.72	0.07	0.00	1,047.24
2019	0.82	5.29	4.22	0.01	1,275.12	0.24	1,275.37	139.60	0.24	139.85	0.00	1,043.41	1,043.41	0.07	0.00	1,044.83
2020	0.77	4.84	4.12	0.01	1,278.54	0.22	1,278.76	139.94	0.22	140.16	0.00	1,044.11	1,044.11	0.06	0.00	1,045.46
2021	0.72	4.40	4.01	0.01	1,275.12	0.19	1,275.32	139.60	0.19	139.79	0.00	1,039.89	1,039.89	0.06	0.00	1,041.14
2022	0.69	4.02	3.93	0.01	1,275.12	0.17	1,275.30	139.60	0.17	139.77	0.00	1,038.04	1,038.04	0.06	0.00	1,039.24
2023	0.66	3.68	3.85	0.01	1,275.12	0.15	1,275.28	139.60	0.15	139.75	0.00	1,036.32	1,036.32	0.05	0.00	1,037.46
2024	0.63	3.38	3.80	0.01	1,278.54	0.14	1,278.68	139.94	0.14	140.08	0.00	1,037.62	1,037.62	0.05	0.00	1,038.71
2025	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2026	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2027	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2028	0.60	3.11	3.74	0.01	1,278.54	0.12	1,278.67	139.94	0.12	140.07	0.00	1,036.16	1,036.16	0.05	0.00	1,037.21
2029	0.60	3.10	3.73	0.01	1,275.12	0.12	1,275.25	139.60	0.12	139.72	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2030	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2031	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2032	0.51	2.10	3.54	0.01	1,278.54	0.07	1,278.62	139.94	0.07	140.02	0.00	1,030.94	1,030.94	0.04	0.00	1,031.81
2033	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2034	0.51	2.10	3.53	0.01	1,275.12	0.07	1,275.20	139.60	0.07	139.68	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2035	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40
2036	0.46	1.59	3.43	0.01	1,278.54	0.05	1,278.59	139.94	0.05	139.99	0.00	1,029.42	1,029.42	0.04	0.00	1,030.21
2037	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40
2038	0.46	1.58	3.42	0.01	1,275.12	0.05	1,275.17	139.60	0.05	139.65	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40
Total	**16.67**	**92.92**	**97.39**	**0.25**	**31,898.52**	**3.99**	**31,902.68**	**3,492.04**	**3.98**	**3,496.13**	**0.00**	**25,917.53**	**25,917.53**	**1.37**	**0.00**	**25,946.45**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.13	8.27	5.07	0.01	1,258.35	0.42	1,258.78	130.38	0.42	130.81	0.00	1,055.60	1,055.60	0.09	0.00	1,057.57
2015	1.06	7.59	4.85	0.01	1,258.35	0.38	1,258.74	130.38	0.38	130.77	0.00	1,052.85	1,052.85	0.09	0.00	1,054.70
2016	1.00	6.96	4.68	0.01	1,261.77	0.35	1,262.12	130.73	0.34	131.07	0.00	1,053.64	1,053.64	0.08	0.00	1,055.38
2017	0.93	6.35	4.50	0.01	1,258.35	0.31	1,258.66	130.38	0.31	130.69	0.00	1,048.18	1,048.18	0.08	0.00	1,049.81

2018	0.87	5.80	4.35	0.01	1,258.35	0.27	1,258.63	130.38	0.27	130.66	0.00	1,045.72	1,045.72	0.07	0.00	1,047.24
2019	0.82	5.29	4.22	0.01	1,258.35	0.24	1,258.60	130.38	0.24	130.63	0.00	1,043.41	1,043.41	0.07	0.00	1,044.83
2020	0.77	4.84	4.12	0.01	1,261.77	0.22	1,261.99	130.73	0.22	130.94	0.00	1,044.11	1,044.11	0.06	0.00	1,045.46
2021	0.72	4.40	4.01	0.01	1,258.35	0.19	1,258.54	130.38	0.19	130.58	0.00	1,039.89	1,039.89	0.06	0.00	1,041.14
2022	0.69	4.02	3.93	0.01	1,258.35	0.17	1,258.52	130.38	0.17	130.55	0.00	1,038.04	1,038.04	0.06	0.00	1,039.24
2023	0.66	3.68	3.85	0.01	1,258.35	0.15	1,258.51	130.38	0.15	130.54	0.00	1,036.32	1,036.32	0.05	0.00	1,037.46
2024	0.63	3.38	3.80	0.01	1,261.77	0.14	1,261.91	130.73	0.14	130.86	0.00	1,037.62	1,037.62	0.05	0.00	1,038.71
2025	0.60	3.10	3.73	0.01	1,258.35	0.12	1,258.48	130.38	0.12	130.51	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2026	0.60	3.10	3.73	0.01	1,258.35	0.12	1,258.48	130.38	0.12	130.51	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2027	0.60	3.10	3.73	0.01	1,258.35	0.12	1,258.48	130.38	0.12	130.51	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2028	0.60	3.11	3.74	0.01	1,261.77	0.12	1,261.89	130.73	0.12	130.85	0.00	1,036.16	1,036.16	0.05	0.00	1,037.21
2029	0.60	3.10	3.73	0.01	1,258.35	0.12	1,258.48	130.38	0.12	130.51	0.00	1,033.33	1,033.33	0.05	0.00	1,034.38
2030	0.51	2.10	3.53	0.01	1,258.35	0.07	1,258.43	130.38	0.07	130.46	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2031	0.51	2.10	3.53	0.01	1,258.35	0.07	1,258.43	130.38	0.07	130.46	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2032	0.51	2.10	3.54	0.01	1,261.77	0.07	1,261.84	130.73	0.07	130.80	0.00	1,030.94	1,030.94	0.04	0.00	1,031.81
2033	0.51	2.10	3.53	0.01	1,258.35	0.07	1,258.43	130.38	0.07	130.46	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2034	0.51	2.10	3.53	0.01	1,258.35	0.07	1,258.43	130.38	0.07	130.46	0.00	1,028.12	1,028.12	0.04	0.00	1,028.99
2035	0.46	1.58	3.42	0.01	1,258.35	0.05	1,258.40	130.38	0.05	130.43	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40
2036	0.46	1.59	3.43	0.01	1,261.77	0.05	1,261.82	130.73	0.05	130.78	0.00	1,029.42	1,029.42	0.04	0.00	1,030.21
2037	0.46	1.58	3.42	0.01	1,258.35	0.05	1,258.40	130.38	0.05	130.43	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40
2038	0.46	1.58	3.42	0.01	1,258.35	0.05	1,258.40	130.38	0.05	130.43	0.00	1,026.61	1,026.61	0.04	0.00	1,027.40
Total	**16.67**	**92.92**	**97.39**	**0.25**	**31,479.27**	**3.99**	**31,483.39**	**3,261.60**	**3.98**	**3,265.70**	**0.00**	**25,917.53**	**25,917.53**	**1.37**	**0.00**	**25,946.45**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Waste						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Water						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**14.57**	**11.31**	**43.91**	**0.06**	**415.67**	**0.43**	**416.09**	**40.94**	**0.40**	**41.34**	**0.00**	**5,721.13**	**5,721.13**	**0.32**	**0.00**	**5,727.92**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Waste						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**14.57**	**11.31**	**43.91**	**0.06**	**415.67**	**0.43**	**416.09**	**40.94**	**0.40**	**41.34**	**0.00**	**5,721.13**	**5,721.13**	**0.32**	**0.00**	**5,727.92**

3.0 Construction Detail

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	1.08	8.20	4.36	0.01		0.42	0.42		0.42	0.42	0.00	928.38	928.38	0.09	0.00	930.20
Total	**1.08**	**8.20**	**4.36**	**0.01**	**27.49**	**0.42**	**27.91**	**15.11**	**0.42**	**15.53**	**0.00**	**928.38**	**928.38**	**0.09**	**0.00**	**930.20**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.06	0.07	0.71	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	126.91	126.91	0.01	0.00	127.05
Total	**0.06**	**0.07**	**0.71**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**127.22**	**127.22**	**0.01**	**0.00**	**127.36**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	1.08	8.20	4.36	0.01		0.42	0.42		0.42	0.42	0.00	928.38	928.38	0.09	0.00	930.20
Total	**1.08**	**8.20**	**4.36**	**0.01**	**10.72**	**0.42**	**11.14**	**5.89**	**0.42**	**6.31**	**0.00**	**928.38**	**928.38**	**0.09**	**0.00**	**930.20**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.06	0.07	0.71	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	126.91	126.91	0.01	0.00	127.05
Total	**0.06**	**0.07**	**0.71**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**127.22**	**127.22**	**0.01**	**0.00**	**127.36**

3.2 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	1.01	7.52	4.20	0.01		0.38	0.38		0.38	0.38	0.00	928.38	928.38	0.08	0.00	930.09

Total	1.01	7.52	4.20	0.01	27.49	0.38	27.87	15.11	0.38	15.49	0.00	928.38	928.38	0.08	0.00	930.09

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.05	0.06	0.65	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	124.16	124.16	0.01	0.00	124.30
Total	**0.05**	**0.06**	**0.65**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**124.47**	**124.47**	**0.01**	**0.00**	**124.61**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	1.01	7.52	4.20	0.01		0.38	0.38		0.38	0.38	0.00	928.38	928.38	0.08	0.00	930.09
Total	**1.01**	**7.52**	**4.20**	**0.01**	**10.72**	**0.38**	**11.10**	**5.89**	**0.38**	**6.27**	**0.00**	**928.38**	**928.38**	**0.08**	**0.00**	**930.09**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.05	0.06	0.65	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	124.16	124.16	0.01	0.00	124.30
Total	**0.05**	**0.06**	**0.65**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**124.47**	**124.47**	**0.01**	**0.00**	**124.61**

3.2 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.95	6.90	4.07	0.01		0.34	0.34		0.34	0.34	0.00	930.92	930.92	0.08	0.00	932.53
Total	**0.95**	**6.90**	**4.07**	**0.01**	**27.49**	**0.34**	**27.83**	**15.11**	**0.34**	**15.45**	**0.00**	**930.92**	**930.92**	**0.08**	**0.00**	**932.53**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.05	0.06	0.61	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	122.41	122.41	0.01	0.00	122.54
Total	**0.05**	**0.06**	**0.61**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**122.72**	**122.72**	**0.01**	**0.00**	**122.85**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.95	6.90	4.07	0.01		0.34	0.34		0.34	0.34	0.00	930.92	930.92	0.08	0.00	932.53
Total	**0.95**	**6.90**	**4.07**	**0.01**	**10.72**	**0.34**	**11.06**	**5.89**	**0.34**	**6.23**	**0.00**	**930.92**	**930.92**	**0.08**	**0.00**	**932.53**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.05	0.06	0.61	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	122.41	122.41	0.01	0.00	122.54

Total	0.05	0.06	0.61	0.00	1,251.04	0.01	1,251.05	124.83	0.01	124.83	0.00	122.72	122.72	0.01	0.00	122.85

3.2 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.88	6.29	3.94	0.01		0.30	0.30		0.30	0.30	0.00	928.38	928.38	0.07	0.00	929.89
Total	**0.88**	**6.29**	**3.94**	**0.01**	**27.49**	**0.30**	**27.79**	**15.11**	**0.30**	**15.41**	**0.00**	**928.38**	**928.38**	**0.07**	**0.00**	**929.89**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.05	0.05	0.56	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	119.49	119.49	0.01	0.00	119.61
Total	**0.05**	**0.05**	**0.56**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**119.80**	**119.80**	**0.01**	**0.00**	**119.92**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.88	6.29	3.94	0.01		0.30	0.30		0.30	0.30	0.00	928.38	928.38	0.07	0.00	929.89
Total	**0.88**	**6.29**	**3.94**	**0.01**	**10.72**	**0.30**	**11.02**	**5.89**	**0.30**	**6.19**	**0.00**	**928.38**	**928.38**	**0.07**	**0.00**	**929.89**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.05	0.05	0.56	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	119.49	119.49	0.01	0.00	119.61
Total	**0.05**	**0.05**	**0.56**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**119.80**	**119.80**	**0.01**	**0.00**	**119.92**

3.2 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.83	5.75	3.83	0.01		0.27	0.27		0.27	0.27	0.00	928.38	928.38	0.07	0.00	929.79
Total	**0.83**	**5.75**	**3.83**	**0.01**	**27.49**	**0.27**	**27.76**	**15.11**	**0.27**	**15.38**	**0.00**	**928.38**	**928.38**	**0.07**	**0.00**	**929.79**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.05	0.51	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	117.03	117.03	0.01	0.00	117.14
Total	**0.04**	**0.05**	**0.51**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**117.34**	**117.34**	**0.01**	**0.00**	**117.45**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.83	5.75	3.83	0.01		0.27	0.27		0.27	0.27	0.00	928.38	928.38	0.07	0.00	929.79
Total	**0.83**	**5.75**	**3.83**	**0.01**	**10.72**	**0.27**	**10.99**	**5.89**	**0.27**	**6.16**	**0.00**	**928.38**	**928.38**	**0.07**	**0.00**	**929.79**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.05	0.51	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	117.03	117.03	0.01	0.00	117.14
Total	**0.04**	**0.05**	**0.51**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**117.34**	**117.34**	**0.01**	**0.00**	**117.45**

3.2 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.78	5.25	3.74	0.01		0.24	0.24		0.24	0.24	0.00	928.38	928.38	0.06	0.00	929.69
Total	**0.78**	**5.25**	**3.74**	**0.01**	**27.49**	**0.24**	**27.73**	**15.11**	**0.24**	**15.35**	**0.00**	**928.38**	**928.38**	**0.06**	**0.00**	**929.69**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.04	0.48	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	114.72	114.72	0.00	0.00	114.83
Total	**0.04**	**0.04**	**0.48**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**115.03**	**115.03**	**0.00**	**0.00**	**115.14**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.78	5.25	3.74	0.01		0.24	0.24		0.24	0.24	0.00	928.38	928.38	0.06	0.00	929.69
Total	**0.78**	**5.25**	**3.74**	**0.01**	**10.72**	**0.24**	**10.96**	**5.89**	**0.24**	**6.13**	**0.00**	**928.38**	**928.38**	**0.06**	**0.00**	**929.69**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.31	0.31	0.00	0.00	0.31
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.04	0.48	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	114.72	114.72	0.00	0.00	114.83
Total	**0.04**	**0.04**	**0.48**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**115.03**	**115.03**	**0.00**	**0.00**	**115.14**

3.2 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.73	4.80	3.67	0.01		0.21	0.21		0.21	0.21	0.00	930.92	930.92	0.06	0.00	932.17
Total	**0.73**	**4.80**	**3.67**	**0.01**	**27.49**	**0.21**	**27.70**	**15.11**	**0.21**	**15.32**	**0.00**	**930.92**	**930.92**	**0.06**	**0.00**	**932.17**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.04	0.45	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	112.87	112.87	0.00	0.00	112.97
Total	**0.04**	**0.04**	**0.45**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**113.19**	**113.19**	**0.00**	**0.00**	**113.29**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.73	4.80	3.67	0.01		0.21	0.21		0.21	0.21	0.00	930.92	930.92	0.06	0.00	932.17
Total	**0.73**	**4.80**	**3.67**	**0.01**	**10.72**	**0.21**	**10.93**	**5.89**	**0.21**	**6.10**	**0.00**	**930.92**	**930.92**	**0.06**	**0.00**	**932.17**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.04	0.45	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	112.87	112.87	0.00	0.00	112.97
Total	**0.04**	**0.04**	**0.45**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**113.19**	**113.19**	**0.00**	**0.00**	**113.29**

3.2 Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.69	4.36	3.59	0.01		0.19	0.19		0.19	0.19	0.00	928.38	928.38	0.06	0.00	929.54
Total	**0.69**	**4.36**	**3.59**	**0.01**	**27.49**	**0.19**	**27.68**	**15.11**	**0.19**	**15.30**	**0.00**	**928.38**	**928.38**	**0.06**	**0.00**	**929.54**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.04	0.42	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	111.19	111.19	0.00	0.00	111.29
Total	**0.04**	**0.04**	**0.42**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**111.51**	**111.51**	**0.00**	**0.00**	**111.61**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.69	4.36	3.59	0.01		0.19	0.19		0.19	0.19	0.00	928.38	928.38	0.06	0.00	929.54
Total	**0.69**	**4.36**	**3.59**	**0.01**	**10.72**	**0.19**	**10.91**	**5.89**	**0.19**	**6.08**	**0.00**	**928.38**	**928.38**	**0.06**	**0.00**	**929.54**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.04	0.42	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	111.19	111.19	0.00	0.00	111.29
Total	**0.04**	**0.04**	**0.42**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**111.51**	**111.51**	**0.00**	**0.00**	**111.61**

3.2 Grading - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.65	3.99	3.53	0.01		0.16	0.16		0.16	0.16	0.00	928.38	928.38	0.05	0.00	929.48
Total	**0.65**	**3.99**	**3.53**	**0.01**	**27.49**	**0.16**	**27.65**	**15.11**	**0.16**	**15.27**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.48**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.03	0.40	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	109.35	109.35	0.00	0.00	109.44
Total	**0.04**	**0.03**	**0.40**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**109.67**	**109.67**	**0.00**	**0.00**	**109.76**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.65	3.99	3.53	0.01		0.16	0.16		0.16	0.16	0.00	928.38	928.38	0.05	0.00	929.48
Total	**0.65**	**3.99**	**3.53**	**0.01**	**10.72**	**0.16**	**10.88**	**5.89**	**0.16**	**6.05**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.48**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.04	0.03	0.40	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	109.35	109.35	0.00	0.00	109.44
Total	**0.04**	**0.03**	**0.40**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**109.67**	**109.67**	**0.00**	**0.00**	**109.76**

3.2 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.62	3.65	3.48	0.01		0.15	0.15		0.15	0.15	0.00	928.38	928.38	0.05	0.00	929.43
Total	**0.62**	**3.65**	**3.48**	**0.01**	**27.49**	**0.15**	**27.64**	**15.11**	**0.15**	**15.26**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.43**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.38	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	107.63	107.63	0.00	0.00	107.71
Total	**0.03**	**0.03**	**0.38**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**107.95**	**107.95**	**0.00**	**0.00**	**108.03**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.62	3.65	3.48	0.01		0.15	0.15		0.15	0.15	0.00	928.38	928.38	0.05	0.00	929.43
Total	**0.62**	**3.65**	**3.48**	**0.01**	**10.72**	**0.15**	**10.87**	**5.89**	**0.15**	**6.04**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.43**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.38	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	107.63	107.63	0.00	0.00	107.71
Total	**0.03**	**0.03**	**0.38**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**107.95**	**107.95**	**0.00**	**0.00**	**108.03**

3.2 Grading - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.60	3.35	3.44	0.01		0.13	0.13		0.13	0.13	0.00	930.92	930.92	0.05	0.00	931.93
Total	**0.60**	**3.35**	**3.44**	**0.01**	**27.49**	**0.13**	**27.62**	**15.11**	**0.13**	**15.24**	**0.00**	**930.92**	**930.92**	**0.05**	**0.00**	**931.93**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.35	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	106.38	106.38	0.00	0.00	106.47
Total	**0.03**	**0.03**	**0.35**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**106.70**	**106.70**	**0.00**	**0.00**	**106.79**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.60	3.35	3.44	0.01		0.13	0.13		0.13	0.13	0.00	930.92	930.92	0.05	0.00	931.93
Total	**0.60**	**3.35**	**3.44**	**0.01**	**10.72**	**0.13**	**10.85**	**5.89**	**0.13**	**6.02**	**0.00**	**930.92**	**930.92**	**0.05**	**0.00**	**931.93**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.35	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	106.38	106.38	0.00	0.00	106.47
Total	**0.03**	**0.03**	**0.35**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**106.70**	**106.70**	**0.00**	**0.00**	**106.79**

3.2 Grading - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**27.49**	**0.12**	**27.61**	**15.11**	**0.12**	**15.23**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**10.72**	**0.12**	**10.84**	**5.89**	**0.12**	**6.01**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

3.2 Grading - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**27.49**	**0.12**	**27.61**	**15.11**	**0.12**	**15.23**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**10.72**	**0.12**	**10.84**	**5.89**	**0.12**	**6.01**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

3.2 Grading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**27.49**	**0.12**	**27.61**	**15.11**	**0.12**	**15.23**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**10.72**	**0.12**	**10.84**	**5.89**	**0.12**	**6.01**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

3.2 Grading - 2028

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.08	3.40	0.01		0.12	0.12		0.12	0.12	0.00	930.92	930.92	0.05	0.00	931.89
Total	**0.57**	**3.08**	**3.40**	**0.01**	**27.49**	**0.12**	**27.61**	**15.11**	**0.12**	**15.23**	**0.00**	**930.92**	**930.92**	**0.05**	**0.00**	**931.89**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Worker	0.03	0.03	0.34	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	104.92	104.92	0.00	0.00	105.00
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**105.24**	**105.24**	**0.00**	**0.00**	**105.32**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.08	3.40	0.01		0.12	0.12		0.12	0.12	0.00	930.92	930.92	0.05	0.00	931.89
Total	**0.57**	**3.08**	**3.40**	**0.01**	**10.72**	**0.12**	**10.84**	**5.89**	**0.12**	**6.01**	**0.00**	**930.92**	**930.92**	**0.05**	**0.00**	**931.89**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	104.92	104.92	0.00	0.00	105.00
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**105.24**	**105.24**	**0.00**	**0.00**	**105.32**

3.2 Grading - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**27.49**	**0.12**	**27.61**	**15.11**	**0.12**	**15.23**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.57	3.07	3.40	0.01		0.12	0.12		0.12	0.12	0.00	928.38	928.38	0.05	0.00	929.35
Total	**0.57**	**3.07**	**3.40**	**0.01**	**10.72**	**0.12**	**10.84**	**5.89**	**0.12**	**6.01**	**0.00**	**928.38**	**928.38**	**0.05**	**0.00**	**929.35**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	104.64	104.64	0.00	0.00	104.72
Total	**0.03**	**0.03**	**0.34**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**104.96**	**104.96**	**0.00**	**0.00**	**105.04**

3.2 Grading - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18

Total	0.48	2.08	3.26	0.01	27.49	0.07	27.56	15.11	0.07	15.18	0.00	928.38	928.38	0.04	0.00	929.18

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**10.72**	**0.07**	**10.79**	**5.89**	**0.07**	**5.96**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

3.2 Grading - 2031

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**27.49**	**0.07**	**27.56**	**15.11**	**0.07**	**15.18**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**10.72**	**0.07**	**10.79**	**5.89**	**0.07**	**5.96**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49

Total	0.03	0.02	0.27	0.00	1,247.63	0.01	1,247.64	124.49	0.01	124.50	0.00	99.75	99.75	0.00	0.00	99.81

3.2 Grading - 2032

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	930.92	930.92	0.04	0.00	931.73
Total	**0.48**	**2.08**	**3.26**	**0.01**	**27.49**	**0.07**	**27.56**	**15.11**	**0.07**	**15.18**	**0.00**	**930.92**	**930.92**	**0.04**	**0.00**	**931.73**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	99.70	99.70	0.00	0.00	99.77
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**100.02**	**100.02**	**0.00**	**0.00**	**100.09**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	930.92	930.92	0.04	0.00	931.73
Total	**0.48**	**2.08**	**3.26**	**0.01**	**10.72**	**0.07**	**10.79**	**5.89**	**0.07**	**5.96**	**0.00**	**930.92**	**930.92**	**0.04**	**0.00**	**931.73**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	99.70	99.70	0.00	0.00	99.77
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**100.02**	**100.02**	**0.00**	**0.00**	**100.09**

3.2 Grading - 2033

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**27.49**	**0.07**	**27.56**	**15.11**	**0.07**	**15.18**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**10.72**	**0.07**	**10.79**	**5.89**	**0.07**	**5.96**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

3.2 Grading - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**27.49**	**0.07**	**27.56**	**15.11**	**0.07**	**15.18**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.48	2.08	3.26	0.01		0.07	0.07		0.07	0.07	0.00	928.38	928.38	0.04	0.00	929.18
Total	**0.48**	**2.08**	**3.26**	**0.01**	**10.72**	**0.07**	**10.79**	**5.89**	**0.07**	**5.96**	**0.00**	**928.38**	**928.38**	**0.04**	**0.00**	**929.18**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.02	0.27	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	99.43	99.43	0.00	0.00	99.49
Total	**0.03**	**0.02**	**0.27**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**99.75**	**99.75**	**0.00**	**0.00**	**99.81**

3.2 Grading - 2035

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.18	0.01		0.04	0.04		0.04	0.04	0.00	928.38	928.38	0.03	0.00	929.11
Total	**0.43**	**1.57**	**3.18**	**0.01**	**27.49**	**0.04**	**27.53**	**15.11**	**0.04**	**15.15**	**0.00**	**928.38**	**928.38**	**0.03**	**0.00**	**929.11**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	97.92	97.92	0.00	0.00	97.98
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**98.24**	**98.24**	**0.00**	**0.00**	**98.30**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.18	0.01		0.04	0.04		0.04	0.04	0.00	928.38	928.38	0.03	0.00	929.11
Total	**0.43**	**1.57**	**3.18**	**0.01**	**10.72**	**0.04**	**10.76**	**5.89**	**0.04**	**5.93**	**0.00**	**928.38**	**928.38**	**0.03**	**0.00**	**929.11**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	97.92	97.92	0.00	0.00	97.98
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**98.24**	**98.24**	**0.00**	**0.00**	**98.30**

3.2 Grading - 2036

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.19	0.01		0.04	0.04		0.04	0.04	0.00	930.92	930.92	0.03	0.00	931.65
Total	**0.43**	**1.57**	**3.19**	**0.01**	**27.49**	**0.04**	**27.53**	**15.11**	**0.04**	**15.15**	**0.00**	**930.92**	**930.92**	**0.03**	**0.00**	**931.65**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	98.18	98.18	0.00	0.00	98.24
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**98.50**	**98.50**	**0.00**	**0.00**	**98.56**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.19	0.01		0.04	0.04		0.04	0.04	0.00	930.92	930.92	0.03	0.00	931.65
Total	**0.43**	**1.57**	**3.19**	**0.01**	**10.72**	**0.04**	**10.76**	**5.89**	**0.04**	**5.93**	**0.00**	**930.92**	**930.92**	**0.03**	**0.00**	**931.65**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,042.53	0.00	1,042.53	104.02	0.00	104.02	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	208.51	0.01	208.52	20.81	0.01	20.81	0.00	98.18	98.18	0.00	0.00	98.24
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,251.04**	**0.01**	**1,251.05**	**124.83**	**0.01**	**124.83**	**0.00**	**98.50**	**98.50**	**0.00**	**0.00**	**98.56**

3.2 Grading - 2037

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.18	0.01		0.04	0.04		0.04	0.04	0.00	928.38	928.38	0.03	0.00	929.11
Total	**0.43**	**1.57**	**3.18**	**0.01**	**27.49**	**0.04**	**27.53**	**15.11**	**0.04**	**15.15**	**0.00**	**928.38**	**928.38**	**0.03**	**0.00**	**929.11**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	97.92	97.92	0.00	0.00	97.98
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**98.24**	**98.24**	**0.00**	**0.00**	**98.30**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.18	0.01		0.04	0.04		0.04	0.04	0.00	928.38	928.38	0.03	0.00	929.11
Total	**0.43**	**1.57**	**3.18**	**0.01**	**10.72**	**0.04**	**10.76**	**5.89**	**0.04**	**5.93**	**0.00**	**928.38**	**928.38**	**0.03**	**0.00**	**929.11**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	97.92	97.92	0.00	0.00	97.98
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**98.24**	**98.24**	**0.00**	**0.00**	**98.30**

3.2 Grading - 2038

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Fugitive Dust					27.49	0.00	27.49	15.11	0.00	15.11	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.18	0.01		0.04	0.04		0.04	0.04	0.00	928.38	928.38	0.03	0.00	929.11
Total	**0.43**	**1.57**	**3.18**	**0.01**	**27.49**	**0.04**	**27.53**	**15.11**	**0.04**	**15.15**	**0.00**	**928.38**	**928.38**	**0.03**	**0.00**	**929.11**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	97.92	97.92	0.00	0.00	97.98
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**98.24**	**98.24**	**0.00**	**0.00**	**98.30**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					10.72	0.00	10.72	5.89	0.00	5.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.43	1.57	3.18	0.01		0.04	0.04		0.04	0.04	0.00	928.38	928.38	0.03	0.00	929.11
Total	**0.43**	**1.57**	**3.18**	**0.01**	**10.72**	**0.04**	**10.76**	**5.89**	**0.04**	**5.93**	**0.00**	**928.38**	**928.38**	**0.03**	**0.00**	**929.11**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	1,039.69	0.00	1,039.69	103.74	0.00	103.74	0.00	0.32	0.32	0.00	0.00	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	207.94	0.01	207.95	20.75	0.01	20.76	0.00	97.92	97.92	0.00	0.00	97.98
Total	**0.02**	**0.02**	**0.24**	**0.00**	**1,247.63**	**0.01**	**1,247.64**	**124.49**	**0.01**	**124.50**	**0.00**	**98.24**	**98.24**	**0.00**	**0.00**	**98.30**

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Unmitigated	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	3,267.00	3,267.00	3267.00	11,022,884	11,022,884
Total	3,267.00	3,267.00	3,267.00	11,022,884	11,022,884

4.3 Trip Type Information

	Miles			Trip %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	59.00	28.00	13.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	0	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	0	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	0					0.00	0.00	0.00	0.00

Total						0.00	0.00	0.00	0.00

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	0					0.00	0.00	0.00	0.00
Total						0.00	0.00	0.00	0.00

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.52					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	7.87					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Total	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.52					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	7.87					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**10.39**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					0.00	0.00	0.00	0.00
Unmitigated					0.00	0.00	0.00	0.00
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	0 / 0					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	0 / 0					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					0.00	0.00	0.00	0.00
Unmitigated					0.00	0.00	0.00	0.00
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	365000					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	365000					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

9.0 Vegetation

White Paper

South Coast AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric
General Heavy Industry	2178	1000sqft

1.2 Other Project Characteristics

Urbanization Urban

Wind Speed (m/s) 2.2

Utility Company Southern California Edison

Climate Zone 11

Precipitation Freq (Days) 31

1.3 User Entered Comments

Project Characteristics -

Land Use -

Construction Phase - Landfill operation continuous grading

Off-road Equipment - 2-Loader (front-end), 1-Scrapper, 1-Rubber Tired Dozer, 2 Other Construction Equipment (compactors), 1 off-road highway truck (water truck)

Trips and VMT - 136 tons/day hauled to landfill, 22 tons/truck, daily truck trips = 6, 47 miles/trip

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	0.17	1.06	0.94	0.00	188.27	0.06	188.33	20.33	0.06	20.39	0.00	186.57	186.57	0.01	0.00	186.88
2015	0.16	0.97	0.89	0.00	188.27	0.05	188.32	20.33	0.05	20.38	0.00	185.05	185.05	0.01	0.00	185.34

2016	0.15	0.89	0.85	0.00	188.78	0.05	188.83	20.38	0.05	20.43	0.00	184.39	184.39	0.01	0.00	184.66
2017	0.14	0.82	0.80	0.00	188.27	0.04	188.32	20.33	0.04	20.37	0.00	182.45	182.45	0.01	0.00	182.71
2018	0.13	0.75	0.76	0.00	188.27	0.04	188.31	20.33	0.04	20.37	0.00	181.08	181.08	0.01	0.00	181.32
2019	0.12	0.68	0.73	0.00	188.27	0.03	188.31	20.33	0.03	20.37	0.00	179.80	179.80	0.01	0.00	180.02
2020	0.11	0.62	0.71	0.00	188.78	0.03	188.81	20.38	0.03	20.41	0.00	179.09	179.09	0.01	0.00	179.30
2021	0.11	0.57	0.68	0.00	188.27	0.03	188.30	20.33	0.03	20.36	0.00	177.84	177.84	0.01	0.00	178.04
2022	0.10	0.52	0.66	0.00	188.27	0.02	188.30	20.33	0.02	20.36	0.00	176.82	176.82	0.01	0.00	177.01
2023	0.10	0.47	0.64	0.00	188.27	0.02	188.30	20.33	0.02	20.35	0.00	175.86	175.86	0.01	0.00	176.04
2024	0.09	0.44	0.63	0.00	188.78	0.02	188.80	20.38	0.02	20.40	0.00	175.49	175.49	0.01	0.00	175.66
2025	0.09	0.40	0.61	0.00	188.27	0.02	188.29	20.33	0.02	20.35	0.00	174.20	174.20	0.01	0.00	174.36
2026	0.09	0.40	0.61	0.00	188.27	0.02	188.29	20.33	0.02	20.35	0.00	174.20	174.20	0.01	0.00	174.36
2027	0.09	0.40	0.61	0.00	188.27	0.02	188.29	20.33	0.02	20.35	0.00	174.20	174.20	0.01	0.00	174.36
2028	0.09	0.40	0.61	0.00	188.78	0.02	188.80	20.38	0.02	20.40	0.00	174.68	174.68	0.01	0.00	174.84
2029	0.09	0.40	0.61	0.00	188.27	0.02	188.29	20.33	0.02	20.35	0.00	174.20	174.20	0.01	0.00	174.36
2030	0.07	0.27	0.56	0.00	188.27	0.01	188.29	20.33	0.01	20.34	0.00	171.31	171.31	0.01	0.00	171.44
2031	0.07	0.27	0.56	0.00	188.27	0.01	188.29	20.33	0.01	20.34	0.00	171.31	171.31	0.01	0.00	171.44
2032	0.07	0.27	0.56	0.00	188.78	0.01	188.79	20.38	0.01	20.40	0.00	171.78	171.78	0.01	0.00	171.91
2033	0.07	0.27	0.56	0.00	188.27	0.01	188.29	20.33	0.01	20.34	0.00	171.31	171.31	0.01	0.00	171.44
2034	0.07	0.27	0.56	0.00	188.27	0.01	188.29	20.33	0.01	20.34	0.00	171.31	171.31	0.01	0.00	171.44
2035	0.07	0.21	0.53	0.00	188.27	0.01	188.28	20.33	0.01	20.34	0.00	170.47	170.47	0.01	0.00	170.59
2036	0.07	0.21	0.53	0.00	188.78	0.01	188.79	20.38	0.01	20.39	0.00	170.93	170.93	0.01	0.00	171.06
2037	0.07	0.21	0.53	0.00	188.27	0.01	188.28	20.33	0.01	20.34	0.00	170.47	170.47	0.01	0.00	170.59
2038	0.07	0.21	0.53	0.00	188.27	0.01	188.28	20.33	0.01	20.34	0.00	170.47	170.47	0.01	0.00	170.59
Total	**2.46**	**11.98**	**16.26**	**0.00**	**4,709.81**	**0.58**	**4,710.47**	**508.55**	**0.58**	**509.16**	**0.00**	**4,395.28**	**4,395.28**	**0.25**	**0.00**	**4,399.76**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					

2014	0.17	1.06	0.94	0.00	186.18	0.06	186.23	19.18	0.06	19.24	0.00	186.57	186.57	0.01	0.00	186.88
2015	0.16	0.97	0.89	0.00	186.18	0.05	186.23	19.18	0.05	19.23	0.00	185.05	185.05	0.01	0.00	185.34
2016	0.15	0.89	0.85	0.00	186.68	0.05	186.73	19.23	0.05	19.28	0.00	184.39	184.39	0.01	0.00	184.66
2017	0.14	0.82	0.80	0.00	186.18	0.04	186.22	19.18	0.04	19.22	0.00	182.45	182.45	0.01	0.00	182.71
2018	0.13	0.75	0.76	0.00	186.18	0.04	186.21	19.18	0.04	19.22	0.00	181.08	181.08	0.01	0.00	181.32
2019	0.12	0.68	0.73	0.00	186.18	0.03	186.21	19.18	0.03	19.21	0.00	179.80	179.80	0.01	0.00	180.02
2020	0.11	0.62	0.71	0.00	186.68	0.03	186.71	19.23	0.03	19.26	0.00	179.09	179.09	0.01	0.00	179.30
2021	0.11	0.57	0.68	0.00	186.18	0.03	186.20	19.18	0.03	19.21	0.00	177.84	177.84	0.01	0.00	178.04
2022	0.10	0.52	0.66	0.00	186.18	0.02	186.20	19.18	0.02	19.20	0.00	176.82	176.82	0.01	0.00	177.01
2023	0.10	0.47	0.64	0.00	186.18	0.02	186.20	19.18	0.02	19.20	0.00	175.86	175.86	0.01	0.00	176.04
2024	0.09	0.44	0.63	0.00	186.68	0.02	186.70	19.23	0.02	19.25	0.00	175.49	175.49	0.01	0.00	175.66
2025	0.09	0.40	0.61	0.00	186.18	0.02	186.20	19.18	0.02	19.20	0.00	174.20	174.20	0.01	0.00	174.36
2026	0.09	0.40	0.61	0.00	186.18	0.02	186.20	19.18	0.02	19.20	0.00	174.20	174.20	0.01	0.00	174.36
2027	0.09	0.40	0.61	0.00	186.18	0.02	186.20	19.18	0.02	19.20	0.00	174.20	174.20	0.01	0.00	174.36
2028	0.09	0.40	0.61	0.00	186.68	0.02	186.70	19.23	0.02	19.25	0.00	174.68	174.68	0.01	0.00	174.84
2029	0.09	0.40	0.61	0.00	186.18	0.02	186.20	19.18	0.02	19.20	0.00	174.20	174.20	0.01	0.00	174.36
2030	0.07	0.27	0.56	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	171.31	171.31	0.01	0.00	171.44
2031	0.07	0.27	0.56	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	171.31	171.31	0.01	0.00	171.44
2032	0.07	0.27	0.56	0.00	186.68	0.01	186.70	19.23	0.01	19.24	0.00	171.78	171.78	0.01	0.00	171.91
2033	0.07	0.27	0.56	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	171.31	171.31	0.01	0.00	171.44
2034	0.07	0.27	0.56	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	171.31	171.31	0.01	0.00	171.44
2035	0.07	0.21	0.53	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	170.47	170.47	0.01	0.00	170.59
2036	0.07	0.21	0.53	0.00	186.68	0.01	186.69	19.23	0.01	19.24	0.00	170.93	170.93	0.01	0.00	171.06
2037	0.07	0.21	0.53	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	170.47	170.47	0.01	0.00	170.59
2038	0.07	0.21	0.53	0.00	186.18	0.01	186.19	19.18	0.01	19.19	0.00	170.47	170.47	0.01	0.00	170.59
Total	**2.46**	**11.98**	**16.26**	**0.00**	**4,657.50**	**0.58**	**4,658.06**	**479.80**	**0.58**	**480.38**	**0.00**	**4,395.28**	**4,395.28**	**0.25**	**0.00**	**4,399.76**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Waste						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**14.57**	**11.31**	**43.91**	**0.06**	**415.67**	**0.43**	**416.09**	**40.94**	**0.40**	**41.34**	**0.00**	**5,721.13**	**5,721.13**	**0.32**	**0.00**	**5,727.92**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mobile	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Waste						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**14.57**	**11.31**	**43.91**	**0.06**	**415.67**	**0.43**	**416.09**	**40.94**	**0.40**	**41.34**	**0.00**	**5,721.13**	**5,721.13**	**0.32**	**0.00**	**5,727.92**

3.0 Construction Detail

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.13	1.03	0.54	0.00		0.05	0.05		0.05	0.05	0.00	116.05	116.05	0.01	0.00	116.28
Total	**0.13**	**1.03**	**0.54**	**0.00**	**3.44**	**0.05**	**3.49**	**1.89**	**0.05**	**1.94**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.28**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.04	0.40	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	70.50	70.50	0.00	0.00	70.58
Total	**0.03**	**0.04**	**0.40**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**70.52**	**70.52**	**0.00**	**0.00**	**70.60**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.13	1.03	0.54	0.00		0.05	0.05		0.05	0.05	0.00	116.05	116.05	0.01	0.00	116.28

Total	**0.13**	**1.03**	**0.54**	**0.00**	**1.34**	**0.05**	**1.39**	**0.74**	**0.05**	**0.79**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.28**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.04	0.40	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	70.50	70.50	0.00	0.00	70.58
Total	**0.03**	**0.04**	**0.40**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**70.52**	**70.52**	**0.00**	**0.00**	**70.60**

3.2 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.13	0.94	0.53	0.00		0.05	0.05		0.05	0.05	0.00	116.05	116.05	0.01	0.00	116.26
Total	**0.13**	**0.94**	**0.53**	**0.00**	**3.44**	**0.05**	**3.49**	**1.89**	**0.05**	**1.94**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.26**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.36	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	68.98	68.98	0.00	0.00	69.05
Total	**0.03**	**0.03**	**0.36**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**69.00**	**69.00**	**0.00**	**0.00**	**69.07**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.13	0.94	0.53	0.00		0.05	0.05		0.05	0.05	0.00	116.05	116.05	0.01	0.00	116.26
Total	**0.13**	**0.94**	**0.53**	**0.00**	**1.34**	**0.05**	**1.39**	**0.74**	**0.05**	**0.79**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.26**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.36	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	68.98	68.98	0.00	0.00	69.05
Total	**0.03**	**0.03**	**0.36**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**69.00**	**69.00**	**0.00**	**0.00**	**69.07**

3.2 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.12	0.86	0.51	0.00		0.04	0.04		0.04	0.04	0.00	116.36	116.36	0.01	0.00	116.57
Total	**0.12**	**0.86**	**0.51**	**0.00**	**3.44**	**0.04**	**3.48**	**1.89**	**0.04**	**1.93**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.57**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	68.01	68.01	0.00	0.00	68.08
Total	**0.03**	**0.03**	**0.34**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**68.03**	**68.03**	**0.00**	**0.00**	**68.10**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.12	0.86	0.51	0.00		0.04	0.04		0.04	0.04	0.00	116.36	116.36	0.01	0.00	116.57
Total	**0.12**	**0.86**	**0.51**	**0.00**	**1.34**	**0.04**	**1.38**	**0.74**	**0.04**	**0.78**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.57**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.34	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	68.01	68.01	0.00	0.00	68.08
Total	**0.03**	**0.03**	**0.34**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**68.03**	**68.03**	**0.00**	**0.00**	**68.10**

3.2 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00

Off-Road	0.11	0.79	0.49	0.00		0.04	0.04		0.04	0.04	0.00	116.05	116.05	0.01	0.00	116.24
Total	**0.11**	**0.79**	**0.49**	**0.00**	**3.44**	**0.04**	**3.48**	**1.89**	**0.04**	**1.93**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.24**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.31	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	66.38	66.38	0.00	0.00	66.45
Total	**0.03**	**0.03**	**0.31**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**66.40**	**66.40**	**0.00**	**0.00**	**66.47**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.11	0.79	0.49	0.00		0.04	0.04		0.04	0.04	0.00	116.05	116.05	0.01	0.00	116.24
Total	**0.11**	**0.79**	**0.49**	**0.00**	**1.34**	**0.04**	**1.38**	**0.74**	**0.04**	**0.78**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.24**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.03	0.03	0.31	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	66.38	66.38	0.00	0.00	66.45
Total	**0.03**	**0.03**	**0.31**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**66.40**	**66.40**	**0.00**	**0.00**	**66.47**

3.2 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.10	0.72	0.48	0.00		0.03	0.03		0.03	0.03	0.00	116.05	116.05	0.01	0.00	116.22
Total	**0.10**	**0.72**	**0.48**	**0.00**	**3.44**	**0.03**	**3.47**	**1.89**	**0.03**	**1.92**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.22**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.03	0.29	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	65.01	65.01	0.00	0.00	65.08
Total	**0.02**	**0.03**	**0.29**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**65.03**	**65.03**	**0.00**	**0.00**	**65.10**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.10	0.72	0.48	0.00		0.03	0.03		0.03	0.03	0.00	116.05	116.05	0.01	0.00	116.22
Total	**0.10**	**0.72**	**0.48**	**0.00**	**1.34**	**0.03**	**1.37**	**0.74**	**0.03**	**0.77**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.22**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.03	0.29	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	65.01	65.01	0.00	0.00	65.08
Total	**0.02**	**0.03**	**0.29**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**65.03**	**65.03**	**0.00**	**0.00**	**65.10**

3.2 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.10	0.66	0.47	0.00		0.03	0.03		0.03	0.03	0.00	116.05	116.05	0.01	0.00	116.21
Total	**0.10**	**0.66**	**0.47**	**0.00**	**3.44**	**0.03**	**3.47**	**1.89**	**0.03**	**1.92**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.21**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.27	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	63.73	63.73	0.00	0.00	63.79
Total	**0.02**	**0.02**	**0.27**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**63.75**	**63.75**	**0.00**	**0.00**	**63.81**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.10	0.66	0.47	0.00		0.03	0.03		0.03	0.03	0.00	116.05	116.05	0.01	0.00	116.21
Total	**0.10**	**0.66**	**0.47**	**0.00**	**1.34**	**0.03**	**1.37**	**0.74**	**0.03**	**0.77**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.21**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.27	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	63.73	63.73	0.00	0.00	63.79
Total	**0.02**	**0.02**	**0.27**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**63.75**	**63.75**	**0.00**	**0.00**	**63.81**

3.2 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.09	0.60	0.46	0.00		0.03	0.03		0.03	0.03	0.00	116.36	116.36	0.01	0.00	116.52
Total	**0.09**	**0.60**	**0.46**	**0.00**	**3.44**	**0.03**	**3.47**	**1.89**	**0.03**	**1.92**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.52**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.25	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	62.71	62.71	0.00	0.00	62.76

Total	0.02	0.02	0.25	0.00	185.34	0.00	185.34	18.49	0.00	18.49	0.00	62.73	62.73	0.00	0.00	62.78

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.09	0.60	0.46	0.00		0.03	0.03		0.03	0.03	0.00	116.36	116.36	0.01	0.00	116.52
Total	0.09	0.60	0.46	0.00	1.34	0.03	1.37	0.74	0.03	0.77	0.00	116.36	116.36	0.01	0.00	116.52

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.25	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	62.71	62.71	0.00	0.00	62.76
Total	0.02	0.02	0.25	0.00	185.34	0.00	185.34	18.49	0.00	18.49	0.00	62.73	62.73	0.00	0.00	62.78

3.2 Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.09	0.55	0.45	0.00		0.02	0.02		0.02	0.02	0.00	116.05	116.05	0.01	0.00	116.19
Total	0.09	0.55	0.45	0.00	3.44	0.02	3.46	1.89	0.02	1.91	0.00	116.05	116.05	0.01	0.00	116.19

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	61.77	61.77	0.00	0.00	61.83
Total	**0.02**	**0.02**	**0.24**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**61.79**	**61.79**	**0.00**	**0.00**	**61.85**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.09	0.55	0.45	0.00		0.02	0.02		0.02	0.02	0.00	116.05	116.05	0.01	0.00	116.19
Total	**0.09**	**0.55**	**0.45**	**0.00**	**1.34**	**0.02**	**1.36**	**0.74**	**0.02**	**0.76**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.19**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.24	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	61.77	61.77	0.00	0.00	61.83
Total	**0.02**	**0.02**	**0.24**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**61.79**	**61.79**	**0.00**	**0.00**	**61.85**

3.2 Grading - 2022

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.08	0.50	0.44	0.00		0.02	0.02		0.02	0.02	0.00	116.05	116.05	0.01	0.00	116.19
Total	**0.08**	**0.50**	**0.44**	**0.00**	**3.44**	**0.02**	**3.46**	**1.89**	**0.02**	**1.91**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.19**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.22	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	60.75	60.75	0.00	0.00	60.80
Total	**0.02**	**0.02**	**0.22**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**60.77**	**60.77**	**0.00**	**0.00**	**60.82**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.08	0.50	0.44	0.00		0.02	0.02		0.02	0.02	0.00	116.05	116.05	0.01	0.00	116.19
Total	**0.08**	**0.50**	**0.44**	**0.00**	**1.34**	**0.02**	**1.36**	**0.74**	**0.02**	**0.76**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.19**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Worker	0.02	0.02	0.22	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	60.75	60.75	0.00	0.00	60.80
Total	**0.02**	**0.02**	**0.22**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**60.77**	**60.77**	**0.00**	**0.00**	**60.82**

3.2 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.08	0.46	0.43	0.00		0.02	0.02		0.02	0.02	0.00	116.05	116.05	0.01	0.00	116.18
Total	**0.08**	**0.46**	**0.43**	**0.00**	**3.44**	**0.02**	**3.46**	**1.89**	**0.02**	**1.91**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.18**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.21	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	59.79	59.79	0.00	0.00	59.84
Total	**0.02**	**0.02**	**0.21**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**59.81**	**59.81**	**0.00**	**0.00**	**59.86**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.08	0.46	0.43	0.00		0.02	0.02		0.02	0.02	0.00	116.05	116.05	0.01	0.00	116.18
Total	**0.08**	**0.46**	**0.43**	**0.00**	**1.34**	**0.02**	**1.36**	**0.74**	**0.02**	**0.76**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.18**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.21	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	59.79	59.79	0.00	0.00	59.84
Total	**0.02**	**0.02**	**0.21**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**59.81**	**59.81**	**0.00**	**0.00**	**59.86**

3.2 Grading - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.42	0.43	0.00		0.02	0.02		0.02	0.02	0.00	116.36	116.36	0.01	0.00	116.49
Total	**0.07**	**0.42**	**0.43**	**0.00**	**3.44**	**0.02**	**3.46**	**1.89**	**0.02**	**1.91**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.49**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.20	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	59.10	59.10	0.00	0.00	59.15
Total	**0.02**	**0.02**	**0.20**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**59.12**	**59.12**	**0.00**	**0.00**	**59.17**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.42	0.43	0.00		0.02	0.02		0.02	0.02	0.00	116.36	116.36	0.01	0.00	116.49
Total	**0.07**	**0.42**	**0.43**	**0.00**	**1.34**	**0.02**	**1.36**	**0.74**	**0.02**	**0.76**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.49**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.20	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	59.10	59.10	0.00	0.00	59.15
Total	**0.02**	**0.02**	**0.20**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**59.12**	**59.12**	**0.00**	**0.00**	**59.17**

3.2 Grading - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

3.2 Grading - 2026

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

3.2 Grading - 2027

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

3.2 Grading - 2028

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.39	0.43	0.00		0.01	0.01		0.01	0.01	0.00	116.36	116.36	0.01	0.00	116.49
Total	**0.07**	**0.39**	**0.43**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.49**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	58.29	58.29	0.00	0.00	58.33
Total	**0.02**	**0.02**	**0.19**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**58.31**	**58.31**	**0.00**	**0.00**	**58.35**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.39	0.43	0.00		0.01	0.01		0.01	0.01	0.00	116.36	116.36	0.01	0.00	116.49

Total	**0.07**	**0.39**	**0.43**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.36**	**116.36**	**0.01**	**0.00**	**116.49**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	58.29	58.29	0.00	0.00	58.33
Total	**0.02**	**0.02**	**0.19**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**58.31**	**58.31**	**0.00**	**0.00**	**58.35**

3.2 Grading - 2029

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.07	0.38	0.42	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.01	0.00	116.17
Total	**0.07**	**0.38**	**0.42**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.01**	**0.00**	**116.17**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.02	0.02	0.19	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	58.13	58.13	0.00	0.00	58.18
Total	**0.02**	**0.02**	**0.19**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**58.15**	**58.15**	**0.00**	**0.00**	**58.20**

3.2 Grading - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

3.2 Grading - 2031

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

3.2 Grading - 2032

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.36	116.36	0.00	0.00	116.47
Total	**0.06**	**0.26**	**0.41**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.36**	**116.36**	**0.00**	**0.00**	**116.47**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	55.39	55.39	0.00	0.00	55.43
Total	**0.01**	**0.01**	**0.15**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**55.41**	**55.41**	**0.00**	**0.00**	**55.45**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.36	116.36	0.00	0.00	116.47
Total	**0.06**	**0.26**	**0.41**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.36**	**116.36**	**0.00**	**0.00**	**116.47**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	55.39	55.39	0.00	0.00	55.43
Total	**0.01**	**0.01**	**0.15**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**55.41**	**55.41**	**0.00**	**0.00**	**55.45**

3.2 Grading - 2033

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

3.2 Grading - 2034

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27

Total	0.01	0.01	0.15	0.00	184.83	0.00	184.84	18.45	0.00	18.45	0.00	55.26	55.26	0.00	0.00	55.29

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.06	0.26	0.41	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.15
Total	**0.06**	**0.26**	**0.41**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.15**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.15	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	55.24	55.24	0.00	0.00	55.27
Total	**0.01**	**0.01**	**0.15**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**55.26**	**55.26**	**0.00**	**0.00**	**55.29**

3.2 Grading - 2035

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.14
Total	**0.05**	**0.20**	**0.40**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.14**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	54.40	54.40	0.00	0.00	54.43
Total	**0.01**	**0.01**	**0.13**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**54.42**	**54.42**	**0.00**	**0.00**	**54.45**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.14
Total	**0.05**	**0.20**	**0.40**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.14**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	54.40	54.40	0.00	0.00	54.43
Total	**0.01**	**0.01**	**0.13**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**54.42**	**54.42**	**0.00**	**0.00**	**54.45**

3.2 Grading - 2036

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.37	116.37	0.00	0.00	116.46
Total	**0.05**	**0.20**	**0.40**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.37**	**116.37**	**0.00**	**0.00**	**116.46**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	54.55	54.55	0.00	0.00	54.58
Total	**0.01**	**0.01**	**0.13**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**54.57**	**54.57**	**0.00**	**0.00**	**54.60**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.37	116.37	0.00	0.00	116.46
Total	**0.05**	**0.20**	**0.40**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.37**	**116.37**	**0.00**	**0.00**	**116.46**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.50	0.00	69.50	6.93	0.00	6.93	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Worker	0.01	0.01	0.13	0.00	115.84	0.00	115.84	11.56	0.00	11.56	0.00	54.55	54.55	0.00	0.00	54.58
Total	**0.01**	**0.01**	**0.13**	**0.00**	**185.34**	**0.00**	**185.34**	**18.49**	**0.00**	**18.49**	**0.00**	**54.57**	**54.57**	**0.00**	**0.00**	**54.60**

3.2 Grading - 2037

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.14
Total	**0.05**	**0.20**	**0.40**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.14**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	54.40	54.40	0.00	0.00	54.43
Total	**0.01**	**0.01**	**0.13**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**54.42**	**54.42**	**0.00**	**0.00**	**54.45**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.14
Total	**0.05**	**0.20**	**0.40**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.14**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	54.40	54.40	0.00	0.00	54.43
Total	**0.01**	**0.01**	**0.13**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**54.42**	**54.42**	**0.00**	**0.00**	**54.45**

3.2 Grading - 2038

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					3.44	0.00	3.44	1.89	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.14
Total	**0.05**	**0.20**	**0.40**	**0.00**	**3.44**	**0.01**	**3.45**	**1.89**	**0.01**	**1.90**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.14**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	54.40	54.40	0.00	0.00	54.43
Total	**0.01**	**0.01**	**0.13**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**54.42**	**54.42**	**0.00**	**0.00**	**54.45**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.34	0.00	1.34	0.74	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Off-Road	0.05	0.20	0.40	0.00		0.01	0.01		0.01	0.01	0.00	116.05	116.05	0.00	0.00	116.14
Total	**0.05**	**0.20**	**0.40**	**0.00**	**1.34**	**0.01**	**1.35**	**0.74**	**0.01**	**0.75**	**0.00**	**116.05**	**116.05**	**0.00**	**0.00**	**116.14**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.00	0.00	0.00	0.00	69.31	0.00	69.31	6.92	0.00	6.92	0.00	0.02	0.02	0.00	0.00	0.02
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker	0.01	0.01	0.13	0.00	115.52	0.00	115.53	11.53	0.00	11.53	0.00	54.40	54.40	0.00	0.00	54.43
Total	**0.01**	**0.01**	**0.13**	**0.00**	**184.83**	**0.00**	**184.84**	**18.45**	**0.00**	**18.45**	**0.00**	**54.42**	**54.42**	**0.00**	**0.00**	**54.45**

4.0 Mobile Detail

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92
Unmitigated	4.18	11.31	43.91	0.06	415.67	0.43	416.09	40.94	0.40	41.34	0.00	5,721.13	5,721.13	0.32	0.00	5,727.92

Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Heavy Industry	3,267.00	3,267.00	3267.00	11,022,884	11,022,884
Total	3,267.00	3,267.00	3,267.00	11,022,884	11,022,884

4.3 Trip Type Information

	Miles			Trip %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW
General Heavy Industry	8.90	13.30	7.40	59.00	28.00	13.00

5.0 Energy Detail

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity Unmitigated						0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Mitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NaturalGas Unmitigated	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	0	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU	tons/yr										MT/yr					
General Heavy Industry	0	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total		**0.00**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	0					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	Electricity Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	kWh	tons/yr				MT/yr			
General Heavy Industry	0					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated	10.39	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.52					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Consumer Products	7.87					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**10.39**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	2.52					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Consumer Products	7.87					0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping	0.00	0.00	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**10.39**	**0.00**	**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

7.0 Water Detail

7.1 Mitigation Measures Water

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr				MT/yr			
Mitigated					0.00	0.00	0.00	0.00
Unmitigated					0.00	0.00	0.00	0.00
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	0 / 0					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	Indoor/Outdoor Use	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	tons/yr				MT/yr			
General Heavy Industry	0 / 0					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
	tons/yr				MT/yr			
Mitigated					0.00	0.00	0.00	0.00
Unmitigated					0.00	0.00	0.00	0.00
Total	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e
Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	365000					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

Mitigated

	Waste Disposed	ROG	NOx	CO	SO2	Total CO2	CH4	N2O	CO2e

Land Use	tons	tons/yr				MT/yr			
General Heavy Industry	365000					0.00	0.00	0.00	0.00
Total						**0.00**	**0.00**	**0.00**	**0.00**

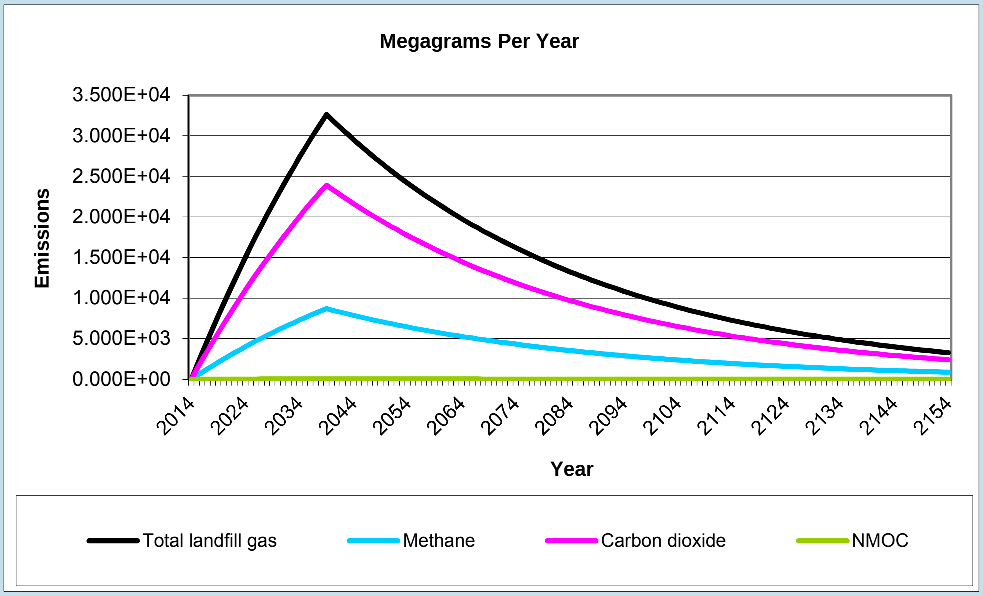
9.0 Vegetation

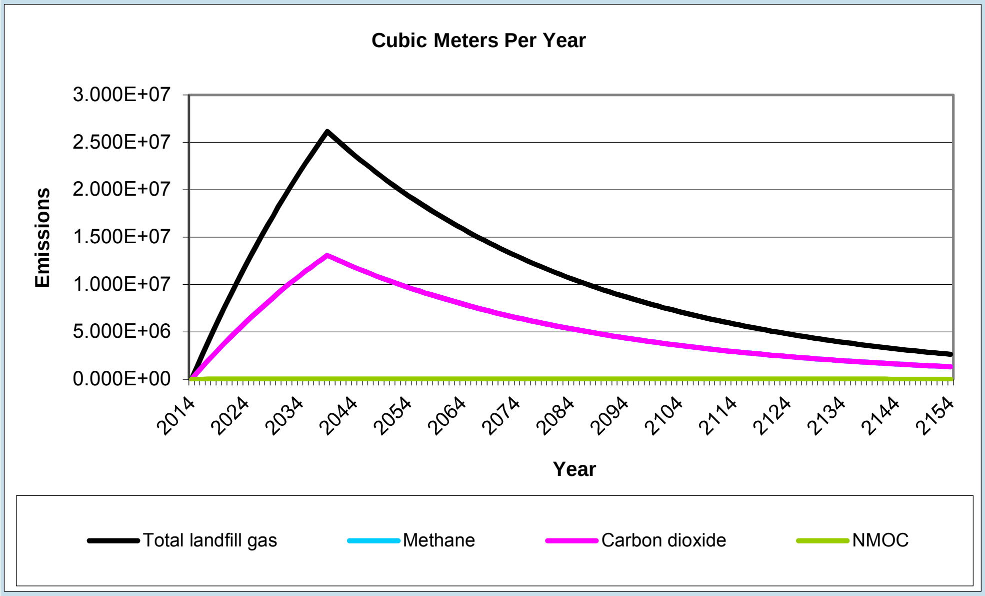
APPENDIX B

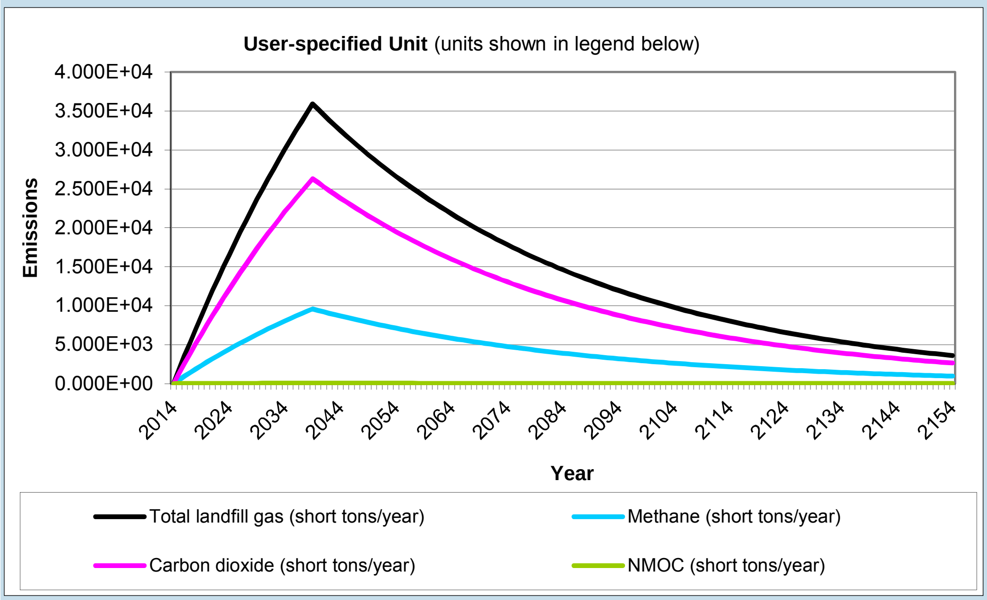
LANDGEM FILES

GRAPHS

Landfill Name or Identifier: LA County Landfill Baseline Emissions







Summary Report

Landfill Name or Identifier: LA County Landfill Baseline Emissions

Date: Monday, May 25, 2015

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} k L_o \left(\frac{M_i}{10} \right) e^{-k t_{ij}}$$

Where,
Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate (*$year^{-1}$*)
L_o = potential methane generation capacity (*m^3/Mg*)

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2014**	
Landfill Closure Year (with 80-year limit)	**2038**	
Actual Closure Year (without limit)	***2038***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity		*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.020**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2014	331,818	365,000	0	0
2015	331,818	365,000	331,818	365,000
2016	331,818	365,000	663,636	730,000
2017	331,818	365,000	995,455	1,095,000
2018	331,818	365,000	1,327,273	1,460,000
2019	331,818	365,000	1,659,091	1,825,000
2020	331,818	365,000	1,990,909	2,190,000
2021	331,818	365,000	2,322,727	2,555,000
2022	331,818	365,000	2,654,545	2,920,000
2023	331,818	365,000	2,986,364	3,285,000
2024	331,818	365,000	3,318,182	3,650,000
2025	331,818	365,000	3,650,000	4,015,000
2026	331,818	365,000	3,981,818	4,380,000
2027	331,818	365,000	4,313,636	4,745,000
2028	331,818	365,000	4,645,455	5,110,000
2029	331,818	365,000	4,977,273	5,475,000
2030	331,818	365,000	5,309,091	5,840,000
2031	331,818	365,000	5,640,909	6,205,000
2032	331,818	365,000	5,972,727	6,570,000
2033	331,818	365,000	6,304,545	6,935,000
2034	331,818	365,000	6,636,364	7,300,000
2035	331,818	365,000	6,968,182	7,665,000
2036	331,818	365,000	7,300,000	8,030,000
2037	331,818	365,000	7,631,818	8,395,000
2038	331,818	365,000	7,963,636	8,760,000
2039	0	0	8,295,455	9,125,000
2040	0	0	8,295,455	9,125,000
2041	0	0	8,295,455	9,125,000
2042	0	0	8,295,455	9,125,000
2043	0	0	8,295,455	9,125,000
2044	0	0	8,295,455	9,125,000
2045	0	0	8,295,455	9,125,000
2046	0	0	8,295,455	9,125,000
2047	0	0	8,295,455	9,125,000
2048	0	0	8,295,455	9,125,000
2049	0	0	8,295,455	9,125,000
2050	0	0	8,295,455	9,125,000
2051	0	0	8,295,455	9,125,000
2052	0	0	8,295,455	9,125,000
2053	0	0	8,295,455	9,125,000

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2054	0	0	8,295,455	9,125,000
2055	0	0	8,295,455	9,125,000
2056	0	0	8,295,455	9,125,000
2057	0	0	8,295,455	9,125,000
2058	0	0	8,295,455	9,125,000
2059	0	0	8,295,455	9,125,000
2060	0	0	8,295,455	9,125,000
2061	0	0	8,295,455	9,125,000
2062	0	0	8,295,455	9,125,000
2063	0	0	8,295,455	9,125,000
2064	0	0	8,295,455	9,125,000
2065	0	0	8,295,455	9,125,000
2066	0	0	8,295,455	9,125,000
2067	0	0	8,295,455	9,125,000
2068	0	0	8,295,455	9,125,000
2069	0	0	8,295,455	9,125,000
2070	0	0	8,295,455	9,125,000
2071	0	0	8,295,455	9,125,000
2072	0	0	8,295,455	9,125,000
2073	0	0	8,295,455	9,125,000
2074	0	0	8,295,455	9,125,000
2075	0	0	8,295,455	9,125,000
2076	0	0	8,295,455	9,125,000
2077	0	0	8,295,455	9,125,000
2078	0	0	8,295,455	9,125,000
2079	0	0	8,295,455	9,125,000
2080	0	0	8,295,455	9,125,000
2081	0	0	8,295,455	9,125,000
2082	0	0	8,295,455	9,125,000
2083	0	0	8,295,455	9,125,000
2084	0	0	8,295,455	9,125,000
2085	0	0	8,295,455	9,125,000
2086	0	0	8,295,455	9,125,000
2087	0	0	8,295,455	9,125,000
2088	0	0	8,295,455	9,125,000
2089	0	0	8,295,455	9,125,000
2090	0	0	8,295,455	9,125,000
2091	0	0	8,295,455	9,125,000
2092	0	0	8,295,455	9,125,000
2093	0	0	8,295,455	9,125,000

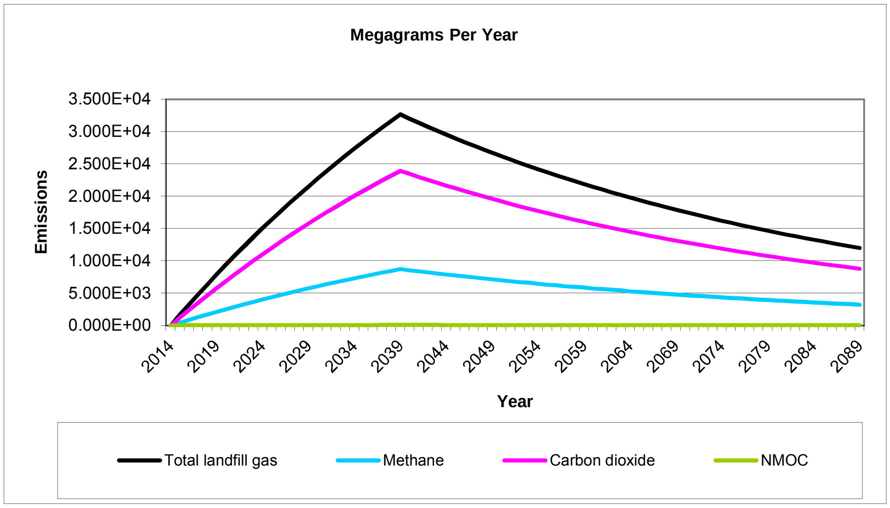
Pollutant Parameters

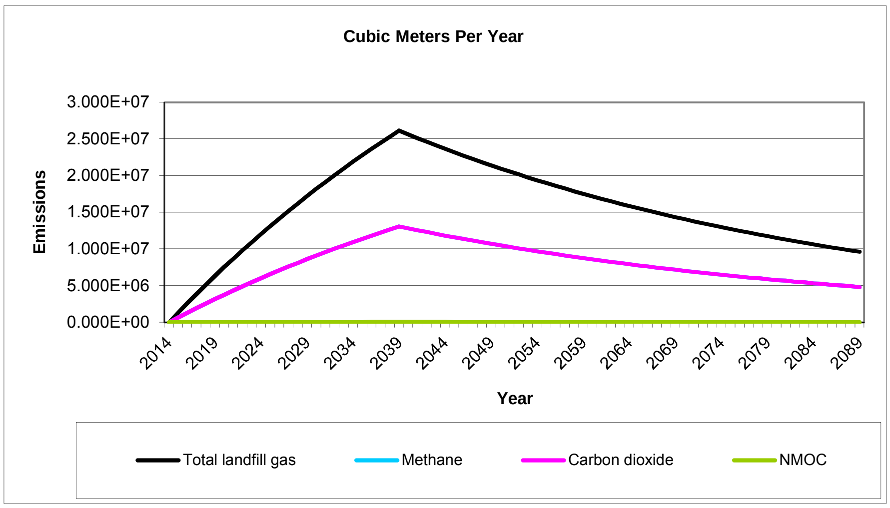
		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

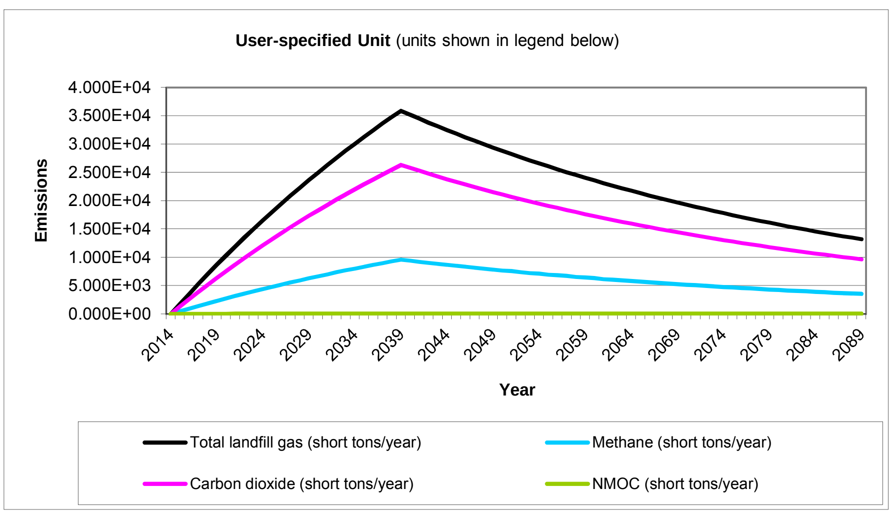
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
Emissions
2014 2019 2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
Emissions
2014 2019 2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
Emissions
2014 2019 2024 2029 2034 2039 2044 2049 2054 2059 2064 2069 2074 2079 2084 2089
Year
Total landfill gas (short tons/year)
Methane (short tons/year)
Carbon dioxide (short tons/year)
NMOC (short tons/year)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2014	0	0	0	0	0	0
2015	1.643E+03	1.315E+06	1.807E+03	4.388E+02	6.577E+05	4.827E+02
2016	3.253E+03	2.605E+06	3.578E+03	8.689E+02	1.302E+06	9.558E+02
2017	4.831E+03	3.869E+06	5.314E+03	1.290E+03	1.934E+06	1.420E+03
2018	6.378E+03	5.107E+06	7.016E+03	1.704E+03	2.554E+06	1.874E+03
2019	7.895E+03	6.322E+06	8.684E+03	2.109E+03	3.161E+06	2.320E+03
2020	9.381E+03	7.512E+06	1.032E+04	2.506E+03	3.756E+06	2.756E+03
2021	1.084E+04	8.679E+06	1.192E+04	2.895E+03	4.339E+06	3.184E+03
2022	1.227E+04	9.822E+06	1.349E+04	3.276E+03	4.911E+06	3.604E+03
2023	1.367E+04	1.094E+07	1.503E+04	3.650E+03	5.472E+06	4.015E+03
2024	1.504E+04	1.204E+07	1.654E+04	4.017E+03	6.021E+06	4.418E+03
2025	1.638E+04	1.312E+07	1.802E+04	4.376E+03	6.559E+06	4.814E+03
2026	1.770E+04	1.417E+07	1.947E+04	4.728E+03	7.087E+06	5.201E+03
2027	1.899E+04	1.521E+07	2.089E+04	5.073E+03	7.605E+06	5.581E+03
2028	2.026E+04	1.622E+07	2.229E+04	5.412E+03	8.112E+06	5.953E+03
2029	2.150E+04	1.722E+07	2.365E+04	5.743E+03	8.609E+06	6.318E+03
2030	2.272E+04	1.819E+07	2.499E+04	6.068E+03	9.096E+06	6.675E+03
2031	2.391E+04	1.915E+07	2.630E+04	6.387E+03	9.574E+06	7.026E+03
2032	2.508E+04	2.008E+07	2.759E+04	6.699E+03	1.004E+07	7.369E+03
2033	2.623E+04	2.100E+07	2.885E+04	7.005E+03	1.050E+07	7.706E+03
2034	2.735E+04	2.190E+07	3.009E+04	7.305E+03	1.095E+07	8.036E+03
2035	2.845E+04	2.278E+07	3.130E+04	7.600E+03	1.139E+07	8.360E+03
2036	2.953E+04	2.365E+07	3.248E+04	7.888E+03	1.182E+07	8.677E+03
2037	3.059E+04	2.449E+07	3.365E+04	8.171E+03	1.225E+07	8.988E+03
2038	3.163E+04	2.532E+07	3.479E+04	8.448E+03	1.266E+07	9.292E+03
2039	3.264E+04	2.614E+07	3.591E+04	8.719E+03	1.307E+07	9.591E+03
2040	3.200E+04	2.562E+07	3.520E+04	8.546E+03	1.281E+07	9.401E+03
2041	3.136E+04	2.511E+07	3.450E+04	8.377E+03	1.256E+07	9.215E+03
2042	3.074E+04	2.462E+07	3.382E+04	8.211E+03	1.231E+07	9.032E+03
2043	3.013E+04	2.413E+07	3.315E+04	8.049E+03	1.206E+07	8.854E+03
2044	2.954E+04	2.365E+07	3.249E+04	7.889E+03	1.183E+07	8.678E+03
2045	2.895E+04	2.318E+07	3.185E+04	7.733E+03	1.159E+07	8.506E+03
2046	2.838E+04	2.272E+07	3.122E+04	7.580E+03	1.136E+07	8.338E+03
2047	2.782E+04	2.227E+07	3.060E+04	7.430E+03	1.114E+07	8.173E+03
2048	2.726E+04	2.183E+07	2.999E+04	7.283E+03	1.092E+07	8.011E+03
2049	2.672E+04	2.140E+07	2.940E+04	7.139E+03	1.070E+07	7.852E+03
2050	2.620E+04	2.098E+07	2.882E+04	6.997E+03	1.049E+07	7.697E+03
2051	2.568E+04	2.056E+07	2.824E+04	6.859E+03	1.028E+07	7.544E+03
2052	2.517E+04	2.015E+07	2.769E+04	6.723E+03	1.008E+07	7.395E+03
2053	2.467E+04	1.975E+07	2.714E+04	6.590E+03	9.877E+06	7.249E+03
2054	2.418E+04	1.936E+07	2.660E+04	6.459E+03	9.682E+06	7.105E+03
2055	2.370E+04	1.898E+07	2.607E+04	6.331E+03	9.490E+06	6.964E+03
2056	2.323E+04	1.860E+07	2.556E+04	6.206E+03	9.302E+06	6.827E+03
2057	2.277E+04	1.824E+07	2.505E+04	6.083E+03	9.118E+06	6.691E+03
2058	2.232E+04	1.787E+07	2.455E+04	5.963E+03	8.937E+06	6.559E+03
2059	2.188E+04	1.752E+07	2.407E+04	5.845E+03	8.760E+06	6.429E+03
2060	2.145E+04	1.717E+07	2.359E+04	5.729E+03	8.587E+06	6.302E+03
2061	2.102E+04	1.683E+07	2.312E+04	5.615E+03	8.417E+06	6.177E+03
2062	2.061E+04	1.650E+07	2.267E+04	5.504E+03	8.250E+06	6.055E+03
2063	2.020E+04	1.617E+07	2.222E+04	5.395E+03	8.087E+06	5.935E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(short tons/year)	(Mg/year)	(m^3/year)	(short tons/year)
2064	1.980E+04	1.585E+07	2.178E+04	5.288E+03	7.927E+06	5.817E+03
2065	1.941E+04	1.554E+07	2.135E+04	5.184E+03	7.770E+06	5.702E+03
2066	1.902E+04	1.523E+07	2.092E+04	5.081E+03	7.616E+06	5.589E+03
2067	1.865E+04	1.493E+07	2.051E+04	4.980E+03	7.465E+06	5.478E+03
2068	1.828E+04	1.463E+07	2.010E+04	4.882E+03	7.317E+06	5.370E+03
2069	1.791E+04	1.434E+07	1.971E+04	4.785E+03	7.172E+06	5.264E+03
2070	1.756E+04	1.406E+07	1.932E+04	4.690E+03	7.030E+06	5.159E+03
2071	1.721E+04	1.378E+07	1.893E+04	4.597E+03	6.891E+06	5.057E+03
2072	1.687E+04	1.351E+07	1.856E+04	4.506E+03	6.755E+06	4.957E+03
2073	1.654E+04	1.324E+07	1.819E+04	4.417E+03	6.621E+06	4.859E+03
2074	1.621E+04	1.298E+07	1.783E+04	4.330E+03	6.490E+06	4.763E+03
2075	1.589E+04	1.272E+07	1.748E+04	4.244E+03	6.361E+06	4.668E+03
2076	1.557E+04	1.247E+07	1.713E+04	4.160E+03	6.235E+06	4.576E+03
2077	1.527E+04	1.222E+07	1.679E+04	4.078E+03	6.112E+06	4.485E+03
2078	1.496E+04	1.198E+07	1.646E+04	3.997E+03	5.991E+06	4.397E+03
2079	1.467E+04	1.174E+07	1.613E+04	3.918E+03	5.872E+06	4.309E+03
2080	1.438E+04	1.151E+07	1.581E+04	3.840E+03	5.756E+06	4.224E+03
2081	1.409E+04	1.128E+07	1.550E+04	3.764E+03	5.642E+06	4.141E+03
2082	1.381E+04	1.106E+07	1.519E+04	3.690E+03	5.530E+06	4.059E+03
2083	1.354E+04	1.084E+07	1.489E+04	3.617E+03	5.421E+06	3.978E+03
2084	1.327E+04	1.063E+07	1.460E+04	3.545E+03	5.313E+06	3.899E+03
2085	1.301E+04	1.042E+07	1.431E+04	3.475E+03	5.208E+06	3.822E+03
2086	1.275E+04	1.021E+07	1.403E+04	3.406E+03	5.105E+06	3.746E+03
2087	1.250E+04	1.001E+07	1.375E+04	3.338E+03	5.004E+06	3.672E+03
2088	1.225E+04	9.810E+06	1.348E+04	3.272E+03	4.905E+06	3.600E+03
2089	1.201E+04	9.616E+06	1.321E+04	3.208E+03	4.808E+06	3.528E+03
2090	1.177E+04	9.425E+06	1.295E+04	3.144E+03	4.713E+06	3.458E+03
2091	1.154E+04	9.239E+06	1.269E+04	3.082E+03	4.619E+06	3.390E+03
2092	1.131E+04	9.056E+06	1.244E+04	3.021E+03	4.528E+06	3.323E+03
2093	1.109E+04	8.876E+06	1.219E+04	2.961E+03	4.438E+06	3.257E+03
2094	1.087E+04	8.701E+06	1.195E+04	2.902E+03	4.350E+06	3.193E+03
2095	1.065E+04	8.528E+06	1.172E+04	2.845E+03	4.264E+06	3.129E+03
2096	1.044E+04	8.359E+06	1.148E+04	2.789E+03	4.180E+06	3.067E+03
2097	1.023E+04	8.194E+06	1.126E+04	2.733E+03	4.097E+06	3.007E+03
2098	1.003E+04	8.032E+06	1.103E+04	2.679E+03	4.016E+06	2.947E+03
2099	9.832E+03	7.873E+06	1.081E+04	2.626E+03	3.936E+06	2.889E+03
2100	9.637E+03	7.717E+06	1.060E+04	2.574E+03	3.858E+06	2.832E+03
2101	9.446E+03	7.564E+06	1.039E+04	2.523E+03	3.782E+06	2.775E+03
2102	9.259E+03	7.414E+06	1.018E+04	2.473E+03	3.707E+06	2.721E+03
2103	9.076E+03	7.267E+06	9.983E+03	2.424E+03	3.634E+06	2.667E+03
2104	8.896E+03	7.123E+06	9.786E+03	2.376E+03	3.562E+06	2.614E+03
2105	8.720E+03	6.982E+06	9.592E+03	2.329E+03	3.491E+06	2.562E+03
2106	8.547E+03	6.844E+06	9.402E+03	2.283E+03	3.422E+06	2.511E+03
2107	8.378E+03	6.709E+06	9.216E+03	2.238E+03	3.354E+06	2.462E+03
2108	8.212E+03	6.576E+06	9.033E+03	2.194E+03	3.288E+06	2.413E+03
2109	8.049E+03	6.446E+06	8.854E+03	2.150E+03	3.223E+06	2.365E+03
2110	7.890E+03	6.318E+06	8.679E+03	2.108E+03	3.159E+06	2.318E+03
2111	7.734E+03	6.193E+06	8.507E+03	2.066E+03	3.096E+06	2.272E+03
2112	7.581E+03	6.070E+06	8.339E+03	2.025E+03	3.035E+06	2.227E+03
2113	7.431E+03	5.950E+06	8.174E+03	1.985E+03	2.975E+06	2.183E+03
2114	7.283E+03	5.832E+06	8.012E+03	1.945E+03	2.916E+06	2.140E+03

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2115	7.139E+03	5.717E+06	7.853E+03	1.907E+03	2.858E+06	2.098E+03
2116	6.998E+03	5.604E+06	7.698E+03	1.869E+03	2.802E+06	2.056E+03
2117	6.859E+03	5.493E+06	7.545E+03	1.832E+03	2.746E+06	2.015E+03
2118	6.723E+03	5.384E+06	7.396E+03	1.796E+03	2.692E+06	1.975E+03
2119	6.590E+03	5.277E+06	7.249E+03	1.760E+03	2.639E+06	1.936E+03
2120	6.460E+03	5.173E+06	7.106E+03	1.725E+03	2.586E+06	1.898E+03
2121	6.332E+03	5.070E+06	6.965E+03	1.691E+03	2.535E+06	1.860E+03
2122	6.207E+03	4.970E+06	6.827E+03	1.658E+03	2.485E+06	1.824E+03
2123	6.084E+03	4.871E+06	6.692E+03	1.625E+03	2.436E+06	1.787E+03
2124	5.963E+03	4.775E+06	6.559E+03	1.593E+03	2.388E+06	1.752E+03
2125	5.845E+03	4.680E+06	6.430E+03	1.561E+03	2.340E+06	1.717E+03
2126	5.729E+03	4.588E+06	6.302E+03	1.530E+03	2.294E+06	1.683E+03
2127	5.616E+03	4.497E+06	6.177E+03	1.500E+03	2.248E+06	1.650E+03
2128	5.505E+03	4.408E+06	6.055E+03	1.470E+03	2.204E+06	1.617E+03
2129	5.396E+03	4.321E+06	5.935E+03	1.441E+03	2.160E+06	1.585E+03
2130	5.289E+03	4.235E+06	5.818E+03	1.413E+03	2.118E+06	1.554E+03
2131	5.184E+03	4.151E+06	5.703E+03	1.385E+03	2.076E+06	1.523E+03
2132	5.081E+03	4.069E+06	5.590E+03	1.357E+03	2.034E+06	1.493E+03
2133	4.981E+03	3.988E+06	5.479E+03	1.330E+03	1.994E+06	1.463E+03
2134	4.882E+03	3.909E+06	5.370E+03	1.304E+03	1.955E+06	1.435E+03
2135	4.786E+03	3.832E+06	5.264E+03	1.278E+03	1.916E+06	1.406E+03
2136	4.691E+03	3.756E+06	5.160E+03	1.253E+03	1.878E+06	1.378E+03
2137	4.598E+03	3.682E+06	5.058E+03	1.228E+03	1.841E+06	1.351E+03
2138	4.507E+03	3.609E+06	4.958E+03	1.204E+03	1.804E+06	1.324E+03
2139	4.418E+03	3.537E+06	4.859E+03	1.180E+03	1.769E+06	1.298E+03
2140	4.330E+03	3.467E+06	4.763E+03	1.157E+03	1.734E+06	1.272E+03
2141	4.244E+03	3.399E+06	4.669E+03	1.134E+03	1.699E+06	1.247E+03
2142	4.160E+03	3.331E+06	4.576E+03	1.111E+03	1.666E+06	1.222E+03
2143	4.078E+03	3.265E+06	4.486E+03	1.089E+03	1.633E+06	1.198E+03
2144	3.997E+03	3.201E+06	4.397E+03	1.068E+03	1.600E+06	1.174E+03
2145	3.918E+03	3.137E+06	4.310E+03	1.047E+03	1.569E+06	1.151E+03
2146	3.840E+03	3.075E+06	4.225E+03	1.026E+03	1.538E+06	1.128E+03
2147	3.764E+03	3.014E+06	4.141E+03	1.006E+03	1.507E+06	1.106E+03
2148	3.690E+03	2.955E+06	4.059E+03	9.856E+02	1.477E+06	1.084E+03
2149	3.617E+03	2.896E+06	3.979E+03	9.661E+02	1.448E+06	1.063E+03
2150	3.545E+03	2.839E+06	3.900E+03	9.470E+02	1.419E+06	1.042E+03
2151	3.475E+03	2.783E+06	3.823E+03	9.282E+02	1.391E+06	1.021E+03
2152	3.406E+03	2.728E+06	3.747E+03	9.098E+02	1.364E+06	1.001E+03
2153	3.339E+03	2.674E+06	3.673E+03	8.918E+02	1.337E+06	9.810E+02
2154	3.273E+03	2.621E+06	3.600E+03	8.742E+02	1.310E+06	9.616E+02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2014	0	0	0	0	0	0
2015	1.204E+03	6.577E+05	1.324E+03	2.829E+00	7.892E+02	3.112E+00
2016	2.384E+03	1.302E+06	2.622E+03	5.602E+00	1.563E+03	6.162E+00
2017	3.541E+03	1.934E+06	3.895E+03	8.320E+00	2.321E+03	9.152E+00
2018	4.675E+03	2.554E+06	5.142E+03	1.098E+01	3.064E+03	1.208E+01
2019	5.786E+03	3.161E+06	6.364E+03	1.360E+01	3.793E+03	1.496E+01
2020	6.875E+03	3.756E+06	7.563E+03	1.616E+01	4.507E+03	1.777E+01
2021	7.943E+03	4.339E+06	8.737E+03	1.866E+01	5.207E+03	2.053E+01
2022	8.990E+03	4.911E+06	9.889E+03	2.112E+01	5.893E+03	2.324E+01
2023	1.002E+04	5.472E+06	1.102E+04	2.353E+01	6.566E+03	2.589E+01
2024	1.102E+04	6.021E+06	1.212E+04	2.590E+01	7.225E+03	2.849E+01
2025	1.201E+04	6.559E+06	1.321E+04	2.821E+01	7.871E+03	3.104E+01
2026	1.297E+04	7.087E+06	1.427E+04	3.048E+01	8.505E+03	3.353E+01
2027	1.392E+04	7.605E+06	1.531E+04	3.271E+01	9.125E+03	3.598E+01
2028	1.485E+04	8.112E+06	1.633E+04	3.489E+01	9.734E+03	3.838E+01
2029	1.576E+04	8.609E+06	1.733E+04	3.703E+01	1.033E+04	4.073E+01
2030	1.665E+04	9.096E+06	1.832E+04	3.913E+01	1.092E+04	4.304E+01
2031	1.752E+04	9.574E+06	1.928E+04	4.118E+01	1.149E+04	4.530E+01
2032	1.838E+04	1.004E+07	2.022E+04	4.319E+01	1.205E+04	4.751E+01
2033	1.922E+04	1.050E+07	2.114E+04	4.517E+01	1.260E+04	4.968E+01
2034	2.004E+04	1.095E+07	2.205E+04	4.710E+01	1.314E+04	5.181E+01
2035	2.085E+04	1.139E+07	2.294E+04	4.900E+01	1.367E+04	5.390E+01
2036	2.164E+04	1.182E+07	2.381E+04	5.086E+01	1.419E+04	5.594E+01
2037	2.242E+04	1.225E+07	2.466E+04	5.268E+01	1.470E+04	5.795E+01
2038	2.318E+04	1.266E+07	2.550E+04	5.446E+01	1.519E+04	5.991E+01
2039	2.392E+04	1.307E+07	2.632E+04	5.621E+01	1.568E+04	6.184E+01
2040	2.345E+04	1.281E+07	2.579E+04	5.510E+01	1.537E+04	6.061E+01
2041	2.298E+04	1.256E+07	2.528E+04	5.401E+01	1.507E+04	5.941E+01
2042	2.253E+04	1.231E+07	2.478E+04	5.294E+01	1.477E+04	5.824E+01
2043	2.208E+04	1.206E+07	2.429E+04	5.189E+01	1.448E+04	5.708E+01
2044	2.165E+04	1.183E+07	2.381E+04	5.087E+01	1.419E+04	5.595E+01
2045	2.122E+04	1.159E+07	2.334E+04	4.986E+01	1.391E+04	5.484E+01
2046	2.080E+04	1.136E+07	2.288E+04	4.887E+01	1.363E+04	5.376E+01
2047	2.039E+04	1.114E+07	2.242E+04	4.790E+01	1.336E+04	5.269E+01
2048	1.998E+04	1.092E+07	2.198E+04	4.695E+01	1.310E+04	5.165E+01
2049	1.959E+04	1.070E+07	2.155E+04	4.602E+01	1.284E+04	5.063E+01
2050	1.920E+04	1.049E+07	2.112E+04	4.511E+01	1.259E+04	4.962E+01
2051	1.882E+04	1.028E+07	2.070E+04	4.422E+01	1.234E+04	4.864E+01
2052	1.845E+04	1.008E+07	2.029E+04	4.334E+01	1.209E+04	4.768E+01
2053	1.808E+04	9.877E+06	1.989E+04	4.249E+01	1.185E+04	4.673E+01
2054	1.772E+04	9.682E+06	1.949E+04	4.164E+01	1.162E+04	4.581E+01
2055	1.737E+04	9.490E+06	1.911E+04	4.082E+01	1.139E+04	4.490E+01
2056	1.703E+04	9.302E+06	1.873E+04	4.001E+01	1.116E+04	4.401E+01
2057	1.669E+04	9.118E+06	1.836E+04	3.922E+01	1.094E+04	4.314E+01
2058	1.636E+04	8.937E+06	1.800E+04	3.844E+01	1.072E+04	4.229E+01
2059	1.604E+04	8.760E+06	1.764E+04	3.768E+01	1.051E+04	4.145E+01
2060	1.572E+04	8.587E+06	1.729E+04	3.694E+01	1.030E+04	4.063E+01
2061	1.541E+04	8.417E+06	1.695E+04	3.620E+01	1.010E+04	3.982E+01
2062	1.510E+04	8.250E+06	1.661E+04	3.549E+01	9.900E+03	3.904E+01
2063	1.480E+04	8.087E+06	1.628E+04	3.478E+01	9.704E+03	3.826E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m³/year)*	*(short tons/year)*	*(Mg/year)*	*(m³/year)*	*(short tons/year)*
2064	1.451E+04	7.927E+06	1.596E+04	3.410E+01	9.512E+03	3.751E+01
2065	1.422E+04	7.770E+06	1.564E+04	3.342E+01	9.324E+03	3.676E+01
2066	1.394E+04	7.616E+06	1.534E+04	3.276E+01	9.139E+03	3.604E+01
2067	1.367E+04	7.465E+06	1.503E+04	3.211E+01	8.958E+03	3.532E+01
2068	1.339E+04	7.317E+06	1.473E+04	3.147E+01	8.781E+03	3.462E+01
2069	1.313E+04	7.172E+06	1.444E+04	3.085E+01	8.607E+03	3.394E+01
2070	1.287E+04	7.030E+06	1.416E+04	3.024E+01	8.437E+03	3.326E+01
2071	1.261E+04	6.891E+06	1.388E+04	2.964E+01	8.269E+03	3.261E+01
2072	1.236E+04	6.755E+06	1.360E+04	2.905E+01	8.106E+03	3.196E+01
2073	1.212E+04	6.621E+06	1.333E+04	2.848E+01	7.945E+03	3.133E+01
2074	1.188E+04	6.490E+06	1.307E+04	2.792E+01	7.788E+03	3.071E+01
2075	1.164E+04	6.361E+06	1.281E+04	2.736E+01	7.634E+03	3.010E+01
2076	1.141E+04	6.235E+06	1.256E+04	2.682E+01	7.483E+03	2.950E+01
2077	1.119E+04	6.112E+06	1.231E+04	2.629E+01	7.334E+03	2.892E+01
2078	1.097E+04	5.991E+06	1.206E+04	2.577E+01	7.189E+03	2.835E+01
2079	1.075E+04	5.872E+06	1.182E+04	2.526E+01	7.047E+03	2.778E+01
2080	1.054E+04	5.756E+06	1.159E+04	2.476E+01	6.907E+03	2.723E+01
2081	1.033E+04	5.642E+06	1.136E+04	2.427E+01	6.770E+03	2.670E+01
2082	1.012E+04	5.530E+06	1.114E+04	2.379E+01	6.636E+03	2.617E+01
2083	9.923E+03	5.421E+06	1.092E+04	2.332E+01	6.505E+03	2.565E+01
2084	9.726E+03	5.313E+06	1.070E+04	2.286E+01	6.376E+03	2.514E+01
2085	9.534E+03	5.208E+06	1.049E+04	2.240E+01	6.250E+03	2.464E+01
2086	9.345E+03	5.105E+06	1.028E+04	2.196E+01	6.126E+03	2.415E+01
2087	9.160E+03	5.004E+06	1.008E+04	2.152E+01	6.005E+03	2.368E+01
2088	8.979E+03	4.905E+06	9.876E+03	2.110E+01	5.886E+03	2.321E+01
2089	8.801E+03	4.808E+06	9.681E+03	2.068E+01	5.769E+03	2.275E+01
2090	8.626E+03	4.713E+06	9.489E+03	2.027E+01	5.655E+03	2.230E+01
2091	8.456E+03	4.619E+06	9.301E+03	1.987E+01	5.543E+03	2.186E+01
2092	8.288E+03	4.528E+06	9.117E+03	1.948E+01	5.433E+03	2.142E+01
2093	8.124E+03	4.438E+06	8.937E+03	1.909E+01	5.326E+03	2.100E+01
2094	7.963E+03	4.350E+06	8.760E+03	1.871E+01	5.220E+03	2.058E+01
2095	7.806E+03	4.264E+06	8.586E+03	1.834E+01	5.117E+03	2.018E+01
2096	7.651E+03	4.180E+06	8.416E+03	1.798E+01	5.016E+03	1.978E+01
2097	7.500E+03	4.097E+06	8.249E+03	1.762E+01	4.916E+03	1.938E+01
2098	7.351E+03	4.016E+06	8.086E+03	1.727E+01	4.819E+03	1.900E+01
2099	7.205E+03	3.936E+06	7.926E+03	1.693E+01	4.724E+03	1.862E+01
2100	7.063E+03	3.858E+06	7.769E+03	1.660E+01	4.630E+03	1.826E+01
2101	6.923E+03	3.782E+06	7.615E+03	1.627E+01	4.538E+03	1.789E+01
2102	6.786E+03	3.707E+06	7.464E+03	1.595E+01	4.449E+03	1.754E+01
2103	6.651E+03	3.634E+06	7.317E+03	1.563E+01	4.360E+03	1.719E+01
2104	6.520E+03	3.562E+06	7.172E+03	1.532E+01	4.274E+03	1.685E+01
2105	6.391E+03	3.491E+06	7.030E+03	1.502E+01	4.189E+03	1.652E+01
2106	6.264E+03	3.422E+06	6.891E+03	1.472E+01	4.107E+03	1.619E+01
2107	6.140E+03	3.354E+06	6.754E+03	1.443E+01	4.025E+03	1.587E+01
2108	6.019E+03	3.288E+06	6.620E+03	1.414E+01	3.945E+03	1.556E+01
2109	5.899E+03	3.223E+06	6.489E+03	1.386E+01	3.867E+03	1.525E+01
2110	5.783E+03	3.159E+06	6.361E+03	1.359E+01	3.791E+03	1.495E+01
2111	5.668E+03	3.096E+06	6.235E+03	1.332E+01	3.716E+03	1.465E+01
2112	5.556E+03	3.035E+06	6.111E+03	1.306E+01	3.642E+03	1.436E+01
2113	5.446E+03	2.975E+06	5.990E+03	1.280E+01	3.570E+03	1.408E+01
2114	5.338E+03	2.916E+06	5.872E+03	1.254E+01	3.499E+03	1.380E+01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(short tons/year)*	*(Mg/year)*	*(m^3/year)*	*(short tons/year)*
2115	5.232E+03	2.858E+06	5.755E+03	1.229E+01	3.430E+03	1.352E+01
2116	5.129E+03	2.802E+06	5.641E+03	1.205E+01	3.362E+03	1.326E+01
2117	5.027E+03	2.746E+06	5.530E+03	1.181E+01	3.296E+03	1.299E+01
2118	4.928E+03	2.692E+06	5.420E+03	1.158E+01	3.230E+03	1.274E+01
2119	4.830E+03	2.639E+06	5.313E+03	1.135E+01	3.166E+03	1.248E+01
2120	4.734E+03	2.586E+06	5.208E+03	1.112E+01	3.104E+03	1.224E+01
2121	4.641E+03	2.535E+06	5.105E+03	1.090E+01	3.042E+03	1.200E+01
2122	4.549E+03	2.485E+06	5.004E+03	1.069E+01	2.982E+03	1.176E+01
2123	4.459E+03	2.436E+06	4.904E+03	1.048E+01	2.923E+03	1.152E+01
2124	4.370E+03	2.388E+06	4.807E+03	1.027E+01	2.865E+03	1.130E+01
2125	4.284E+03	2.340E+06	4.712E+03	1.007E+01	2.808E+03	1.107E+01
2126	4.199E+03	2.294E+06	4.619E+03	9.867E+00	2.753E+03	1.085E+01
2127	4.116E+03	2.248E+06	4.527E+03	9.671E+00	2.698E+03	1.064E+01
2128	4.034E+03	2.204E+06	4.438E+03	9.480E+00	2.645E+03	1.043E+01
2129	3.954E+03	2.160E+06	4.350E+03	9.292E+00	2.592E+03	1.022E+01
2130	3.876E+03	2.118E+06	4.264E+03	9.108E+00	2.541E+03	1.002E+01
2131	3.799E+03	2.076E+06	4.179E+03	8.928E+00	2.491E+03	9.821E+00
2132	3.724E+03	2.034E+06	4.097E+03	8.751E+00	2.441E+03	9.626E+00
2133	3.650E+03	1.994E+06	4.015E+03	8.578E+00	2.393E+03	9.436E+00
2134	3.578E+03	1.955E+06	3.936E+03	8.408E+00	2.346E+03	9.249E+00
2135	3.507E+03	1.916E+06	3.858E+03	8.241E+00	2.299E+03	9.066E+00
2136	3.438E+03	1.878E+06	3.782E+03	8.078E+00	2.254E+03	8.886E+00
2137	3.370E+03	1.841E+06	3.707E+03	7.918E+00	2.209E+03	8.710E+00
2138	3.303E+03	1.804E+06	3.633E+03	7.762E+00	2.165E+03	8.538E+00
2139	3.238E+03	1.769E+06	3.561E+03	7.608E+00	2.122E+03	8.369E+00
2140	3.174E+03	1.734E+06	3.491E+03	7.457E+00	2.080E+03	8.203E+00
2141	3.111E+03	1.699E+06	3.422E+03	7.310E+00	2.039E+03	8.040E+00
2142	3.049E+03	1.666E+06	3.354E+03	7.165E+00	1.999E+03	7.881E+00
2143	2.989E+03	1.633E+06	3.288E+03	7.023E+00	1.959E+03	7.725E+00
2144	2.930E+03	1.600E+06	3.222E+03	6.884E+00	1.920E+03	7.572E+00
2145	2.872E+03	1.569E+06	3.159E+03	6.748E+00	1.882E+03	7.422E+00
2146	2.815E+03	1.538E+06	3.096E+03	6.614E+00	1.845E+03	7.275E+00
2147	2.759E+03	1.507E+06	3.035E+03	6.483E+00	1.809E+03	7.131E+00
2148	2.704E+03	1.477E+06	2.975E+03	6.355E+00	1.773E+03	6.990E+00
2149	2.651E+03	1.448E+06	2.916E+03	6.229E+00	1.738E+03	6.852E+00
2150	2.598E+03	1.419E+06	2.858E+03	6.105E+00	1.703E+03	6.716E+00
2151	2.547E+03	1.391E+06	2.801E+03	5.985E+00	1.670E+03	6.583E+00
2152	2.496E+03	1.364E+06	2.746E+03	5.866E+00	1.637E+03	6.453E+00
2153	2.447E+03	1.337E+06	2.692E+03	5.750E+00	1.604E+03	6.325E+00
2154	2.398E+03	1.310E+06	2.638E+03	5.636E+00	1.572E+03	6.200E+00

APPENDIX C

EPA LANDFILL ENERGY BENEFIT MODEL FILES

Emission Reductions and Environmental and Energy Benefits for Landfill Gas Energy Projects

For electricity generation projects, enter megawatt (MW) capacity: 7.65

\- OR -

For direct-use projects, enter landfill gas utilized by project: [ ] million standard cubic feet per day (mmscfd) or [ ] standard cubic feet per minute (scfm)

Direct Equivalent Emissions Reduced [Reduction of methane emitted directly from the landfill]		Avoided Equivalent Emissions Reduced [Offset of carbon dioxide from avoiding the use of fossil fuels]		Total Equivalent Emissions Reduced [Total = Direct + Avoided]		
$MMTCO_2E/yr$ million metric tons of carbon dioxide equivalents per year	tons CH_4/yr tons of methane per year	$MMTCO_2E/yr$ million metric tons of carbon dioxide equivalents per year	tons CO_2/yr tons of carbon dioxide per year	$MMTCO_2E/yr$ million metric tons of carbon dioxide equivalents per year	tons CH_4/yr tons of methane per year	tons CO_2/yr tons of carbon dioxide per year
0.4701	15,239	0.0170	18,760	0.4871	15,239	18,760

Equivalent to any one of the following annual benefits:		Equivalent to any one of the following annual benefits:		Equivalent to any one of the following annual benefits:	
Environmental Benefits		Environmental Benefits		Environmental Benefits	
• Carbon sequestered annually by __ acres of U.S. forests:	385,289	• Carbon sequestered annually by __ acres of U.S. forests:	13,950	• Carbon sequestered annually by __ acres of U.S. forests:	399,239
• CO2 emissions from burning __ railcars' worth of coal:	2,020	• CO2 emissions from burning __ railcars' worth of coal:	73	• CO2 emissions from burning __ railcars' worth of coal:	2,093
• CO2 emissions from __ gallons of gasoline consumed:	52,696,445	• CO2 emissions from __ gallons of gasoline consumed:	1,907,951	• CO2 emissions from __ gallons of gasoline consumed:	54,604,395

Energy Benefits (based on project size entered)**:**

• Powering __ homes: 4,579

View Calculations and References

For additional environmental benefit options, view the Greenhouse Gas Equivalencies Calculator on the EPA Clean Energy website.

APPENDIX 2

HDR WARM Analysis and Air Emissions Estimates

APPENDIX 2

THERMAL GASIFICATION
WARM ANALYSIS AND AIR EMISSIONS ESTIMATES

1. INTRODUCTION

Project Team member, HDR, conducted this analysis to determine the air emissions of a limited number of pollutants for the thermal gasification component of the White Paper study. The analysis was based on a fixed amount of post-recycled MRF residual waste (1,000 tons per day) being further processed by a co-located integrated MRF with select materials being processed through an anaerobic digestion facility and other select materials being processed through the thermal gasification facility. The following two scenarios were evaluated:

- Thermal gasification of select materials with the anaerobic digestion digestate assumed to go to a composting facility or be land applied (not gasified) – SCENARIO 1
- Thermal gasification of select materials with the anaerobic digestion digestate assumed gasified – SCENARIO 2

2. TARGET AIR POLLUTANTS

In California, local air quality management districts or air pollution control districts are responsible for air quality in their respective judicial areas. The proposed project would be located in Los Angeles County, which is under the jurisdiction of the South Coast Air Quality Management District (SCAQMD). SCAQMD's responsibilities include monitoring of air pollution and promulgating Rules and Regulations to limit and permit the emissions of certain air pollutants.

In addition to GHGs, this air emissions analysis included the following subset of pollutants regulated by SCAQMD: SO_2, NO_x, and dioxin/furans.

3. DESCRIPTION OF EMISSION SOURCES

One major purpose of further processing of the existing MRF residue in the integrated MRF is to produce refuse derived fuel (RDF) consisting of the dry fraction of the incoming waste stream. This RDF is assumed to be thermally gasified and the resulting synthetic gas (syngas) combusted in an energy recovery device (e.g., reciprocating engine, combustion turbine, etc.). For purposes of this analysis, a specific thermal gasification technology or vendor was not specified, nor was a specific energy recovery device specified. Emissions of the pollutants evaluated in this White Paper were estimated generically based on the RDF composition, feed rate to the gasification process, and review of emission factors from Project Team libraries of information.

4. EMISSION QUANTIFICATION METHODOLOGY

There are a number of methodologies and models available to assess air emissions of the thermal gasification portion of the facility. Following is a description of each model and methodology used in this study, which varied based on pollutant.

4.1 GHG Emissions

GHG emissions from thermal gasification were estimated using EPA's Waste Reduction Model (WARM), version 12 (2/12) [Ref. 1], which was the version of the model available during preparation of the White Paper for Peer Review. EPA created WARM to help solid waste planners evaluate the GHG impacts of several waste management practices, including source reduction, recycling, combustion, composting, and landfilling as compared to a baseline scenario consisting of one or more of these practices. WARM was used only to evaluate the thermal gasification portion of the overall facility.

WARM version 12 uses the 1996 IPCC global warming potentials (GWP) to estimate GHG impacts. While the GWP values have been revised in subsequent IPCC reports, the 1996 values are hardwired into WARM and cannot be changed by the user. A further limitation of WARM is that biogenic CO_2 emissions are not included in the calculations. In addition, WARM outputs only the net GHG impact for a given waste management option and does not specify direct emissions and avoided electricity-related emissions. See the WARM documentation [Ref. 2] for a detailed discussion of WARM and its underlying assumptions and methodologies.

To estimate the GHG impacts associated with the avoided electricity-related emissions, the material specific emission factors for the Pacific region utility mix were extracted from the WARM model and calculations were performed via a spreadsheet outside of WARM. Biogenic GHG emission estimates were based on information provided by the vendor of a Japanese gasification technology similar to the idealized facility.

WARM is available in two formats – a Web-based calculator and a downloadable Microsoft Excel spreadsheet. For this analysis, the spreadsheet option was used. The RDF composition information input to WARM was developed by Project Team members as presented in Table 7of the White Paper.

4.2 SO_2, NO_x, and Dioxin/Furan Emissions

SO_2, NO_x, and dioxin/furan emissions are a function of the type of gasification and combustion processes that will be used, as well as the composition of the RDF. In lieu of estimating emissions for a specific type of gasification and combustion process, emissions information from a variety of vendor proposals and actual operating facilities was collected, reviewed, and used as the basis for emissions estimates as shown in the following table.

Stack Test Data/Expected Emissions - USEPA Typical Units

Pollutant	Units	Tokyo, Japan Facility	US Demo Facility	US Demo Facility	US Demo Facility	Chiba, Japan Facility	US Demo Facility	Japanese Reference Facility
NOx	ppm @ 7% O_2	7.8	6	12	11	5.2	92.6	57.7
SO2	ppm @ 7% O_2	1.6	3	12	3	0.26	9.7	1.5
Dioxin/Furan	ng/dscm @ 7% O_2	0.030	NA	2.2	NA	0.0007	NA	0.0050

NOTES:
NA = Not available.
ppm = parts per million, dry volume basis
d = dry
s = standard (20°C - 68°F, 1 atm).
The USEPA currently regulates dioxin furan emissions from MWCs on a total mass basis rather than a TEQ basis. While there is no exact conversion factor between TEQ and total mass, EPA indicates that the 40 CFR Part 60, Subpart Eb limit of 13 ng/dscm total mass value corresponds to 0.1 to 0.3 ng/dscm TEQ. For purposes of this analysis, and average value of 0.2 ng/dscm TEQ corresponding to 13 ng/dscm total mass was used.
Where applicable, the mg/dscm values for NO_x and SO_2 were converted to ppm values using conversion factors from 40 CFR Part 60, Appendix A, Method 19.

The emissions information used were on a volumetric basis (i.e., ppmdv corrected to 7% oxygen and ng/dscm corrected to 7% oxygen). For purposes of this analysis, these concentration values needed to be converted to mass emission values. This conversion was done using the concentration value, the anticipated RDF heat content (But/lb), and Equation 19-1 and the Fd factor for MSW combustion from Table 19-2 of 40 CFR Part 60, Appendix A-7, Method 19 [Ref. 3].

5. WARM ASSUMPTIONS

WARM accepts certain material categories, some of which did not directly correspond to the RDF composition categories. In order to input the data to WARM, the RDF composition categories were assigned to WARM material categories, as summarized in Table 1.

WARM's combustion solid waste management option was determined to most appropriately represent the thermal gasification process considered in this White Paper, based on input of the information in Table 1. Please note that the term "combustion" refers to a solid waste management option, not to the specific thermal transformation of a given material. Although materials such as metals are not combustible, they are in the material stream sent to a combustor and they do impact the WARM's GHG calculations. For more information on this, please see the WARM documentation available at:

http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html.

For combustion, WARM accounts for GHG emissions generated by the waste management practice as well as avoided electricity-related emissions resulting from the electricity generated by the facility. WARM contains two options for estimating the avoided electricity-related emissions - a national average mix of electric generation or a state specific mix. The California mix of electricity generation was chosen for this analysis.

Operation of the facility was assumed full capacity, 365 days per year for 25 years. Because the integrated MRF with conversion technology facility was assumed to be co-located with the existing MRF, a travel distance of zero was input to WARM.

Since WARM's main purpose is to allow the comparison of various waste management options it requires that both a baseline and an alternative scenario be input. The baseline scenario has no bearing for purposes of the analysis presented in this White Paper, but had to be input in order to use WARM. The baseline scenario chosen was landfilling. The GHG emissions information used in this analysis corresponds to the WARM calculated value for Total GHG Emissions from Alternative MSW Generation and Management.

The daily RDF to be gasified was input to WARM for each scenario and the results calculated. The WARM input and calculated results for SCENARIO 1 are shown in Figures 1 and 2, respectively. The WARM input and calculated results for SCENARIO 2 are shown in Figures 3 and 4, respectively.

6. RESULT SUMMARY

The SO_2, NO_x, dioxin/furan, and GHG emission calculations for SCENARIO 1 are presented in Figure 5. Figure 6 presents the SO_2, NO_x, and dioxin/furan emission calculations for SCENARIO 2.

Table 1 - RDF Composition to WARM Material Categories and WARM Input Quantity

RDF Composition	WARM Material Category	Input Quantity (tpd)	
		SCENARIO 1	SCENARIO 2
Aluminum Cans	Aluminum Cans (Deposit)	0.1	0.1
Tin Cans	Steel Cans	1.6	1.6
Other Ferrous Metals			
Other Non-Ferrous Metals	Copper Wire	0.4	0.4
#2 HDPE Bottles	HDPE	3.0	3.0
#1 PET Bottles/Containers (Deposit)	PET	4.4	4.4
#1 PET Bottles/Containers (Non-Deposit)			
Plastic Film/Wrap	LLDPE	78.3	78.3
OCC (Recyclable)/Kraft	Corrugated Containers	40.0	40.0
Newspaper	Newspaper	34.2	34.2
High Grade Office Paper	Office Paper	37.1	37.1
Untreated Wood	Dimensional Lumber	29.9	29.9
Treated Wood			
Green/Yard Waste	Yard Trimmings	17.8	17.8
Stumps	Branches	3.4	3.4
Mixed Recyclable Paper	Mixed Paper (general)	165.7	235.7
Compostable Paper			
Non-Recyclable Paper			
Mixed Metals/Other Materials	Mixed Metals	3.7	3.7
Other Bottles/Containers	Mixed Plastics	67.3	67.3
Other Plastic Products			
Miscellaneous Organics	Mixed Organics	4.9	4.9
Carpet	Carpet	16.7	16.7
Textiles and Leather			
Other C&D	Drywall	9.7	9.7
	TOTAL	519	589

Figure 1 - WARM Input – SCENARIO 1

Version 12

Waste Reduction Model (WARM) -- Inputs

Use this worksheet to describe the baseline and alternative MSW management scenarios that you want to compare. The blue shaded areas indicate where you need to enter information.

1. Describe the baseline generation and management for the MSW materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.

2. Describe the alternative management scenario for the MSW materials generated in the baseline. Any decrease in generation should be entered in the Source Reduction column. Any increase in generation should be entered in the Source Reduction column as a negative value. (Make sure that the total quantity generated equals the total quantity managed.)

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Generated	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans		0.1		NA	0.1				0.1	NA
Aluminum Ingot				NA	0.0					NA
Steel Cans		1.6		NA	1.6				1.6	NA
Copper Wire		0.4		NA	0.4				0.4	NA
Glass				NA	0.0					NA
HDPE		3.0		NA	3.0				3.0	NA
LDPE	NA			NA	0.0		NA			NA
PET		4.4		NA	4.4				4.4	NA
LLDPE	NA	78.3		NA	78.3		NA		78.3	NA
PP	NA			NA	0.0		NA			NA
PS	NA			NA	0.0		NA			NA
PVC	NA			NA	0.0		NA			NA
PLA	NA				0.0		NA			
Corrugated Containers		40.0		NA	40.0				40.0	NA
Magazines/Third-class Mail				NA	0.0					NA
Newspaper		34.2		NA	34.2				34.2	NA
Office Paper		37.1		NA	37.1				37.1	NA
Phonebooks				NA	0.0					NA
Textbooks				NA	0.0					NA
Dimensional Lumber		29.9		NA	29.9				29.9	NA
Medium-density Fiberboard				NA	0.0					NA
Food Scraps	NA				0.0	NA	NA			
Yard Trimmings	NA	17.8			17.8	NA	NA		17.8	
Grass	NA				0.0	NA	NA			
Leaves	NA				0.0	NA	NA			
Branches	NA	3.4			3.4	NA	NA		3.4	
Mixed Paper (general)		165.7		NA	165.7	NA			165.7	NA
Mixed Paper (primarily residential)				NA	0.0	NA				NA
Mixed Paper (primarily from offices)				NA	0.0	NA				NA
Mixed Metals		3.7		NA	3.7	NA			3.7	NA
Mixed Plastics		67.3		NA	67.3	NA			67.3	NA
Mixed Recyclables				NA	0.0	NA				NA
Mixed Organics	NA	4.9			4.9	NA	NA		4.9	
Mixed MSW	NA			NA	0.0	NA	NA			NA
Carpet		16.7		NA	16.7				16.7	NA
Personal Computers				NA	0.0					NA
Clay Bricks	NA		NA	NA	0.0		NA		NA	NA
Concrete [1]			NA	NA	0.0	NA			NA	NA
Fly Ash [2]			NA	NA	0.0	NA			NA	NA
Tires [3]				NA	0.0					NA
Asphalt Concrete			NA	NA	0.0				NA	NA
Asphalt Shingles				NA	0.0					NA
Drywall		9.7	NA	NA	9.7			9.7	NA	NA
Fiberglass Insulation	NA		NA	NA	0.0		NA		NA	NA
Vinyl Flooring	NA			NA	0.0		NA			NA
Wood Flooring	NA			NA	0.0		NA			NA

Please enter data in short tons (1 short ton = 2,000 lbs.)

Please refer to the User's Guide if you need assistance completing this table.

[1] Recycled concrete used as aggregate in the production of new concrete

[2] Recycled fly ash is utilized to displace portland cement in concrete production.

[3] Recycling tires is defined in this analysis as using tires for crumb rubber applications and tire-derived aggregate uses in civil engineering applications

Figure 2 - WARM Output – SCENARIO 1

Waste Reduction Model (WARM) -- Results

Total GHG Emissions from Baseline MSW Generation and Management ($MTCO_2E$):	(159)
Total GHG Emissions from Alternative MSW Generation and Management ($MTCO_2E$):	157
Incremental GHG Emissions ($MTCO_2E$):	316

$MTCO_2E$ = metric tons of carbon dioxide equivalent

Figure 3 - WARM Input – SCNENARIO 2

Version 12

Waste Reduction Model (WARM) -- Inputs

Use this worksheet to describe the baseline and alternative MSW management scenarios that you want to compare. The blue shaded areas indicate where you need to enter information.

1. Describe the baseline generation and management for the MSW materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.

2. Describe the alternative management scenario for the MSW materials generated in the baseline. Any decrease in generation should be entered in the Source Reduction column. Any increase in generation should be entered in the Source Reduction column as a negative value. (Make sure that the total quantity generated equals the total quantity managed.)

Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Generated	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted
Aluminum Cans		0.1		NA	0.1				0.1	NA
Aluminum Ingot				NA	0.0					NA
Steel Cans		1.6		NA	1.6				1.6	NA
Copper Wire		0.4		NA	0.4				0.4	NA
Glass				NA	0.0					NA
HDPE		3.0		NA	3.0				3.0	NA
LDPE	NA			NA	0.0		NA			NA
PET		4.4		NA	4.4				4.4	NA
LLDPE	NA	78.3		NA	78.3		NA		78.3	NA
PP	NA			NA	0.0		NA			NA
PS	NA			NA	0.0		NA			NA
PVC	NA			NA	0.0		NA			NA
PLA	NA				0.0		NA			
Corrugated Containers		40.0		NA	40.0				40.0	NA
Magazines/Third-class Mail				NA	0.0					NA
Newspaper		34.2		NA	34.2				34.2	NA
Office Paper		37.1		NA	37.1				37.1	NA
Phonebooks				NA	0.0					NA
Textbooks				NA	0.0					NA
Dimensional Lumber		29.9		NA	29.9				29.9	NA
Medium-density Fiberboard				NA	0.0					NA
Food Scraps	NA				0.0	NA	NA			
Yard Trimmings	NA	17.8			17.8	NA	NA		17.8	
Grass	NA				0.0	NA	NA			
Leaves	NA				0.0	NA	NA			
Branches	NA	3.4			3.4	NA	NA		3.4	
Mixed Paper (general)		235.7		NA	235.7	NA			235.7	NA
Mixed Paper (primarily residential)				NA	0.0	NA				NA
Mixed Paper (primarily from offices)				NA	0.0	NA				NA
Mixed Metals		3.7		NA	3.7	NA			3.7	NA
Mixed Plastics		67.3		NA	67.3	NA			67.3	NA
Mixed Recyclables				NA	0.0	NA				NA
Mixed Organics	NA	4.9			4.9	NA	NA		4.9	
Mixed MSW	NA			NA	0.0	NA	NA			NA
Carpet		16.7		NA	16.7				16.7	NA
Personal Computers				NA	0.0					NA
Clay Bricks	NA		NA	NA	0.0		NA		NA	NA
Concrete [1]			NA	NA	0.0	NA			NA	NA
Fly Ash [2]			NA	NA	0.0	NA			NA	NA
Tires [3]				NA	0.0					NA
Asphalt Concrete			NA	NA	0.0				NA	NA
Asphalt Shingles				NA	0.0					NA
Drywall		9.7	NA	NA	9.7			9.7	NA	NA
Fiberglass Insulation	NA		NA	NA	0.0		NA		NA	NA
Vinyl Flooring	NA			NA	0.0		NA			NA
Wood Flooring	NA			NA	0.0		NA			NA

Please enter data in short tons (1 short ton = 2,000 lbs.)

Please refer to the User's Guide if you need assistance completing this table.

[1] Recycled concrete used as aggregate in the production of new concrete

[2] Recycled fly ash is utilized to displace portland cement in concrete production.

[3] Recycling tires is defined in this analysis as using tires for crumb rubber applications and tire-derived aggregate uses in civil engineering applications

Figure 4 - WARM Output – SCENARIO 2

Waste Reduction Model (WARM) -- Results

Total GHG Emissions from Baseline MSW Generation and Management ($MTCO_2E$):	(194)
Total GHG Emissions from Alternative MSW Generation and Management ($MTCO_2E$):	133
Incremental GHG Emissions ($MTCO_2E$):	327

$MTCO_2E$ = metric tons of carbon dioxide equivalent

Figure 5 - SO_2, NO_x, Dioxin/Furan, and GHG Emissions – SCENARIO 1

LA County
CT White Paper
Gasification Emission Calculations
Digestate to Land Application

Gasifier RDF Throughput:	519	tpd	Anaergia - "20131218_LA_County_-_BFD_(Scenario_2_-_Cake_to_Composting).pdf"
	4,735,875	tons over 25 year period	Based on 365 days per year operation
RDF Heat Content:	17.80	MJ/kg	JFE - "LQ1092_WB_A23_A000-001_MASS_BALANCE_r2.pdf"
	7659	Btu/lb	Calculated
Total Heat Input:	7950	MMBtu/day	Calculated
RDF F_d:	9570	dscf/MMBtu	40 CFR Part 60, Appendix A-7, Table 19-2, factor for MSW
Exhaust Flow:	114,395,087	dscf per day @ 7% O2	Calculated

Pollutant	Emission Factors		lb/day*	lb/ton RDF	Emissions over 25 years of operation: tons	lbs	metric tons
NOx	57.7	ppm @ 7% O2	788	1.52	3595		3261
SO2	1.5	ppm @ 7% O2	29.0	0.056	132.1		120
Dioxin/Furan	0.005	ng/dscm @ 7% O2	3.58E-08	6.90E-11		3.27E-04	1.48E-07

		metric tons/day	metric ton/ton RDF			metric tons
Net GHG as CO2e	WARM Output	157	0.302			1,431,620
Avoided GHG as CO2e	Calculated using WARM Avoided Pacific Utility Emissions	299	0.576			2,726,834
Nonbiogenic GHG as CO2e	Net GHG Plus Avoided GHG					4,158,454
Biogenic GHG as CO2e	Obtained from JFE Biogenic Calculations					4,019,707
Gross GHG as CO2e	Nonbiogenic Plus Biogenic					8,178,161

NOTES:
F_d = Volume of combustion components per unit of heat content, dry basis.
ppm = parts per million, dry volume basis
d = dry
s = standard (20°C - 68°F, 1 atm).
The GHG emissions estimated by WARM include only anthropogenic emissions of carbon dioxide.

* Calculated using conversion factors obtained from 40 CFR Part 60, Appendix A-7, Table 19-1.

Figure 6 - SO_2, NO_x, Dioxin/Furan, and GHG Emissions – SCENARIO 2

LA County
CT White Paper
Gasification Emission Calculations
Digestate to Gasifier

Gasifier RDF Throughput:	589	tpd	Anaergia - "20131213_LA_County_-_BFD_(Scenario_1_-_Cake_to_RDF).pdf"
	5,374,625	tons over 25 year period	Based on 365 days per year operation
RDF Heat Content:	17.00	MJ/kg	JFE - "LQ1092_WB_A23_A000-001_MASS_BALANCE_r2.pdf"
	7315	Btu/lb	Calculated
Total Heat Input:	8617	MMBtu/day	Calculated
RDF F_d:	9570	dscf/MMBtu	40 CFR Part 60, Appendix A-7, Table 19-2, factor for MSW
Exhaust Flow:	123,989,305	dscf per day @ 7% O2	Calculated

					Emissions over 25 years of operation		
Pollutant	Emission Factors		lb/day*	lb/ton RDF	tons	lbs	metric tons
NOx	57.7	ppm @ 7% O2	854	1.45	3896		3535
SO2	1.5	ppm @ 7% O2	31.4	0.053	143.2		130
Dioxin/Furan	0.005	ng/dscm @ 7% O2	3.88E-08	6.59E-11		3.54E-04	1.61E-07

		metric tons/day	metric ton/ton RDF	metric tons
Net GHG as CO2e	WARM Output	133	0.226	1,215,826
Avoided GHG as CO2e	Calculated using WARM Avoided Pacific Utility Emissions	327	0.555	2,981,608
Nonbiogenic GHG as CO2e	Net GHG Plus Avoided GHG			4,197,434
Biogenic GHG as CO2e	Obtained from JFE Biogenic Calculations			5,165,959
Gross GHG as CO2e	Nonbiogenic Plus Biogenic			9,363,393

NOTES:
F_d = Volume of combustion components per unit of heat content, dry basis.
ppm = parts per million, dry volume basis
d = dry
s = standard (20°C - 68°F, 1 atm).
The GHG emissions estimated by WARM include only anthropogenic emissions of carbon dioxide.

* Calculated using conversion factors obtained from 40 CFR Part 60, Appendix A-7, Table 19-1.

REFERENCES

1. EPA, Waste Reduction Model (WARM), http://epa.gov/epawaste/conserve/tools/warm/index.html.

2. EPA, "Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)", http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html.

3. EPA, 40 CFR Part 60, Appendix A-7, http://www.ecfr.gov/cgi-bin/text-idx?SID=3baea625ada928c1d8e5f5aa76e21633&node=40:8.0.1.1.1&rgn=div5#40:8.0.1.1.1.0.1.1.7.

ABBREVIATION

Btu	British Thermal Unit
C&D	Construction and Demolition
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
dscm	Dry Standard Cubic Meter
dscf	Dry Standard Cubic Feet
EPA	Environmental Protection Agency
EpE	Entreprises Pour l'Environnement
Fd	Fuel Factor (dscf/10^6 Btu)
GHG	Greenhouse Gas
GWP	Global Warming Potential
HDPE	High Density Polyethylene
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogram
lb	Pound
LLDPE	Linear Low Density Polyethylene
MJ	Mega Joules
MMBtu	Million Btu
MRF	Materials Recovery Facility
$MTCO_2E$	Metric Tons of Carbon Dioxide Equivalent
ng	Nanogram
NO_x	Nitrogen Oxides, measured as NO_2
O_2	Oxygen
OCC	Old Corrugated Cardboard
PET	Polyethylene terephthalate
ppm	Parts per Million, volume basis
RDF	Refuse Derived Fuel
s	Standard Conditions (1 atm, 68 °F)
SCAQMD	South Coast Air Quality Management District
SO_2	Sulfur Dioxide
tpd	Tons Per Day
WARM	Waste Reduction Model

APPENDIX 3

MRF Preprocessing and Anaerobic Digestion
Process Flow Diagrams – Digestate to RDF

Appendix 3

Summary of Anaergia MRF Preprocessing and Anaerobic Digestion Process Design Scenarios

To calculate the GHG emissions that would result from a facility that would best meet the technical and policy requirements for the "Integrated MRF with Conversion Technologies", the facility design was based on "modular components" in which the various key operations were aggregated into operational units; 1) MRF Preprocessing, 2) Anaerobic Digestion/Composting, and 3) Thermal Process/Ash Recovery.

Further, the MRF preprocessing operational unit and the anaerobic digestion/composting operational units are aggregated together. This is reflective of the European Union's commercially proven Mechanical Biological Treatment (MBT) approach to processing mixed waste residues which is currently being utilized to achieve maximum diversion from landfill and recovery of recyclables, as well as reducing the greenhouse gas emissions impact of the overall solid waste management system.

The key policy requirements that had to be met for the MRF front end preprocessing are the following:

- Integrated Waste Management Hierarchy
- MRF First
- Highest and Best Use (maximize beneficial use from solid waste)
- Minimization of Waste to Disposal (minimum organics disposal)

The key technical requirements that had to be met are a combination of legal/regulatory requirements, and technical operational best management practices for MRF processing in which the wet and dry feedstocks are optimized for their appropriate post-MRF processing by either anaerobic digestion and/or thermal processing.

The key legal / regulatory requirements that had to be met for the MRF front end preprocessing are the following:

- AB 1826((Chesbro) Solid Waste, Organic Waste)
- AB 1126 ((Gordon) Engineered MSW Conversion)
- SB 498 ((Lara) Biomass Conversion)
- AB 341((Chesbro) Mandatory Commercial Recycling)

- Proposed CalRecycle composting regulations for “contamination levels” for land application of compost and digestate from anaerobic digestion process (e.g., 0.1 percent threshold for materials <4mm for physical contamination, etc.)

The key legal / regulatory and statutory requirements that had to be considered for the MRF front end preprocessing are the following:

1. AB 1826 Requirements:

Public Resources Code Section 42649.81. (a) (1) On and after April 1, 2016, a business that generates eight cubic yards or more of organic waste per week shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(2) On and after January 1, 2017, a business that generates four cubic yards or more of organic waste per week shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(3) On and after January 1, 2019, a business that generates four cubic yards or more of commercial solid waste, as defined in Section 42649.1, per week, shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(4) On or after January 1, 2020, if the department determines that statewide disposal of organic waste has not been reduced to 50 percent of the level of disposal during 2014, a business that generates two cubic yards or more per week of commercial solid waste shall arrange for the organic waste recycling services specified in paragraph (3), unless the department determines that this requirement will not result in significant additional reductions of organics disposal.

2. AB 1126 Requirements:

Public Resources Code Section 40131.2. (a) “Engineered municipal solid waste conversion” or “EMSW conversion” means the conversion of solid waste through a process that meets all of the following requirements:

(1) The waste to be converted is beneficial and effective in that it replaces or supplements the use of fossil fuels.

(2) The waste to be converted, the resulting ash, and any other products of conversion do not meet the criteria or guidelines for the identification of a hazardous waste

adopted by the Department of Toxic Substances Control pursuant to Section 25141 of the Health and Safety Code.

(3) The conversion is efficient and maximizes the net calorific value and burn rate of the waste.

(4) The waste to be converted contains less than 25 percent moisture and less than 25 percent noncombustible waste.

(5) The waste received at the facility for conversion is handled in compliance with the requirements for the handling of solid waste imposed pursuant to this division, and no more than a seven-day supply of that waste, based on the throughput capacity of the operation or facility, is stored at the facility at any one time.

(6) No more than 500 tons per day of waste is converted at the facility where the operation takes place.

(7) The waste has an energy content equal to, or greater than, 5,000 BTU per pound.

(8) The waste to be converted is mechanically processed at a transfer or processing station to reduce the fraction of chlorinated plastics and materials.

(b) "Engineered municipal solid waste conversion facility" or "EMSW facility" means a facility where municipal solid waste conversion that meets the requirements of subdivision (a) takes place.

(c) Notwithstanding Section 40201, a transformation facility where solid waste conversion takes place that meets all of the requirements of subdivision (a) may elect to be considered an EMSW facility for purposes of this division and Division 31 (commencing with Section 50000), except that if a portion of a transformation facility's operations does not meet the requirements of subdivision (a), the facility shall be considered to be a transformation facility.

<u>3. SB 498 Requirements:</u>

Public Resources Code Section 40106. (a) "Biomass conversion" means the production of heat, fuels, or electricity by the controlled combustion of, or the use of other noncombustion thermal conversion technologies on, the following materials, when separated from other solid waste:

(1) Agricultural crop residues.

(2) Bark, lawn, yard, and garden clippings.

(3) Leaves, silvicultural residue, and tree and brush pruning.

(4) Wood, wood chips, and wood waste.

(5) Nonrecyclable pulp or nonrecyclable paper materials.

(b) "Biomass conversion" does not include the controlled combustion of recyclable pulp or recyclable paper materials, or materials that contain sewage sludge, industrial sludge, medical waste, hazardous waste, or either high-level or low-level radioactive waste.

(c) For purposes of this section, "nonrecyclable pulp or nonrecyclable paper materials" means either of the following, as determined by the department:

(1) Paper products or fibrous materials that cannot be technically, feasibly, or legally recycled because of themanner in which the product or material has been manufactured, treated, coated, or constructed.

(2) Paper products or fibrous materials that have become soiled or contaminated and as a result cannot be technically, feasibly, or legally recycled.

Another key regulatory consideration is the contamination standards for compost and digestate, which at the time of the preparation of this White Paper, was only in the proposed format and was undergoing the public comment period. As the process was being designed, the standard that was the design objective/goal for the contamination threshold was <0.1% of physical contaminants <4mm in size recognizing that this may change (note that the contamination determination on a wet basis or dry basis had not been clarified.)

The technical operational best management practices criteria required the following:

- Ability to process post recycled MRF residuals based on the average composition (by material type by weight percent) of post MRF residuals from the CalRecycle Statewide Post Recycled MRF Residual Waste Composition Study completed in 2006, and can be found at the following link: http://www.calrecycle.ca.gov/WasteChar/WasteStudies.htm#2006MRF
- Ability to process post recycled MRF residuals to recover additional recyclables which are not recovered by the source separation programs or the mixed waste MRF process (prior to receiving the post recycled MRF residuals) to ensure compliance with AB 341 (e.g., equivalency performance recovery of recyclables as compared to a source separated program)
- Ability to meet the technical requirements for materials composition, moisture content, ash content, "preprocessing requirement" (e.g., removal of chlorinated plastic, heating value, etc.) described in the key legal/regulatory requirements above

- Ability to separate the post recycled MRF residuals into a wet fraction and a dry fraction, each of which must be optimized for their respective end processing (e.g., European Union MBT approach to processing mixed waste residues)
- Ability to create separate or blended refuse derived fuel which would meet either the AB 1126 requirement or the SB 498 requirements
- Technology had to be based on a commercially proven scale (e.g., existing continuous full scale operations)
- The anaerobic digestion and composting feedstocks have to be optimized and resulting materials for land application must meet the proposed CalRecycle land application contamination thresholds.
- Technology and approach (including unit process equipment must be currently manufactured on a commercial scale).
- The “preprocessing front end” (MBT process) must also have the ability to process both source separated organics and/or have the ability to process the organics from the mixed waste stream.
- The front end processing and the overall systems process design must also be flexible enough to deal with changing market conditions for recyclables.

Project team members (Eugene Tseng & Associates) worked cooperatively with Anaergia mechanical process design engineers to develop a process design that would accomplish all of the above requirements. The process flow for the mass balance was specifically analyzed based on the average composition (by material type by weight percent) of post MRF residuals from the CalRecycle Statewide Post Recycled MRF Residual Waste Composition Study completed in 2006.

Two “processing scenarios” were considered, 1) wet fraction from preprocessing to anaerobic digestion with digestate going to composting, and 2) wet fraction from preprocessing to anaerobic digestion with digestate going to the thermal processing module. Since the “MRF First” policy and the integrated waste management hierarchy places “composting” in a classification that is more preferable to thermal processing, the processing scenario in which the wet fraction from preprocessing to anaerobic digestion with digestate going to composting was chosen as the primary alternative scenario for the White Paper analysis.

The process flow diagram shows the unit processing equipment sequential progressive fractionation operations for a single line. The initial set of unit processes are designed to enable the inspection and removal of non-acceptable materials and non-processible materials. Non-acceptable materials are materials that are generally prohibited by disposal at a MRF, e.g., partially full propane tanks, red bag (regulated medical waste, etc.) and non-processible materials refer to materials that can be legally acceptable, but may potentially be detrimental

to the unit process equipment further down on the process train. Examples of non-processible materials include items such as garden hoses and Christmas lights (which tend to wrap themselves around rotating equipment) and other materials that may be too bulky, e.g., large carpet rolls, etc.

The primary purpose of removing the non-acceptable and non-processible materials is to enhance the ability of the MRF equipment to concentrate the recyclables into a fraction that allows for efficient removal of the recyclables (maximizing recovery of materials and reducing the throughput requirements of the back end). After removal of the recyclables (e.g., magnet for recovery of ferrous materials), the processing train is designed to separate and concentrate the wet fraction (mostly decomposable organics, e.g., food, etc.) through size screening to concentrate the decomposable wet organics in the undersize in preparation for the anaerobic digestion process. The wet fraction is prepared into an anaerobic digestion slurry via a hydraulic press (OREX). The organics press has a sizing sieve that also serves to remove contaminates to produce a feedtstock, and the resulting digestate, which after cleanup will result in a digestate (or compost) with minimal contamination that will meet the proposed CalRecycle land application standards. The Anaergia anaerobic digestion technology which is modeled is referred to as a “high solids digestion” technology which is designed to work on a feedstock produced from the wet fraction of the mixed wastestream.

The dry fraction, which consists of non-recyclable materials and the non-digestable materials and non-compostable materials (e.g., plastic, composite paper materials, etc.) are designated to be further processed into a feedstock for the thermal processing, energy recovery, and ash recovery/recycling operations. Air density separators (e.g., Windsifter) separate the light materials (plastic and paper, the high fuel value portions) from the heavy materials (mostly inorganic materials, the residual materials designated to landfill). The lights materials are separate into paper and plastic via an optical sorter, and the plastic is further separated to remove chlorinated plastics via an optical sorter. This process design enables the production of both an AB 1126 engineered municipal solid waste conversion technology feedstock and also a separate SB 498 Biomass conversion feedstock (non-recyclable paper and or paper pulp). Anaergia’s high solids digesters can process three times more organic material and generate three times more biogas than conventional low solids anaerobic digesters, like those found at municipal wastewater treatment plants. Anaergia builds new digesters uniquely designed for high solid digestion, and offers a retrofit called Omnivore™ that converts conventional low high solids digesters into high solids digesters by concentrating solids with recuperative thickening – a process that discharges water from digesters while retaining solids.

During anaerobic digestion, microorganisms consume organic feedstocks to generate biogas methane. These microorganisms grow slowly typically requiring at least 25 days to consume

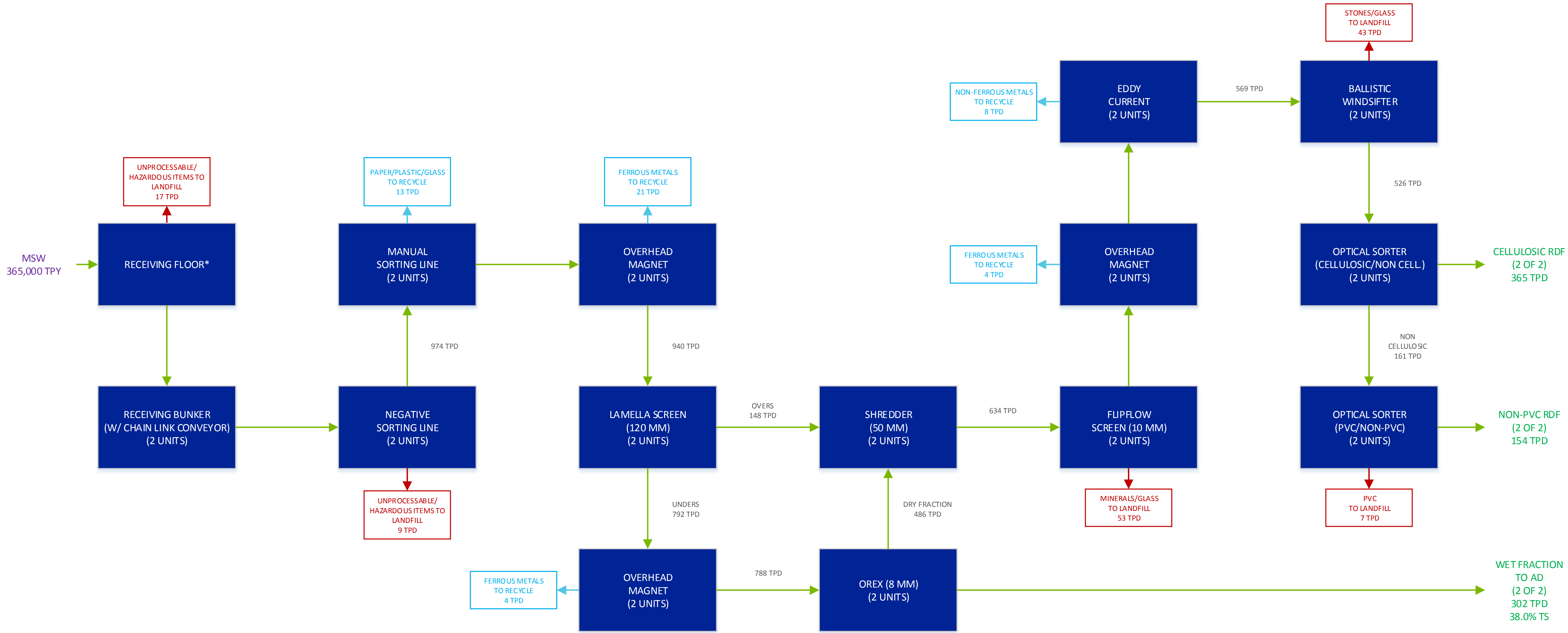
organic material. For organic feedstocks to convert to biogas, digesters must be large enough to retain the feedstock for an average of roughly 25 days. Yet most feedstock are combinations of organic solids and soluble organics with water. Consequently, digesters are often times unnecessarily large in order to retain both the solids and water; however, only organic solids and dissolved organics contribute to biogas production.

The Omnivore™ retrofit system uses recuperative thickening and submersible high solids mixers to enable high solids digestion in conventional low digesters. The system increases the solids retention time (SRT) and consequently the solids content in digesters. This is achieved by recovering and reintroducing digester solids while discharging liquid in a digestate recirculation loop, effectively decoupling solids residence time (SRT) from hydraulic residence time (HRT). Separate control of SRT and HRT improves digester performance and allows operation at higher organic loading rates. Biogas generation and volatile solids destruction increases with longer SRT while digester organic loading increases with shorter HRT. Recuperative thickening extends the SRT by increasing the solids content in the digester. This also increases digestate viscosity to levels that are not suitable for conventional gas, jet, or mechanical mixers. The Omnivore™ system utilizes Anaergia high-torque submersible mixers specifically designed to efficiency mix high solids and high viscous fluids and service boxes mounted to the digester cover than enable servicing and adjustment while the digester is operating. Conventional municipal anaerobic digesters can be retrofitted using the Omnivore™ system to increase biogas generation and organic loading by 2 to 4 times.

The parasitic energy loading and the output biogas composition (and net energy output) of the anaerobic digestion process was developed by Anaergia engineers based on their process design experience on over 1600 anaerobic digestion projects. Project team members reviewed Anaergia's confidential process engineering mass and energy balance to check that the calculations and assumptions met the criteria established for the White Paper alternative scenario.

Anaergia

LA County – Scenario 1: Cake to RDF
Block 1 of 2: MSW Pre-Treatment
December 13, 2013
Designed By: J. Josse
Drawn By: A. Kasza

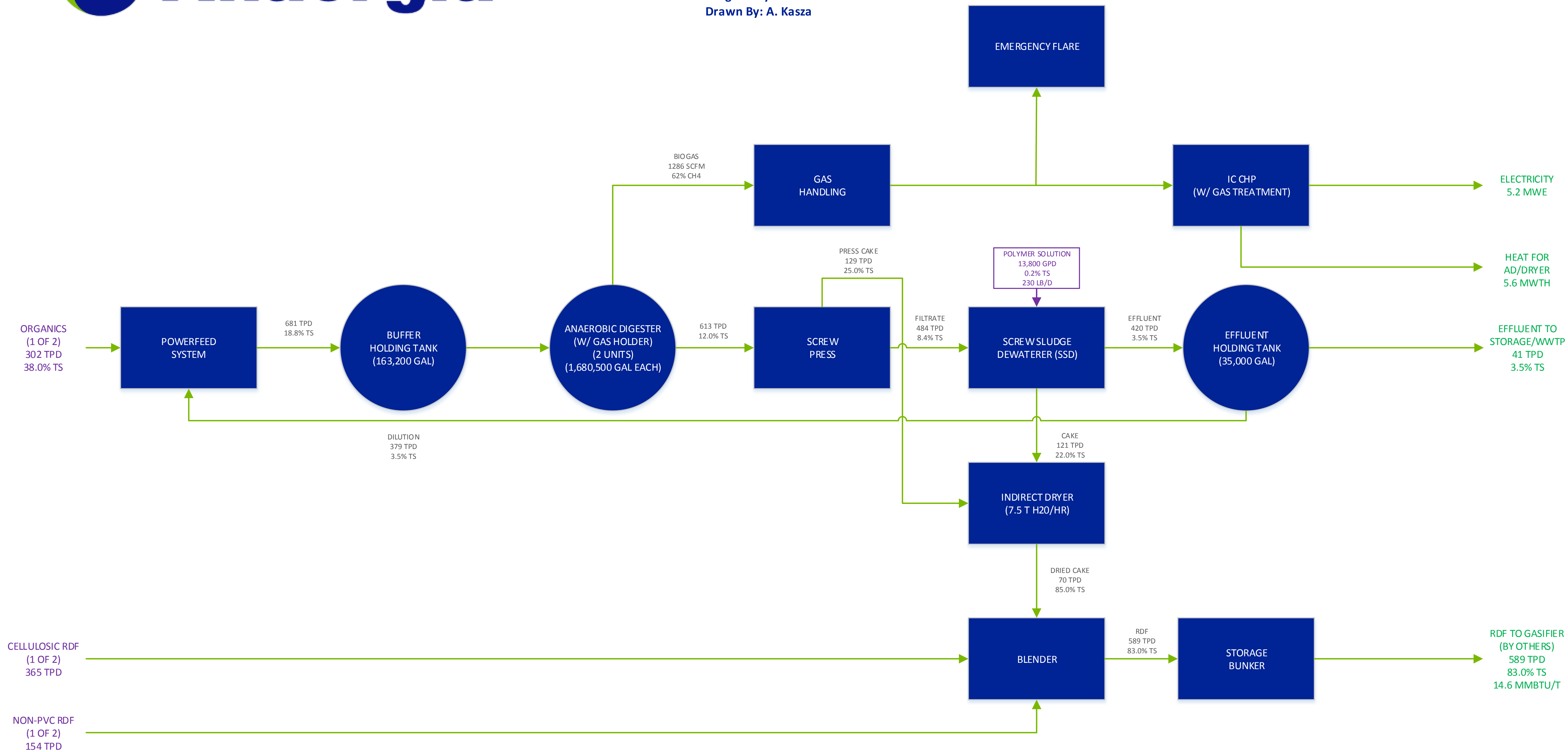


*COMMON RECEIVING FLOOR WHICH FEEDS 2 SEPARATE PRE-PROCESSING TRAINS.
**NOTE: ALL FLOWS SHOWN ARE BASED ON 365 DAYS PER YEAR.

ACTUAL OPERATING HOURS ARE AS FOLLOWS,

1. MSW RECEIVING, PROCESSING AND RDF PRODUCTION WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (16 HOURS PER DAY).
2. THE ANAEROBIC DIGESTION SYSTEM (INCLUDING CHP AND DRYER) WILL OPERATE ON A BASIS OF 7 DAYS PER WEEK (24 HOURS PER DAY).
3. DIGESTATE DEWATERING WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (8 HOURS PER DAY)

LA County – Scenario 1: Cake to RDF
Block 2 of 2: Overall Process
December 13, 2013
Designed By: J. Josse
Drawn By: A. Kasza



*NOTE: ALL FLOWS SHOWN ARE BASED ON 365 DAYS PER YEAR.

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1. MSW RECEIVING, PROCESSING AND RDF PRODUCTION WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (16 HOURS PER DAY).
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APPENDIX 3

MRF Preprocessing and Anaerobic Digestion
Process Flow Diagrams – Digestate to RDF

Appendix 3

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- AB 1126 ((Gordon) Engineered MSW Conversion)
- SB 498 ((Lara) Biomass Conversion)
- AB 341((Chesbro) Mandatory Commercial Recycling)

- Proposed CalRecycle composting regulations for "contamination levels" for land application of compost and digestate from anaerobic digestion process (e.g., 0.1 percent threshold for materials <4mm for physical contamination, etc.)

The key legal / regulatory and statutory requirements that had to be considered for the MRF front end preprocessing are the following:

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Public Resources Code Section 42649.81. (a) (1) On and after April 1, 2016, a business that generates eight cubic yards or more of organic waste per week shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(2) On and after January 1, 2017, a business that generates four cubic yards or more of organic waste per week shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(3) On and after January 1, 2019, a business that generates four cubic yards or more of commercial solid waste, as defined in Section 42649.1, per week, shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(4) On or after January 1, 2020, if the department determines that statewide disposal of organic waste has not been reduced to 50 percent of the level of disposal during 2014, a business that generates two cubic yards or more per week of commercial solid waste shall arrange for the organic waste recycling services specified in paragraph (3), unless the department determines that this requirement will not result in significant additional reductions of organics disposal.

2. AB 1126 Requirements:

Public Resources Code Section 40131.2. (a) "Engineered municipal solid waste conversion" or "EMSW conversion" means the conversion of solid waste through a process that meets all of the following requirements:

(1) The waste to be converted is beneficial and effective in that it replaces or supplements the use of fossil fuels.

(2) The waste to be converted, the resulting ash, and any other products of conversion do not meet the criteria or guidelines for the identification of a hazardous waste

adopted by the Department of Toxic Substances Control pursuant to Section 25141 of the Health and Safety Code.

(3) The conversion is efficient and maximizes the net calorific value and burn rate of the waste.

(4) The waste to be converted contains less than 25 percent moisture and less than 25 percent noncombustible waste.

(5) The waste received at the facility for conversion is handled in compliance with the requirements for the handling of solid waste imposed pursuant to this division, and no more than a seven-day supply of that waste, based on the throughput capacity of the operation or facility, is stored at the facility at any one time.

(6) No more than 500 tons per day of waste is converted at the facility where the operation takes place.

(7) The waste has an energy content equal to, or greater than, 5,000 BTU per pound.

(8) The waste to be converted is mechanically processed at a transfer or processing station to reduce the fraction of chlorinated plastics and materials.

(b) "Engineered municipal solid waste conversion facility" or "EMSW facility" means a facility where municipal solid waste conversion that meets the requirements of subdivision (a) takes place.

(c) Notwithstanding Section 40201, a transformation facility where solid waste conversion takes place that meets all of the requirements of subdivision (a) may elect to be considered an EMSW facility for purposes of this division and Division 31 (commencing with Section 50000), except that if a portion of a transformation facility's operations does not meet the requirements of subdivision (a), the facility shall be considered to be a transformation facility.

<u>3. SB 498 Requirements:</u>

Public Resources Code Section 40106. (a) "Biomass conversion" means the production of heat, fuels, or electricity by the controlled combustion of, or the use of other noncombustion thermal conversion technologies on, the following materials, when separated from other solid waste:

(1) Agricultural crop residues.

(2) Bark, lawn, yard, and garden clippings.

(3) Leaves, silvicultural residue, and tree and brush pruning.

(4) Wood, wood chips, and wood waste.

(5) Nonrecyclable pulp or nonrecyclable paper materials.

(b) "Biomass conversion" does not include the controlled combustion of recyclable pulp or recyclable paper materials, or materials that contain sewage sludge, industrial sludge, medical waste, hazardous waste, or either high-level or low-level radioactive waste.

(c) For purposes of this section, "nonrecyclable pulp or nonrecyclable paper materials" means either of the following, as determined by the department:

(1) Paper products or fibrous materials that cannot be technically, feasibly, or legally recycled because of themanner in which the product or material has been manufactured, treated, coated, or constructed.

(2) Paper products or fibrous materials that have become soiled or contaminated and as a result cannot be technically, feasibly, or legally recycled.

Another key regulatory consideration is the contamination standards for compost and digestate, which at the time of the preparation of this White Paper, was only in the proposed format and was undergoing the public comment period. As the process was being designed, the standard that was the design objective/goal for the contamination threshold was <0.1% of physical contaminants <4mm in size recognizing that this may change (note that the contamination determination on a wet basis or dry basis had not been clarified.)

The technical operational best management practices criteria required the following:

- Ability to process post recycled MRF residuals based on the average composition (by material type by weight percent) of post MRF residuals from the CalRecycle Statewide Post Recycled MRF Residual Waste Composition Study completed in 2006, and can be found at the following link: http://www.calrecycle.ca.gov/WasteChar/WasteStudies.htm#2006MRF
- Ability to process post recycled MRF residuals to recover additional recyclables which are not recovered by the source separation programs or the mixed waste MRF process (prior to receiving the post recycled MRF residuals) to ensure compliance with AB 341 (e.g., equivalency performance recovery of recyclables as compared to a source separated program)
- Ability to meet the technical requirements for materials composition, moisture content, ash content, "preprocessing requirement" (e.g., removal of chlorinated plastic, heating value, etc.) described in the key legal/regulatory requirements above

- Ability to separate the post recycled MRF residuals into a wet fraction and a dry fraction, each of which must be optimized for their respective end processing (e.g., European Union MBT approach to processing mixed waste residues)
- Ability to create separate or blended refuse derived fuel which would meet either the AB 1126 requirement or the SB 498 requirements
- Technology had to be based on a commercially proven scale (e.g., existing continuous full scale operations)
- The anaerobic digestion and composting feedstocks have to be optimized and resulting materials for land application must meet the proposed CalRecycle land application contamination thresholds.
- Technology and approach (including unit process equipment must be currently manufactured on a commercial scale).
- The “preprocessing front end” (MBT process) must also have the ability to process both source separated organics and/or have the ability to process the organics from the mixed waste stream.
- The front end processing and the overall systems process design must also be flexible enough to deal with changing market conditions for recyclables.

Project team members (Eugene Tseng & Associates) worked cooperatively with Anaergia mechanical process design engineers to develop a process design that would accomplish all of the above requirements. The process flow for the mass balance was specifically analyzed based on the average composition (by material type by weight percent) of post MRF residuals from the CalRecycle Statewide Post Recycled MRF Residual Waste Composition Study completed in 2006.

Two “processing scenarios” were considered, 1) wet fraction from preprocessing to anaerobic digestion with digestate going to composting, and 2) wet fraction from preprocessing to anaerobic digestion with digestate going to the thermal processing module. Since the “MRF First” policy and the integrated waste management hierarchy places “composting” in a classification that is more preferable to thermal processing, the processing scenario in which the wet fraction from preprocessing to anaerobic digestion with digestate going to composting was chosen as the primary alternative scenario for the White Paper analysis.

The process flow diagram shows the unit processing equipment sequential progressive fractionation operations for a single line. The initial set of unit processes are designed to enable the inspection and removal of non-acceptable materials and non-processible materials. Non-acceptable materials are materials that are generally prohibited by disposal at a MRF, e.g., partially full propane tanks, red bag (regulated medical waste, etc.) and non-processible materials refer to materials that can be legally acceptable, but may potentially be detrimental

to the unit process equipment further down on the process train. Examples of non-processible materials include items such as garden hoses and Christmas lights (which tend to wrap themselves around rotating equipment) and other materials that may be too bulky, e.g., large carpet rolls, etc.

The primary purpose of removing the non-acceptable and non-processible materials is to enhance the ability of the MRF equipment to concentrate the recyclables into a fraction that allows for efficient removal of the recyclables (maximizing recovery of materials and reducing the throughput requirements of the back end). After removal of the recyclables (e.g., magnet for recovery of ferrous materials), the processing train is designed to separate and concentrate the wet fraction (mostly decomposable organics, e.g., food, etc.) through size screening to concentrate the decomposable wet organics in the undersize in preparation for the anaerobic digestion process. The wet fraction is prepared into an anaerobic digestion slurry via a hydraulic press (OREX). The organics press has a sizing sieve that also serves to remove contaminates to produce a feedtstock, and the resulting digestate, which after cleanup will result in a digestate (or compost) with minimal contamination that will meet the proposed CalRecycle land application standards. The Anaergia anaerobic digestion technology which is modeled is referred to as a “high solids digestion” technology which is designed to work on a feedstock produced from the wet fraction of the mixed wastestream.

The dry fraction, which consists of non-recyclable materials and the non-digestable materials and non-compostable materials (e.g., plastic, composite paper materials, etc.) are designated to be further processed into a feedstock for the thermal processing, energy recovery, and ash recovery/recycling operations. Air density separators (e.g., Windsifter) separate the light materials (plastic and paper, the high fuel value portions) from the heavy materials (mostly inorganic materials, the residual materials designated to landfill). The lights materials are separate into paper and plastic via an optical sorter, and the plastic is further separated to remove chlorinated plastics via an optical sorter. This process design enables the production of both an AB 1126 engineered municipal solid waste conversion technology feedstock and also a separate SB 498 Biomass conversion feedstock (non-recyclable paper and or paper pulp). Anaergia’s high solids digesters can process three times more organic material and generate three times more biogas than conventional low solids anaerobic digesters, like those found at municipal wastewater treatment plants. Anaergia builds new digesters uniquely designed for high solid digestion, and offers a retrofit called Omnivore™ that converts conventional low high solids digesters into high solids digesters by concentrating solids with recuperative thickening – a process that discharges water from digesters while retaining solids.

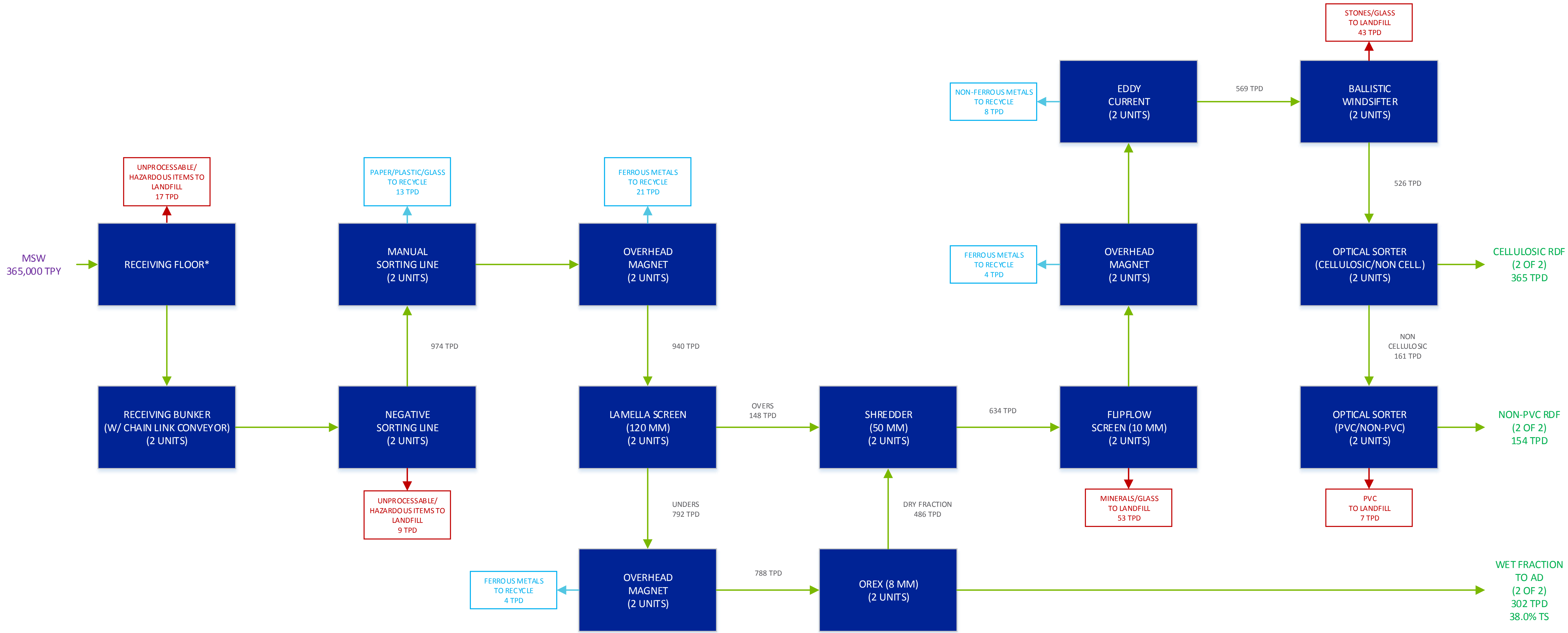
During anaerobic digestion, microorganisms consume organic feedstocks to generate biogas methane. These microorganisms grow slowly typically requiring at least 25 days to consume

organic material. For organic feedstocks to convert to biogas, digesters must be large enough to retain the feedstock for an average of roughly 25 days. Yet most feedstock are combinations of organic solids and soluble organics with water. Consequently, digesters are often times unnecessarily large in order to retain both the solids and water; however, only organic solids and dissolved organics contribute to biogas production.

The Omnivore™ retrofit system uses recuperative thickening and submersible high solids mixers to enable high solids digestion in conventional low digesters. The system increases the solids retention time (SRT) and consequently the solids content in digesters. This is achieved by recovering and reintroducing digester solids while discharging liquid in a digestate recirculation loop, effectively decoupling solids residence time (SRT) from hydraulic residence time (HRT). Separate control of SRT and HRT improves digester performance and allows operation at higher organic loading rates. Biogas generation and volatile solids destruction increases with longer SRT while digester organic loading increases with shorter HRT. Recuperative thickening extends the SRT by increasing the solids content in the digester. This also increases digestate viscosity to levels that are not suitable for conventional gas, jet, or mechanical mixers. The Omnivore™ system utilizes Anaergia high-torque submersible mixers specifically designed to efficiency mix high solids and high viscous fluids and service boxes mounted to the digester cover than enable servicing and adjustment while the digester is operating. Conventional municipal anaerobic digesters can be retrofitted using the Omnivore™ system to increase biogas generation and organic loading by 2 to 4 times.

The parasitic energy loading and the output biogas composition (and net energy output) of the anaerobic digestion process was developed by Anaergia engineers based on their process design experience on over 1600 anaerobic digestion projects. Project team members reviewed Anaergia's confidential process engineering mass and energy balance to check that the calculations and assumptions met the criteria established for the White Paper alternative scenario.

LA County – Scenario 1: Cake to RDF
Block 1 of 2: MSW Pre-Treatment
December 13, 2013
Designed By: J. Josse
Drawn By: A. Kasza

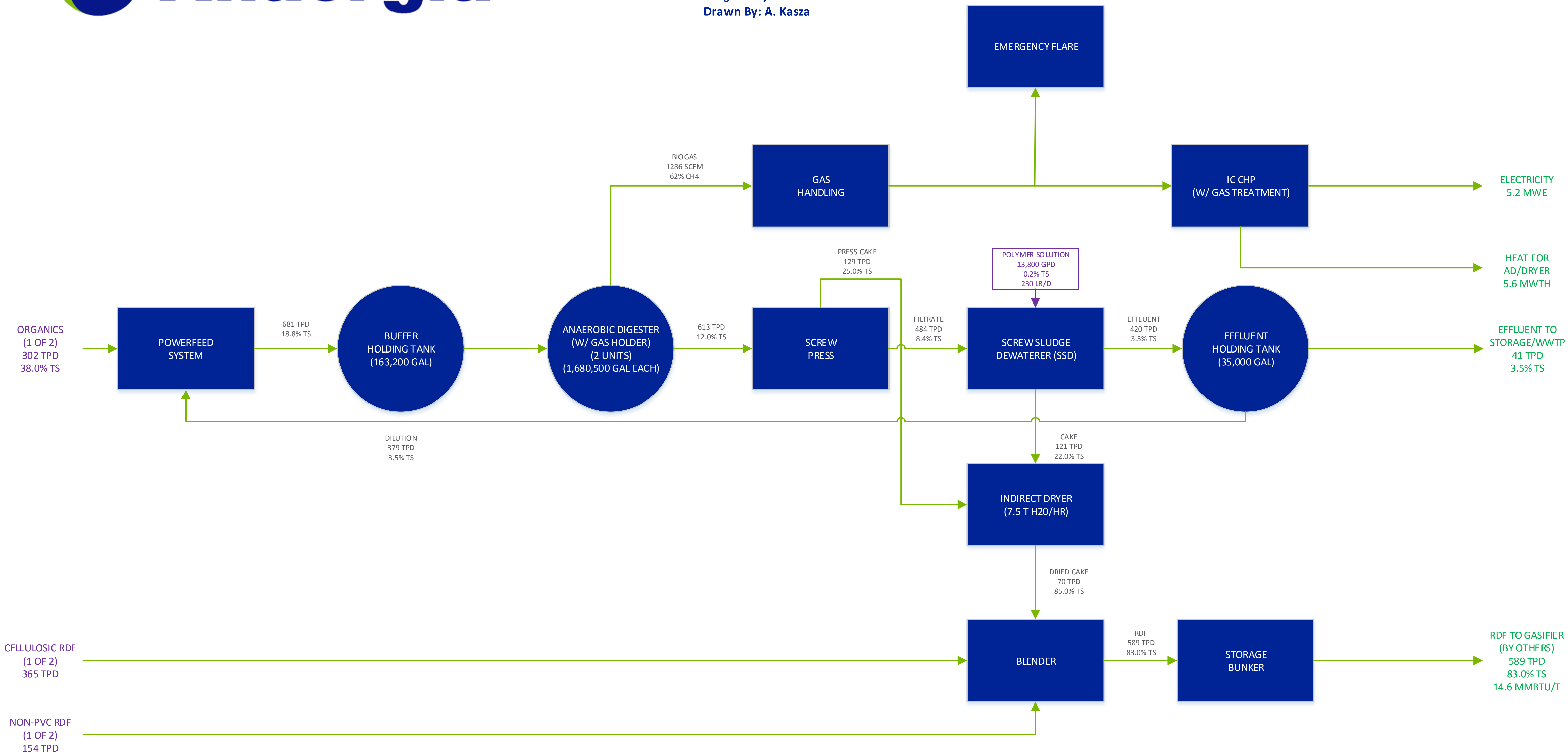


*COMMON RECEIVING FLOOR WHICH FEEDS 2 SEPARATE PRE-PROCESSING TRAINS.
**NOTE: ALL FLOWS SHOWN ARE BASED ON 365 DAYS PER WEEK.

ACTUAL OPERATING HOURS ARE AS FOLLOWS,

1. MSW RECEIVING, PROCESSING AND RDF PRODUCTION WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (16 HOURS PER DAY).
2. THE ANAEROBIC DIGESTION SYSTEM (INCLUDING CHP AND DRYER) WILL OPERATE ON A BASIS OF 7 DAYS PER WEEK (24 HOURS PER DAY).
3. DIGESTATE DEWATERING WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (8 HOURS PER DAY)

LA County – Scenario 1: Cake to RDF
Block 2 of 2: Overall Process
December 13, 2013
Designed By: J. Josse
Drawn By: A. Kasza



*NOTE: ALL FLOWS SHOWN ARE BASED ON 365 DAYS PER YEAR.

ACTUAL OPERATING HOURS ARE AS FOLLOWS,

1. MSW RECEIVING, PROCESSING AND RDF PRODUCTION WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (16 HOURS PER DAY).
2. THE ANAEROBIC DIGESTION SYSTEM (INCLUDING CHP AND DRYER) WILL OPERATE ON A BASIS OF 7 DAYS PER WEEK (24 HOURS PER DAY).
3. DIGESTATE DEWATERING WILL OPERATE ON A BASIS OF 6 DAYS PER WEEK (8 HOURS PER DAY)

APPENDIX 4

MRF Preprocessing and Anaerobic Digestion
Process Flow Diagrams – Digestate to Composting

Appendix 4

Summary of Anaergia MRF Preprocessing and Anaerobic Digestion Process Design Scenarios

To calculate the GHG emissions that would result from a facility that would best meet the technical and policy requirements for the "Integrated MRF with Conversion Technologies", the facility design was based on "modular components" in which the various key operations were aggregated into operational units; 1) MRF Preprocessing, 2) Anaerobic Digestion/Composting, and 3) Thermal Process/Ash Recovery.

Further, the MRF preprocessing operational unit and the anaerobic digestion/composting operational units are aggregated together. This is reflective of the European Union's commercially proven Mechanical Biological Treatment (MBT) approach to processing mixed waste residues which is currently being utilized to achieve maximum diversion from landfill and recovery of recyclables, as well as reducing the greenhouse gas emissions impact of the overall solid waste management system.

The key policy requirements that had to be met for the MRF front end preprocessing are the following:

- Integrated Waste Management Hierarchy
- MRF First
- Highest and Best Use (maximize beneficial use from solid waste)
- Minimization of Waste to Disposal (minimum organics disposal)

The key technical requirements that had to be met are a combination of legal/regulatory requirements, and technical operational best management practices for MRF processing in which the wet and dry feedstocks are optimized for their appropriate post-MRF processing by either anaerobic digestion and/or thermal processing.

The key legal / regulatory requirements that had to be met for the MRF front end preprocessing are the following:

- AB 1826((Chesbro) Solid Waste, Organic Waste)
- AB 1126 ((Gordon) Engineered MSW Conversion)
- SB 498 ((Lara) Biomass Conversion)
- AB 341((Chesbro) Mandatory Commercial Recycling)

- Proposed CalRecycle composting regulations for "contamination levels" for land application of compost and digestate from anaerobic digestion process (e.g., 0.1 percent threshold for materials <4mm for physical contamination, etc.)

The key legal / regulatory and statutory requirements that had to be considered for the MRF front end preprocessing are the following:

<u>1. AB 1826 Requirements:</u>

Public Resources Code Section 42649.81. (a) (1) On and after April 1, 2016, a business that generates eight cubic yards or more of organic waste per week shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(2) On and after January 1, 2017, a business that generates four cubic yards or more of organic waste per week shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(3) On and after January 1, 2019, a business that generates four cubic yards or more of commercial solid waste, as defined in Section 42649.1, per week, shall arrange for recycling services specifically for organic waste in the manner specified in subdivision (b).

(4) On or after January 1, 2020, if the department determines that statewide disposal of organic waste has not been reduced to 50 percent of the level of disposal during 2014, a business that generates two cubic yards or more per week of commercial solid waste shall arrange for the organic waste recycling services specified in paragraph (3), unless the department determines that this requirement will not result in significant additional reductions of organics disposal.

<u>2. AB 1126 Requirements:</u>

Public Resources Code Section 40131.2. (a) "Engineered municipal solid waste conversion" or "EMSW conversion" means the conversion of solid waste through a process that meets all of the following requirements:

(1) The waste to be converted is beneficial and effective in that it replaces or supplements the use of fossil fuels.

(2) The waste to be converted, the resulting ash, and any other products of conversion do not meet the criteria or guidelines for the identification of a hazardous waste

adopted by the Department of Toxic Substances Control pursuant to Section 25141 of the Health and Safety Code.

(3) The conversion is efficient and maximizes the net calorific value and burn rate of the waste.

(4) The waste to be converted contains less than 25 percent moisture and less than 25 percent noncombustible waste.

(5) The waste received at the facility for conversion is handled in compliance with the requirements for the handling of solid waste imposed pursuant to this division, and no more than a seven-day supply of that waste, based on the throughput capacity of the operation or facility, is stored at the facility at any one time.

(6) No more than 500 tons per day of waste is converted at the facility where the operation takes place.

(7) The waste has an energy content equal to, or greater than, 5,000 BTU per pound.

(8) The waste to be converted is mechanically processed at a transfer or processing station to reduce the fraction of chlorinated plastics and materials.

(b) "Engineered municipal solid waste conversion facility" or "EMSW facility" means a facility where municipal solid waste conversion that meets the requirements of subdivision (a) takes place.

(c) Notwithstanding Section 40201, a transformation facility where solid waste conversion takes place that meets all of the requirements of subdivision (a) may elect to be considered an EMSW facility for purposes of this division and Division 31 (commencing with Section 50000), except that if a portion of a transformation facility's operations does not meet the requirements of subdivision (a), the facility shall be considered to be a transformation facility.

3. SB 498 Requirements:

Public Resources Code Section 40106. (a) "Biomass conversion" means the production of heat, fuels, or electricity by the controlled combustion of, or the use of other noncombustion thermal conversion technologies on, the following materials, when separated from other solid waste:

(1) Agricultural crop residues.

(2) Bark, lawn, yard, and garden clippings.

(3) Leaves, silvicultural residue, and tree and brush pruning.

(4) Wood, wood chips, and wood waste.

(5) Nonrecyclable pulp or nonrecyclable paper materials.

(b) "Biomass conversion" does not include the controlled combustion of recyclable pulp or recyclable paper materials, or materials that contain sewage sludge, industrial sludge, medical waste, hazardous waste, or either high-level or low-level radioactive waste.

(c) For purposes of this section, "nonrecyclable pulp or nonrecyclable paper materials" means either of the following, as determined by the department:

(1) Paper products or fibrous materials that cannot be technically, feasibly, or legally recycled because of themanner in which the product or material has been manufactured, treated, coated, or constructed.

(2) Paper products or fibrous materials that have become soiled or contaminated and as a result cannot be technically, feasibly, or legally recycled.

Another key regulatory consideration is the contamination standards for compost and digestate, which at the time of the preparation of this White Paper, was only in the proposed format and was undergoing the public comment period. As the process was being designed, the standard that was the design objective/goal for the contamination threshold was <0.1% of physical contaminants <4mm in size recognizing that this may change (note that the contamination determination on a wet basis or dry basis had not been clarified.)

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- Ability to process post recycled MRF residuals to recover additional recyclables which are not recovered by the source separation programs or the mixed waste MRF process (prior to receiving the post recycled MRF residuals) to ensure compliance with AB 341 (e.g., equivalency performance recovery of recyclables as compared to a source separated program)
- Ability to meet the technical requirements for materials composition, moisture content, ash content, "preprocessing requirement" (e.g., removal of chlorinated plastic, heating value, etc.) described in the key legal/regulatory requirements above

- Ability to separate the post recycled MRF residuals into a wet fraction and a dry fraction, each of which must be optimized for their respective end processing (e.g., European Union MBT approach to processing mixed waste residues)
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Two “processing scenarios” were considered, 1) wet fraction from preprocessing to anaerobic digestion with digestate going to composting, and 2) wet fraction from preprocessing to anaerobic digestion with digestate going to the thermal processing module. Since the “MRF First” policy and the integrated waste management hierarchy places “composting” in a classification that is more preferable to thermal processing, the processing scenario in which the wet fraction from preprocessing to anaerobic digestion with digestate going to composting was chosen as the primary alternative scenario for the White Paper analysis.

The process flow diagram shows the unit processing equipment sequential progressive fractionation operations for a single line. The initial set of unit processes are designed to enable the inspection and removal of non-acceptable materials and non-processible materials. Non-acceptable materials are materials that are generally prohibited by disposal at a MRF, e.g., partially full propane tanks, red bag (regulated medical waste, etc.) and non-processible materials refer to materials that can be legally acceptable, but may potentially be detrimental

to the unit process equipment further down on the process train. Examples of non-processible materials include items such as garden hoses and Christmas lights (which tend to wrap themselves around rotating equipment) and other materials that may be too bulky, e.g., large carpet rolls, etc.

The primary purpose of removing the non-acceptable and non-processible materials is to enhance the ability of the MRF equipment to concentrate the recyclables into a fraction that allows for efficient removal of the recyclables (maximizing recovery of materials and reducing the throughput requirements of the back end). After removal of the recyclables (e.g., magnet for recovery of ferrous materials), the processing train is designed to separate and concentrate the wet fraction (mostly decomposable organics, e.g., food, etc.) through size screening to concentrate the decomposable wet organics in the undersize in preparation for the anaerobic digestion process. The wet fraction is prepared into an anaerobic digestion slurry via a hydraulic press (OREX). The organics press has a sizing sieve that also serves to remove contaminates to produce a feedtstock, and the resulting digestate, which after cleanup will result in a digestate (or compost) with minimal contamination that will meet the proposed CalRecycle land application standards. The Anaergia anaerobic digestion technology which is modeled is referred to as a "high solids digestion" technology which is designed to work on a feedstock produced from the wet fraction of the mixed wastestream.

The dry fraction, which consists of non-recyclable materials and the non-digestable materials and non-compostable materials (e.g., plastic, composite paper materials, etc.) are designated to be further processed into a feedstock for the thermal processing, energy recovery, and ash recovery/recycling operations. Air density separators (e.g., Windsifter) separate the light materials (plastic and paper, the high fuel value portions) from the heavy materials (mostly inorganic materials, the residual materials designated to landfill). The lights materials are separate into paper and plastic via an optical sorter, and the plastic is further separated to remove chlorinated plastics via an optical sorter. This process design enables the production of both an AB 1126 engineered municipal solid waste conversion technology feedstock and also a separate SB 498 Biomass conversion feedstock (non-recyclable paper and or paper pulp). Anaergia's high solids digesters can process three times more organic material and generate three times more biogas than conventional low solids anaerobic digesters, like those found at municipal wastewater treatment plants. Anaergia builds new digesters uniquely designed for high solid digestion, and offers a retrofit called Omnivore™ that converts conventional low high solids digesters into high solids digesters by concentrating solids with recuperative thickening – a process that discharges water from digesters while retaining solids.

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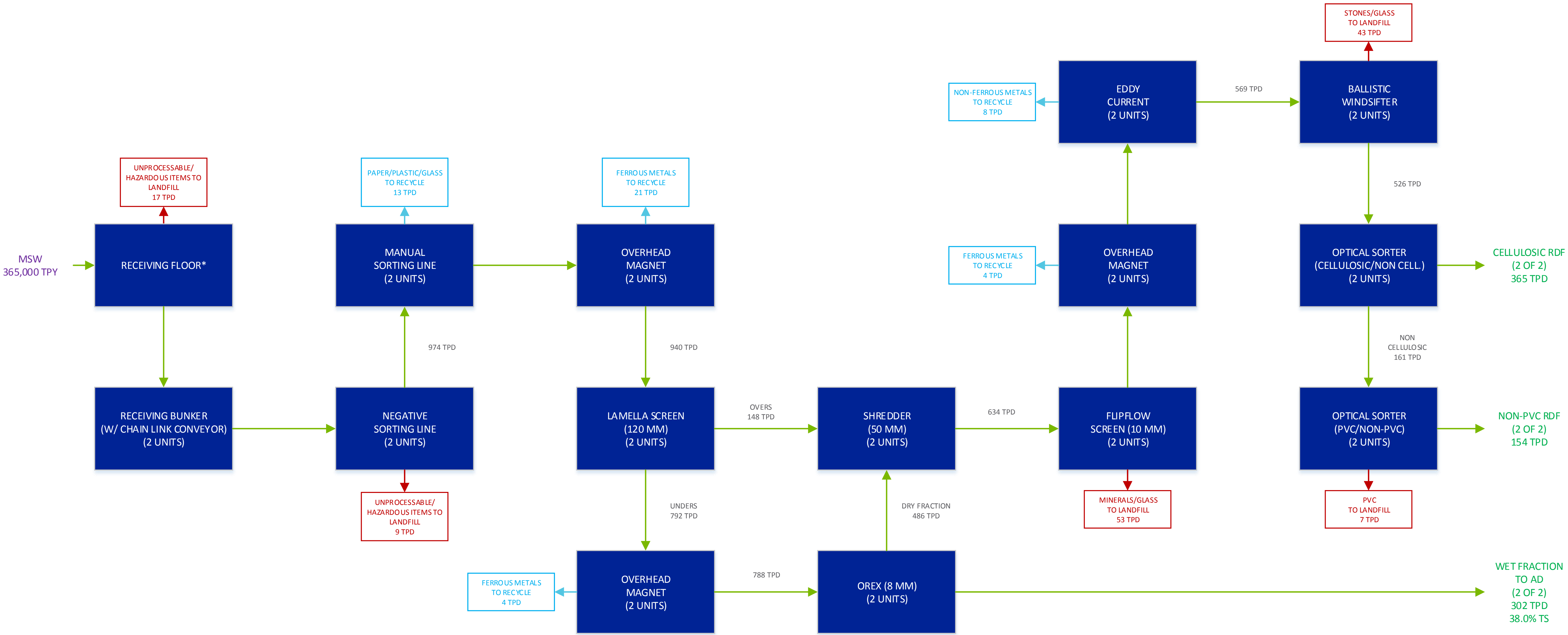
organic material. For organic feedstocks to convert to biogas, digesters must be large enough to retain the feedstock for an average of roughly 25 days. Yet most feedstock are combinations of organic solids and soluble organics with water. Consequently, digesters are often times unnecessarily large in order to retain both the solids and water; however, only organic solids and dissolved organics contribute to biogas production.

The Omnivore™ retrofit system uses recuperative thickening and submersible high solids mixers to enable high solids digestion in conventional low digesters. The system increases the solids retention time (SRT) and consequently the solids content in digesters. This is achieved by recovering and reintroducing digester solids while discharging liquid in a digestate recirculation loop, effectively decoupling solids residence time (SRT) from hydraulic residence time (HRT). Separate control of SRT and HRT improves digester performance and allows operation at higher organic loading rates. Biogas generation and volatile solids destruction increases with longer SRT while digester organic loading increases with shorter HRT. Recuperative thickening extends the SRT by increasing the solids content in the digester. This also increases digestate viscosity to levels that are not suitable for conventional gas, jet, or mechanical mixers. The Omnivore™ system utilizes Anaergia high-torque submersible mixers specifically designed to efficiency mix high solids and high viscous fluids and service boxes mounted to the digester cover than enable servicing and adjustment while the digester is operating. Conventional municipal anaerobic digesters can be retrofitted using the Omnivore™ system to increase biogas generation and organic loading by 2 to 4 times.

The parasitic energy loading and the output biogas composition (and net energy output) of the anaerobic digestion process was developed by Anaergia engineers based on their process design experience on over 1600 anaerobic digestion projects. Project team members reviewed Anaergia's confidential process engineering mass and energy balance to check that the calculations and assumptions met the criteria established for the White Paper alternative scenario.

Anaergia

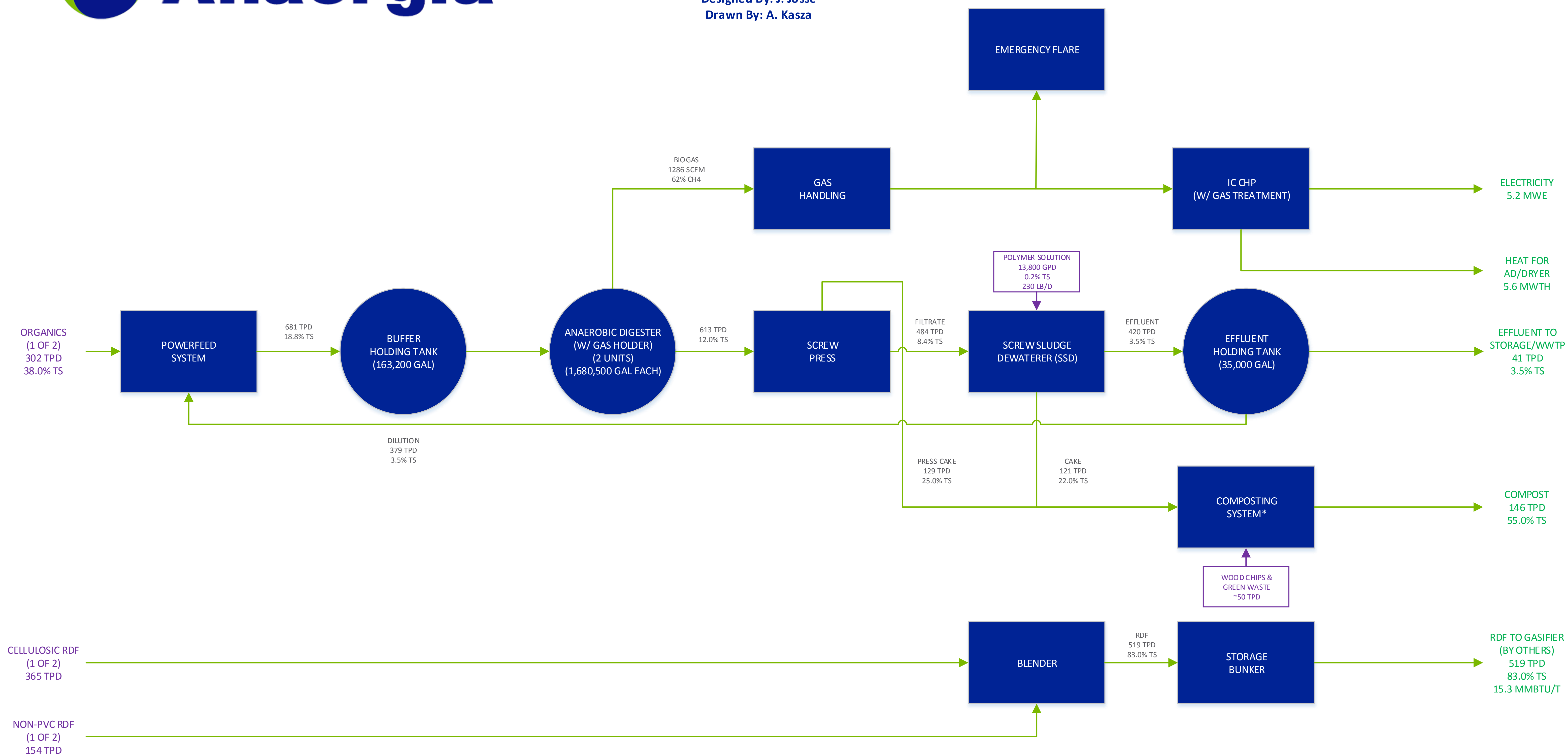
LA County – Scenario 2: Cake to Composting
Block 1 of 2: MSW Pre-Treatment
December 18, 2013
Designed By: J. Josse
Drawn By: A. Kasza



*COMMON RECEIVING FLOOR WHICH FEEDS 2 SEPARATE PRE-PROCESSING TRAINS.
**NOTE: ALL FLOWS SHOWN ARE BASED ON 365 DAYS PER YEAR.

Anaergia

LA County – Scenario 2: Cake to Composting
Block 2 of 2: Overall Process
December 18, 2013
Designed By: J. Josse
Drawn By: A. Kasza



NOTE: ALL FLOWS SHOWN ARE BASED ON 365 DAYS PER YEAR.
*COMPOSTING SYSTEM PERFORMANCE IS BASED ON AN APPROXIMATION.

APPENDIX 5

EpE Model Output for Integrated MRF with Conversion Technology

Appendix 5

EpE Model Output of Integrated MRF with Conversion Technology

Two widely used GHG emissions modeling tools for comparing waste management options were used for the White Paper Integrated MRF with Conversion Technologies scenario: the U.S. EPA's Waste Reduction Model (WARM) and the *Entreprises pour l'Environment* (EpE) tool.

Because of the limitations of the individual models, the most applicable module from each tool was utilized for analysis. Limitations on these analytical tools are that WARM does not have emissions factors for anaerobic digestion, neither model has emissions factors for gasification and ash melting and neither model could apply the IPCC Fifth Assessment Report Global Warming Potential (GWP) factors or California grid-specific emissions factors. To estimate the GHG impacts associated with the avoided electricity-related emissions, the material specific emission factors for the Pacific region utility mix were extracted from the WARM model and calculations were performed via a spreadsheet outside of WARM. The Project Team used the applicable component parts from the various model tools. For gasification, a technology facility operator provided emissions calculations based on the reference dry fraction composition and actual plant operation experience in Japan. Information provided by the operating facility in Japan was reviewed, assessed and vetted by Project Team member Eugene Tseng & Associates and was compared with the WARM results developed independently by Project Team member HDR Inc. (included in Appendix 2). WARM had emissions factor estimators for "incineration" and was used to cross-check vetted emissions calculations for gasification provided by the reference facility operator.

As a "cross check" of the results obtained by utilizing the aggregated components from the two modes, Project Team member Eugene Tseng & Associates conducted an analysis using the EpE model in its entirety. It should be noted that since the EpE model has no provision for thermal gasification, the results are reflective of traditional waste to energy using "incineration" technology. Incineration is the most prevalent thermal processing waste to energy technology utilized in the European Union.

Two "processing scenarios" using the EpE model were considered, 1) wet fraction from preprocessing to anaerobic digestion with digestate going to composting, and 2) wet fraction from preprocessing to anaerobic digestion with digestate going to the thermal processing by incineration.

The following "Summary of GHG Emissions from EpE Modeling" provides the EpE calculated GHG emissions using the updated Climate Registry AR-5 "global warming potential factors".

This summary is provided only for the purposes of a "cross check" to see if the values are within a reasonable range of the GHG calculations from the composite model used for the White Paper.

SUMMARY OF GHG EMISSIONS FROM EpE MODELING (UPDATED WITH CLIMATE REGISTRY FACTORS)

SCENARIO 1 - DIGESTATE TO INCINERATION				
		CO2 EQUIVALENT METRIC TONS		
		Annual	**Life Span**	
Preprocessing				
	Scope 2 - Purchased Electricity	0	0	Climate Registry-AR5-CA
	Scope 3 - Avoided-Recycling	65,877.51	1,646,937.77	EpE
Anaerobic Digestion				
	Scope 1 - Anaerobic Digester-Non-Biogenic	4,099.06	102,476.54	EpE-AR5
	Non-Scope 1 - Anaerobic Digester-Biogenic	29,613.54	740,338.43	Climate Registry-AR5
	Scope 1 - Purchased Natural Gas	2,681.31	67,032.77	Climate Registry-AR5
	Scope 3 - Avoided-Produced Heat	8,921.88	223,047.06	Climate Registry-AR5
	Scope 3 - Avoided-Produced Electricity	13,613.67	340,341.72	Climate Registry-AR5-CA
Incineration				
	Scope 1 - Incineration-Non-Biogenic	174,843.70	4,371,092.46	Epe-AR5 (CO2), Climate
	Non-Scope 1 - Incineration-Biogenic	184,260.36	4,606,509.08	EpE-AR5
	Scope 2 - Purchased Electricity	0	0	Climate Registry-AR5-CA
	Scope 3 - Avoided-Produced Electricity	57,119.45	1,427,986.37	Climate Registry-AR5-CA
SCENARIO 2 - DIGESTATE TO COMPOSTING				
		CO2 EQUIVALENT METRIC TONS		
		Annual	**Life Span**	
Preprocessing				
	Scope 2 - Purchased Electricity	0	0	Climate Registry-AR5-CA
	Scope 3 - Avoided-Recycling	65,877.51	1,646,937.77	EpE
Anaerobic Digestion				
	Scope 1 - Anaerobic Digester-Non-Biogenic	4,099.06	102,476.54	EpE-AR5
	Non-Scope 1 - Anaerobic Digester-Biogenic	29,613.54	740,338.43	Climate Registry-AR5
	Scope 1 - Purchased Natural Gas	0	0	Climate Registry-AR5
	Scope 3 - Avoided-Produced Heat	8,921.88	223,047.06	Climate Registry-AR5
	Scope 3 - Avoided-Produced Electricity	13,613.67	340,341.72	Climate Registry-AR5-CA
Incineration				
	Scope 1 - Incineration-Non-Biogenic	174,287.57	4,357,189.35	Epe-AR5 (CO2), Climate
	Non-Scope 1 - Incineration-Biogenic	142,697.11	3,567,427.86	EpE-AR5
	Scope 2 - Purchased Electricity	0	0	Climate Registry-AR5-CA
	Scope 3 - Avoided-Produced Electricity	52,709.35	1,317,733.66	Climate Registry-AR5-CA
Composting				
	Scope 1 - Composting-Non-Biogenic	6,579.72	164,492.95	EpE-AR5
	Non-Scope 1 - Composting-Biogenic	7,117.68	177,942.06	EpE-AR5
	Scope 2 - Purchased Electricity	0	0	Climate Registry-AR5-CA
	Scope 3 - Avoided-Compost	386.67	9,666.81	EpE

APPENDIX 6

Gasifying and Direct Melting Calculations (Based on Operating Facility)

Emissions Summary Calculations (Gasification Based on Operating Facility)

Avoided GHG Emissions from Recycled Slag and Metal Calculations

Appendix 6

Summary of JFE Engineering
Thermal Gasification and Ash Melting Process Design

To calculate the GHG emissions that would result from a facility that would best meet the technical and policy requirements for the Integrated MRF with Conversion Technologies, the facility design for the thermal processing module

The key policy requirements that had to be met for the thermal processing module are the following:

- Integrated Waste Management Hierarchy (e.g., all other approaches first before using thermal processing and recovery of ash to minimize landfill disposal)
- MRF First (e.g., recovery of marketable recyclables maximized, and following the integrated waste management hierarchy)
- Highest and Best Use (maximize beneficial use from solid waste, recovering energy and ash, e.g., ash conversion to useful and marketable materials such as road base, construction materials, and recyclable metal slag)
- Minimization of Waste to Disposal (e.g., minimum disposal to minimize vehicular and minimize organics bound for landfill disposal to minimize landfill GHG emissions)

The thermal gasification technology needs to be flexible enough to process a variety of feedstocks. The key statutory/regulatory requirements for the feedstock that had to be met for the thermal processing module are the following:

1. AB 1126 Requirements:

Public Resources Code Section 40131.2. (a) “Engineered municipal solid waste conversion” or “EMSW conversion” means the conversion of solid waste through a process that meets all of the following requirements:

(1) The waste to be converted is beneficial and effective in that it replaces or supplements the use of fossil fuels.

(2) The waste to be converted, the resulting ash, and any other products of conversion do not meet the criteria or guidelines for the identification of a hazardous waste adopted by the Department of Toxic Substances Control pursuant to Section 25141 of the Health and Safety Code.

(3) The conversion is efficient and maximizes the net calorific value and burn rate of the waste.

(4) The waste to be converted contains less than 25 percent moisture and less than 25 percent noncombustible waste.

(5) The waste received at the facility for conversion is handled in compliance with the requirements for the handling of solid waste imposed pursuant to this division, and no more than a seven-day supply of that waste, based on the throughput capacity of the operation or facility, is stored at the facility at any one time.

(6) No more than 500 tons per day of waste is converted at the facility where the operation takes place.

(7) The waste has an energy content equal to, or greater than, 5,000 BTU per pound.

(8) The waste to be converted is mechanically processed at a transfer or processing station to reduce the fraction of chlorinated plastics and materials.

(b) “Engineered municipal solid waste conversion facility” or “EMSW facility” means a facility where municipal solid waste conversion that meets the requirements of subdivision (a) takes place.

(c) Notwithstanding Section 40201, a transformation facility where solid waste conversion takes place that meets all of the requirements of subdivision (a) may elect to be considered an EMSW facility for purposes of this division and Division 31 (commencing with Section 50000), except that if a portion of a transformation facility’s operations does not meet the requirements of subdivision (a), the facility shall be considered to be a transformation facility.

2. SB 498 Requirements:

Public Resources Code Section 40106. (a) “Biomass conversion” means the production of heat, fuels, or electricity by the controlled combustion of, or the use of other noncombustion thermal conversion technologies on, the following materials, when separated from other solid waste:

(1) Agricultural crop residues.

(2) Bark, lawn, yard, and garden clippings.

(3) Leaves, silvicultural residue, and tree and brush pruning.

(4) Wood, wood chips, and wood waste.

(5) Nonrecyclable pulp or nonrecyclable paper materials.

(b) "Biomass conversion" does not include the controlled combustion of recyclable pulp or recyclable paper materials, or materials that contain sewage sludge, industrial sludge, medical waste, hazardous waste, or either high-level or low-level radioactive waste.

(c) For purposes of this section, "nonrecyclable pulp or nonrecyclable paper materials" means either of the following, as determined by the department:

(1) Paper products or fibrous materials that cannot be technically, feasibly, or legally recycled because of themanner in which the product or material has been manufactured, treated, coated, or constructed.

(2) Paper products or fibrous materials that have become soiled or contaminated and as a result cannot be technically, feasibly, or legally recycled.

The technical operational best management practices criteria required the following:

- Ability to process post recycled MRF residuals (mixed waste) based on the average composition (by material type by weight percent) of post MRF residuals from the CalRecycle Statewide Post Recycled MRF Residual Waste Composition Study completed in 2006, and can be found at the following link: http://www.calrecycle.ca.gov/WasteChar/WasteStudies.htm#2006MRF
- Ability to process the "dry fraction" of the post recycled MRF residuals after the recovery of additional recyclables which are not recovered by source separation programs or the mixed waste MRF process (prior to receiving the post recycled MRF residuals) to ensure compliance with AB 341 (e.g., equivalency performance recovery of recyclables as compared to a source separated program)
- Ability to meet the technical requirements for materials composition, moisture content, ash content, "preprocessing requirement" (e.g., removal of chlorinated plastic, heating value, etc.) described in the key legal/regulatory requirements above
- Gasification technology has to be at a commercially proven scale (e.g., existing continuous full scale operations)
- The resulting ash/slag from thermal processing should have the ability to be recovered and recycled (converted to useful materials) to minimize landfill disposal
- Emissions must be able to meet the current U.S. EPA, California and South Coast Air Quality Management Emissions Standards (current waste to energy facility standards)

- Gasification technology must be currently operating on a continuous basis at a proven commercial scale similar to that modeled in the White Paper (e.g., multiple full scale reference facilities available for site visit / verification)
- Technology and approach (including unit process equipment must be currently manufactured on a commercial scale and available for implementation in the U.S.).
- Overall, the thermal processing gasification technology must be flexible and robust enough to process the expected seasonal and material type variation of the various feedstocks that may result from the operational variables of the various processing modules that are in the process train before the thermal processing module.

The thermal gasification and ash melting module component is based on existing technology in commercial use as one of the thermal conversion technology reference standards in Japan. In Japan, the ash from these gasification units is usually melted (vitrified) to produce recyclable byproducts, consistent with the policy to minimize disposal in landfills.

The White Paper analysis includes gasification with ash melting because it is consistent with maximizing diversion from landfill. Although ash melting requires additional energy for processing, the resultant vitrified ash is recycled and used in Japan for paving blocks, road base, and other construction materials, with the metal slag also typically recycled as raw material (e.g., aggregate for concrete blocks, tiles, road base). It should be noted that the market for these materials do not currently exist in the United States.

Project Team member Eugene Tseng & Associates utilized the JFE Engineering thermal gasification technology for the White Paper alternative scenario case study analysis. The JFE Engineering thermal gasification technology had been previously reviewed (site visit and detailed engineering review) by the U.S. Navy under a project completed by UCLA Engineering Extension, in which an “Initial Decision Report” (IDR) Waste to Clean Energy was completed. The project team that completed the “Naval Facilities Engineering Command, Technical Report TR-2367-ENV (September 11, 2011)” document conducted an international best management practices technology assessment tour to evaluate full scale, continuously operating, commercially proven thermal gasification technologies that the Navy could utilize in converting their solid waste into clean energy to meet their recycling and renewable energy/fuels goals.

The JFE Engineering thermal gasification and ash melting technology was chosen as it met all of the above technical criteria for the White Paper analysis.

The JFE thermal gasification technology is derived from the steel-making blast furnace, and has commercially proven installations size ranging from 1 ton per hour to 13 tons per hour per line. This gasification technology is robust and has been commercial proven with mixed municipal solid waste and also proven with various feedstocks such as auto shredder fluff, hazardous waste, sewage sludge, and excavated landfill waste. The technology itself is a “scale down” of existing steel making blast furnace technology, so operational process control experience on a much larger scale was easily transferred to smaller scale municipal solid waste operations.

The gasification technology is a high temperature reducing atmosphere combined gasification and ash melting furnace with continuous tapping of the molten slag. The heat source for the gasifier is coke. The high temperature and negative pressure system in the freeboard zone (gasification zone) is designed to prevent flame surge and gas leakage. A metal slag and a glassy water granulated slag are produced. The metal slag is recycled. The water granulated glassy slag that is produced is standardized by Japan Industrial Standard (JIS) for recycling as asphalt and concrete aggregate along with a host of other beneficial uses. Only a small amount of stabilized flyash needs to be disposed of. JFE has built 10 full-scale thermal gasification facilities (20 processing lines) in Japan since 2003.

JFE Engineering provided emissions calculations based on the reference dry fraction composition (provided by the White Paper Project Team) based on actual thermal gasification plant operations experience in Japan. Information provided by the operating facility in Japan was reviewed, assessed and vetted by Eugene Tseng & Associates and was compared with independent WARM results developed by Project Team member HDR Inc. (included in Appendix 2). WARM had emissions factor estimators for “incineration” and was used to cross-check vetted emissions calculations for gasification provided by the facility operator.

It should be noted that other gasification technologies that do not use fossil fuel (i.e., coke) as a heat source or include ash melting to form metal slag for recycling potential would likely have a lower emissions profile.

Checked

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技 部長	
第一技術	
第二技術	
設 部長	
燃焼溶融炉	
ﾎﾞｲﾗ設計	
ﾌﾟﾛｾｽ設計	
配管設計	
機器設計	
建 部長	
計画	
製作管理	
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技術部	
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制御技術	
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海外本部	
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発行元控	1
合計	4

JFE

JFE Engineering Corporation

MASS BALANCE OF JFE GASIFYING AND DIRECT MELTING FURNACE FOR THE COUNTY OF LOS ANGELES WHITE PAPER

(REV.2)

JFE
JFE ENGINEERING CORPORATION
ENGINEERING DEPARTMENT
OVERSEAS BUSINESS SECTOR
- 5 FEB 2014
YOKOHAMA JAPAN

Rev.	Description	Signature				Date
5						
4						
3						
2	Change of amount of RDF in Case2-2	S.Nishimura		S.Nagayama	S.Higuchi	6 Feb.'14
1	Change of RDF design data.	S.Nishimura	T.Tatami	S.Nagayama	T.Oyama S.Higuchi	9 Jan.'14

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APPENDIX 6

CONTENTS

1-1. RDF Design Data (Case1-1 : Upper Bound)

1 **Characteristics of RDF**

Table 1 - RDF Design Data

Item		Value	Unit	Note
		Upper bound		
Total Capacity		578	st/day	short ton
ditto		526	mT/day	metric ton
Capacity per line		263	mT/day	metric ton
Number of lines		2	lines	
Lower Heating Value		17.60	MJ/kg	
Industrial Composition				
(Total 100%)				
Moisture Content		17.00%	%	
Ash Component		11.27%	%	
Combustible Component		71.73%	%	
	Total	100.00%	%	
Elemental Composition of Combustible Component				
(Total 100%)				
C - Carbon		58.88%	%	
H - Hydrogen		7.57%	%	
N - Nitrogen		0.35%	%	
S - Sulphur		0.03%	%	
Cl - Chlorine		1.47%	%	
O - Oxygen		31.70%	%	
	Total	100.00%	%	

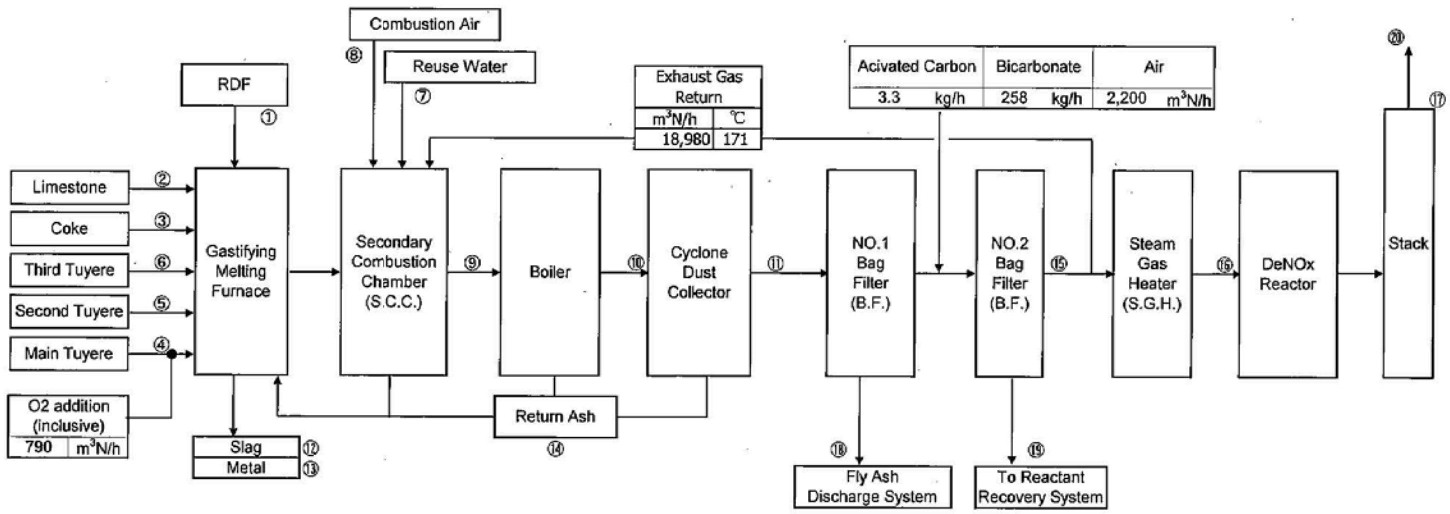
Notes:

1. All design data of RDF is an assumption from "IntegratedMRF-AnaergiaMaterials-120213.xls" and calculated based on our experiences in Japan.

4

1-2.MASS BALANCE (Case1-1 : Upper Bound)

RDF/Air/Flue Gas/Fry Ash Mass Balance (Per 1 line) - Case1-1 (263 mT/d × 2 lines)



Hu		① RDF		② Limestone	③ Coke	④ Main Tuyere Air		⑤ Second Tuyere Air		⑥ Third Tuyere Air		⑦ Reuse Water	⑧ Combustion Air		⑨ S.C.C. Outlet Gas		⑩ Boiler Outlet Gas		⑪ No.1 B.F Inlet Gas		⑫ Slag	⑬ Metal	⑭ Return Ash
MJ/kg	kcal/kg	mT/d	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h	kg/h
17.6	4,210	263	10,958	440	645	3,890	200	10,880	40	2,490	20	2,207	62,140	20	108,720	900	108,720	180	108,720	177	1,084	190	1,022

Hu		⑮ NO.2 B.F Outlet Gas		⑯ S.G.H Outlet Gas		⑰ Stack Outlet Gas		⑱ Fly Ash	⑲ Reactant
MJ/kg	kcal/kg	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h
17.6	4,210	110,920	171	91,940	190	91,940	182	340	220

⑳ Total GHG Emissions *1 (as CO_2 equivalent)	Gas Component *2,3 Dust	SOx *4	NOx *4	CO	Dioxin *4
mT-CO_2/mT-RDF	kg/h	kg/h	kg/h	kg/h	ng-TEQ/h
0.68	<0.08	15.30	10.14	0.63	4.43

*1 except GHG emissions from paper, green waste, wood and organics which are carbon free materials
*2 Each value is calculated from records of a certain reference plant in Japan.
*3 Normal Condition : 273.15K, 101.3kPa, Dry, 7%-O_2
*4 These are values after gas treatment sysytem and depend on the emission limit control.

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1-3. RDF Design Data (Case1-2 : Average)

1 **Characteristics of RDF**

Table 2 - RDF Design Data

Item		Value	Unit	Note
		Average		
Total Capacity		518	st/day	short ton
ditto		472	mT/day	metric ton
Capacity per line		236	mT/day	
Number of lines		2	lines	
Lower Heating Value		17.80	MJ/kg	
Industrial Composition				
(Total 100%)				
Moisture Content		17.00%	%	
Ash Component		10.96%	%	
Combustible Component		72.04%	%	
	Total	100.00%	%	
Elemental Composition of Combustible Component				
(Total 100%)				
C - Carbon		59.10%	%	
H - Hydrogen		7.59%	%	
N - Nitrogen		0.33%	%	
S - Sulphur		0.03%	%	
Cl - Chlorine		1.50%	%	
O - Oxygen		31.45%	%	
	Total	100.00%	%	

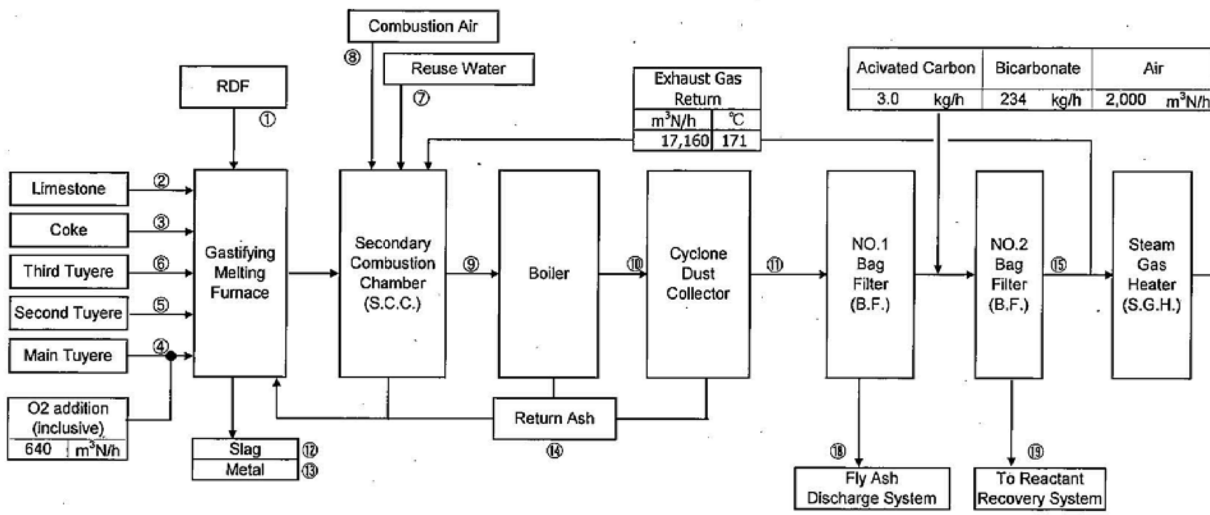
Notes:

1. All design data of RDF is an assumption from "IntegratedMRF-AnaergiaMaterials-120213.xls" and calculated based on our experiences in Japan.

6

1-4.MASS BALANCE (Case1-2 : Average)

RDF/Air/Flue Gas/Fry Ash Mass Balance (Per 1 line) - Case1-2 (236 mT/d × 2 lines)



Hu		① RDF		② Limestone	③ Coke	④ Main Tuyere Air		⑤ Second Tuyere Air		⑥ Third Tuyere Air		⑦ Reuse Water	⑧ Combustion Air		⑨ S.C.C. Outlet Gas		⑩ Boiler Outlet Gas		⑪ No.1 B.F Inlet Gas		⑫ Slag	⑬ Metal	⑭ Return Ash
MJ/kg	kcal/kg	mT/d	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h	kg/h
17.8	4,250	236	9,833	385	565	3,170	200	10,340	40	2,270	20	1,934	56,170	20	98,350	900	98,350	180	98,350	177	947	166	895

Hu		⑮ NO.2 B.F Outlet Gas		⑯ S.G.H Outlet Gas		⑰ Stack Outlet Gas		⑱ Fly Ash	⑲ Reactant
MJ/kg	kcal/kg	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h
17.8	4,250	100,350	171	83,190	190	83,190	182	300	200

⑳ Total GHG Emissions *1 (as CO_2 equivalent)	Gas Component *2,3 Dust	SOx *4	NOx *4	CO	Dioxin *4
mT-CO_2/mT-RDF	kg/h	kg/h	kg/h	kg/h	ng-TEQ/h
0.69	<0.08	15.30	10.14	0.63	4.43

*1 except GHG emissions from paper, green waste, wood and organics which are carbon free materials

*2 Each value is calculated from records of a certain reference plant in Japan.

*3 Normal Condition : 273.15K, 101.3kPa, Dry, 7%-O_2

*4 These are values after gas treatment sysytem and depend on the emission limit control.

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1-5. RDF Design Data (Case1-3 : Lower Bound)

1 Characteristics of RDF

Table 3 - RDF Design Data

Item		Value	Unit	Note
		Lower bound		
Total Capacity		459	st/day	short ton
ditto		418	mT/day	metric ton
Capacity per line		209	mT/day	
Number of lines		2	lines	
Lower Heating Value		18.00	MJ/kg	
Industrial Composition				
(Total 100%)				
Moisture Content		17.00%	%	
Ash Component		10.57%	%	
Combustible Component		72.43%	%	
	Total	100.00%	%	
Elemental Composition of Combustible Component				
(Total 100%)				
C - Carbon		59.36%	%	
H - Hydrogen		7.62%	%	
N - Nitrogen		0.32%	%	
S - Sulphur		0.03%	%	
Cl - Chlorine		1.53%	%	
O - Oxygen		31.14%	%	
	Total	100.00%	%	

Notes:

1. All design data of RDF is an assumption from "IntegratedMRF-AnaergiaMaterials-120213.xls" and calculated based on our experiences in Japan.

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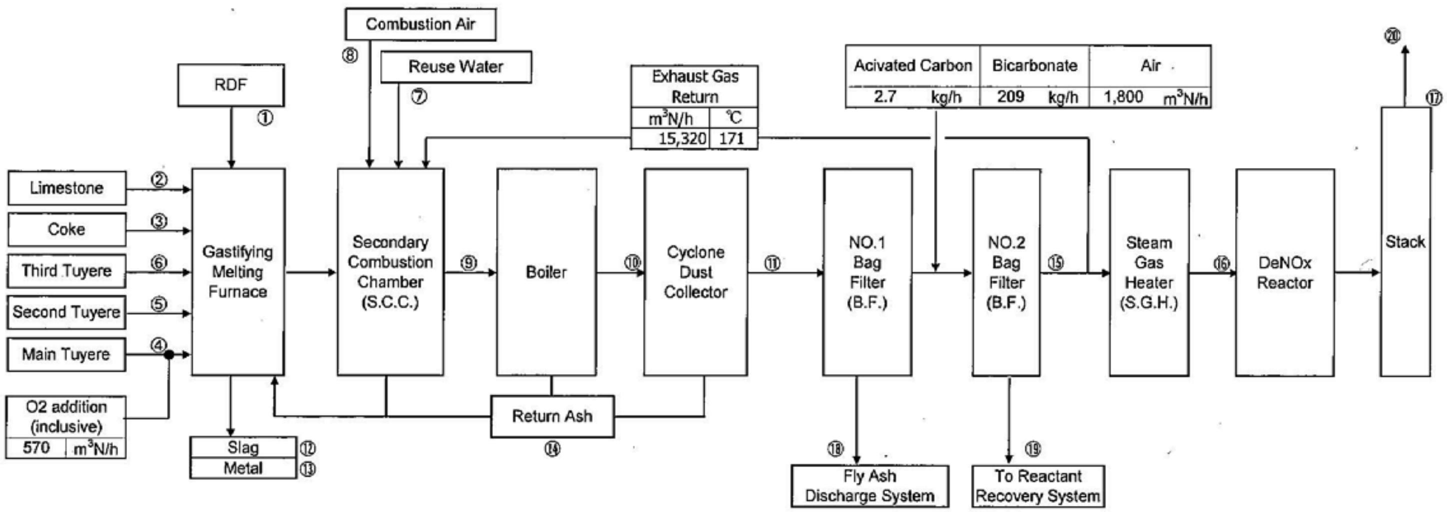
1-6.MASS BALANCE (Case1-3 : Lower Bound)

RDF/Air/Flue Gas/Fry Ash Mass Balance (Per 1 line) - Case1-3 (209 mT/d × 2 lines)



Hu		① RDF		② Limestone	③ Coke	④ Main Tuyere Air		⑤ Second Tuyere Air		⑥ Third Tuyere Air		⑦ Reuse Water	⑧ Combustion Air		⑨ S.C.C. Outlet Gas		⑩ Boiler Outlet Gas		⑪ No.1 B.F Inlet Gas		⑫ Slag	⑬ Metal	⑭ Return Ash
MJ/kg	kcal/kg	mT/d	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h	kg/h
18.0	4,300	209	8,708	330	485	2,800	200	9,270	40	2,040	20	1,660	50,150	20	87,720	900	87,720	180	87,720	177	809	142	767

Hu		⑮ NO.2 B.F Outlet Gas		⑯ S.G.H Outlet Gas		⑰ Stack Outlet Gas		⑱ Fly Ash	⑲ Reactant
MJ/kg	kcal/kg	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h
18.0	4,300	89,520	171	74,200	190	74,200	182	250	180

⑳ Total GHG Emissions *1 (as CO_2 equivalent)	Gas Component *2,3: Dust	SOx *4	NOx *4	CO	Dioxin *4
mT-CO_2/mT-RDF	kg/h	kg/h	kg/h	kg/h	ng-TEQ/h
0.70	<0.08	15.30	10.14	0.63	4.43

*1 except GHG emissions from paper, green waste, wood and organics which are carbon free materials
*2 Each value is calculated from records of a certain reference plant in Japan.
*3 Normal Condition : 273.15K, 101.3kPa, Dry, 7%-O_2
*4 These are values after gas treatment sysytem and depend on the emission limit control.

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2-1. RDF Design Data (Case2-1 : Upper Bound)

1. Characteristics of RDF

Table 4.1 - RDF Design Data

Item		Value	Unit	Note
		Upper bound		
Total Capacity		658	st/day	short ton
ditto		597	mT/day	metric ton
Capacity per line		199	mT/day	
Number of lines		3	lines	
Lower Heating Value		16.80	MJ/kg	
Industrial Composition				
(Total 100%)				
Moisture Content		17.00%	%	
Ash Component		13.83%	%	
Combustible Component		69.17%	%	
	Total	100.00%	%	
Elemental Composition of Combustible Component				
(Total 100%)				
C - Carbon		58.16%	%	
H - Hydrogen		7.60%	%	
N - Nitrogen		0.97%	%	
S - Sulphur		0.16%	%	
Cl - Chlorine		1.31%	%	
O - Oxygen		31.80%	%	
	Total	100.00%	%	

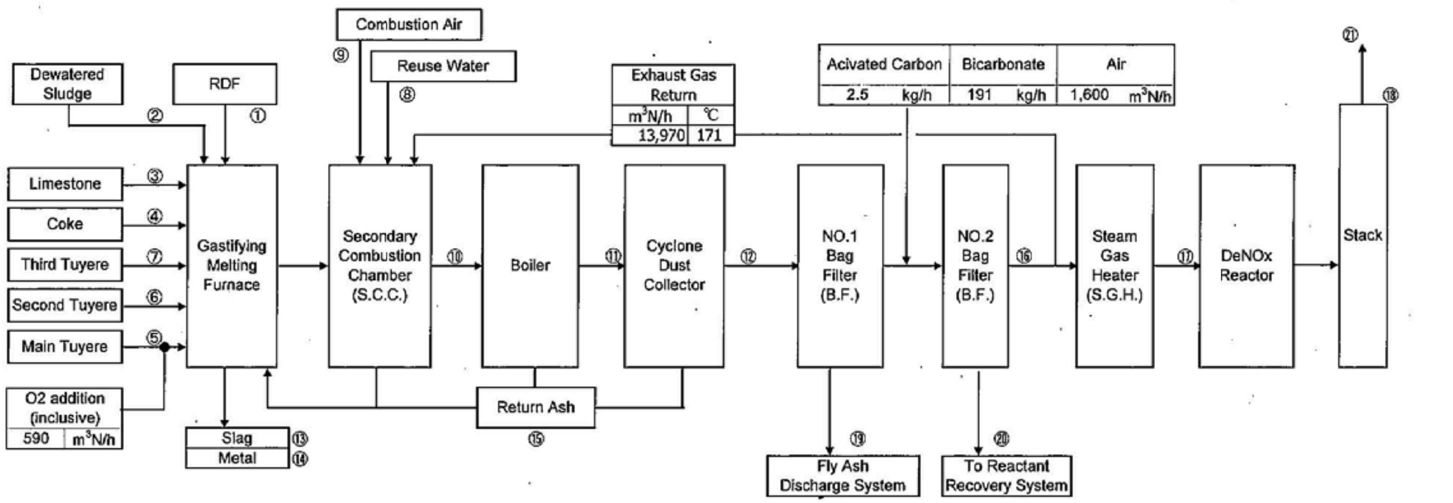
Table 4.2 - Component of RDF Design Data

Item		Value		Unit	Note
		RDF (equivalent to Case1-1)	Dewatered Sludge		
Capacity		176	23	mT/day	per one line
Lower Heating Value		17.60	13.54	MJ/kg	
Industrial Composition					
(Total 100%)					
Moisture Content		17.00%	15.00%	%	
Ash Component		11.27%	25.60%	%	
Combustible Component		71.73%	59.40%	%	
	Total	100.00%	100.00%	%	
Elemental Composition of Combustible Component					
(Total 100%)					
C - Carbon		58.88%	52.75%	%	
H - Hydrogen		7.57%	7.86%	%	
N - Nitrogen		0.35%	5.61%	%	
S - Sulphur		0.03%	1.12%	%	
Cl - Chlorine		1.47%	0.11%	%	
O - Oxygen		31.70%	32.55%	%	
	Total	100.00%	100.00%	%	

Notes:
1. All design data of RDF is an assumption from "IntegratedMRF-AnaergiaMaterials-120213.xls" and calculated based on our experiences in Japan.

2-2.MASS BALANCE (Case2-1 : Upper Bound)

RDF/Air/Flue Gas/Fry Ash Mass Balance (Per 1 line) - Case2-1 (199 mT/d × 3 lines)



Hu		① RDF		② Dewatered Sludge		③ Limestone	④ Coke	⑤ Main Tuyere Air		⑥ Second Tuyere Air		⑦ Third Tuyere Air		⑧ Reuse Water	⑨ Combustion Air		⑩ S.C.C. Outlet Gas		⑪ Boiler Outlet Gas		⑫ No.1 B.F Inlet Gas	
MJ/kg	kcal/kg	mT/d	kg/h	mT/d	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	m³N/h	℃
16.8	4,020	176	7,333	23	958	410	600	2,890	200	8,470	40	1,840	20	1,492	45,720	20	80,410	900	80,410	180	80,410	177

Hu		⑬ Slag	⑭ Metal	⑮ Return Ash	⑯ NO.2 B.F Outlet Gas		⑰ S.G.H Outlet Gas		⑱ Stack Outlet Gas		⑲ Fly Ash	⑳ Reactant
MJ/kg	kcal/kg	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h
16.8	4,020	1,008	177	944	82,010	171	68,040	190	68,040	182	310	160

㉑ Total GHG Emissions *1 (as CO_2 equivalent)	Gas Component *2,3 Dust	SOx *4	NOx *4	CO	Dioxin *4
mT-CO_2/mT-(①+②)	kg/h	kg/h	kg/h	kg/h	ng-TEQ/h
0.65	<0.08	15.30	10.14	0.63	4.43

*1 except GHG emissions from paper, green waste, wood and organics which are carbon free materials

*2 Each value is calculated from records of a certain reference plant in Japan.

*3 Normal Condition : 273.15K, 101.3kPa, Dry, 7%-O_2

*4 These are values after gas treatment sysytem and depend on the emission limit control.

//

2-3. RDF Design Data (Case2-2)

1 **Characteristics of RDF**

Table 5.1 - RDF Design Data

Item		Value	Unit	Note
		Average		
Total Capacity		589 ⚠2	st/day	short ton
ditto		534	mT/day	metric ton
Capacity per line		178	mT/day	
Number of lines		3	lines	
Lower Heating Value		17.00	MJ/kg	
Industrial Composition				
(Total 100%)				
Moisture Content		17.00%	%	
Ash Component		13.56%	%	
Combustible Component		69.44%	%	
	Total	100.00%	%	
Elemental Composition of Combustible Component				
(Total 100%)				
C - Carbon		58.35%	%	
H - Hydrogen		7.62%	%	
N - Nitrogen		0.96%	%	
S - Sulphur		0.16%	%	
Cl - Chlorine		1.33%	%	
O - Oxygen		31.58%	%	
	Total	100.00%	%	

Table 5.2 - Component of RDF Design Data

Item		Value		Unit	Note
		RDF (equivalent to Case1-2)	Dewatered Sludge		
Capacity		⚠2 157	21	mT/day	per one line
Lower Heating Value		17.77	13.54	MJ/kg	
Industrial Composition					
(Total 100%)					
Moisture Content		17.00%	15.00%	%	
Ash Component		10.96%	25.60%	%	
Combustible Component		72.04%	59.40%	%	
	Total	100.00%	100.00%	%	
Elemental Composition of Combustible Component					
(Total 100%)					
C - Carbon		59.10%	52.75%	%	
H - Hydrogen		7.59%	7.86%	%	
N - Nitrogen		0.33%	5.61%	%	
S - Sulphur		0.03%	1.12%	%	
Cl - Chlorine		1.50%	0.11%	%	
O - Oxygen		31.45%	32.55%	%	
	Total	100.00%	100.00%	%	

Notes:

1. All design data of RDF is an assumption from "IntegratedMRF-AnaergiaMaterials-120213.xls" and calculated based on our experiences in Japan.

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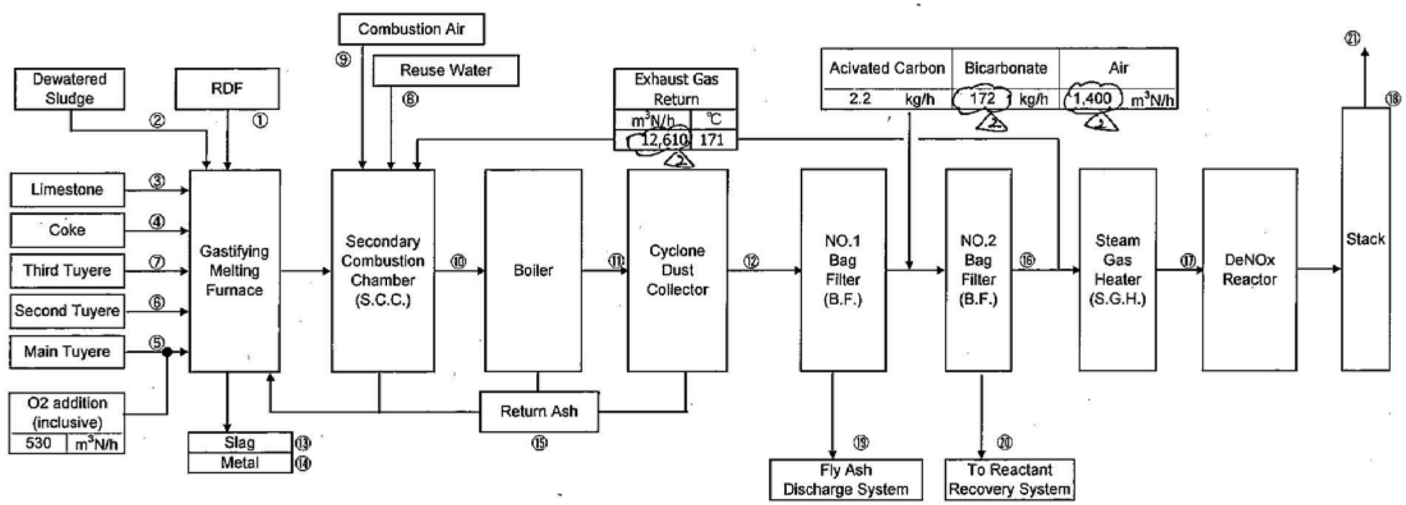
2-4.MASS BALANCE (Case2-2 : Average)

RDF/Air/Flue Gas/Fry Ash Mass Balance (Per 1 line) - Case2-2 178 mT/d × 3 lines)



Hu		① RDF		② Dewatered Sludge		③ Limestone	④ Coke	⑤ Main Tuyere Air		⑥ Second Tuyere Air		⑦ Third Tuyere Air		⑧ Reuse Water	⑨ Combustion Air		⑩ S.C.C. Outlet Gas		⑪ Boiler Outlet Gas		⑫ No.1 B.F Inlet Gas	
MJ/kg	kcal/kg	mT/d	kg/h	mT/d	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	m³N/h	℃
17.0	4,060	157	6,542	21	875	360	530	2,600	200	7,460	40	1,660	20	1,305	41,270	20	72,330	900	72,330	180	72,330	177

Hu		⑬ Slag	⑭ Metal	⑮ Return Ash	⑯ NO.2 B.F Outlet Gas		⑰ S.G.H Outlet Gas		⑱ Stack Outlet Gas		⑲ Fly Ash	⑳ Reactant
MJ/kg	kcal/kg	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h
17.0	4,060	885	155	829	73,730	171	61,120	190	61,120	182	280	150

㉑ Total GHG Emissions *1 (as CO_2 equivalent)	Gas Component *2,3 Dust	SOx *4	NOx *4	CO	Dioxin *4
mT-CO_2/mT-(①+②)	kg/h	kg/h	kg/h	kg/h	ng-TEQ/h
0.66	<0.08	15.30	10.14	0.63	4.43

*1 except GHG emissions from paper, green waste, wood and organics which are carbon free materials

*2 Each value is calculated from records of a certain reference plant in Japan.

*3 Normal Condition : 273.15K, 101.3kPa, Dry, 7%-O_2

*4 These are values after gas treatment sysytem and depend on the emission limit control.

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2-5. RDF Design Data (Case2-3 : Lower Bound)

1 Characteristics of RDF

Table 6.1 - RDF Design Data

Item		Value	Unit	Note
		Lower bound	MJ/kg	
Total Capacity		523	st/day	short ton
ditto		474	mT/day	metric ton
Capacity per line		237	mT/day	
Number of lines		2	lines	
Lower Heating Value		17.10	MJ/kg	
Industrial Composition				
(Total 100%)				
Moisture Content		17.00%	%	
Ash Component		13.23%	%	
Combustible Component		69.77%	%	
	Total	100.00%	%	
Elemental Composition of Combustible Component				
(Total 100%)				
C - Carbon		58.56%	%	
H - Hydrogen		7.65%	%	
N - Nitrogen		0.96%	%	
S - Sulphur		0.16%	%	
Cl - Chlorine		1.36%	%	
O - Oxygen		31.31%	%	
	Total	100.00%	%	

Table 6.2 - Component of RDF Design Data

Item		Value		Unit	Note
		RDF (equivalent to Case1-3)	Dewatered Sludge		
Capacity		208	29	mT/day	per one line
Lower Heating Value		17.99	13.54	MJ/kg	
Industrial Composition					
(Total 100%)					
Moisture Content		17.00%	15.00%	%	
Ash Component		10.57%	25.60%	%	
Combustible Component		72.43%	59.40%	%	
	Total	100.00%	100.00%	%	
Elemental Composition of Combustible Component					
(Total 100%)					
C - Carbon		59.36%	52.75%	%	
H - Hydrogen		7.62%	7.86%	%	
N - Nitrogen		0.32%	5.61%	%	
S - Sulphur		0.03%	1.12%	%	
Cl - Chlorine		1.53%	0.11%	%	
O - Oxygen		31.14%	32.55%	%	
	Total	100.00%	100.00%	%	

Notes:

1. All design data of RDF is an assumption from "IntegratedMRF-AnaergiaMaterials-120213.xls" and calculated based on our experiences in Japan.

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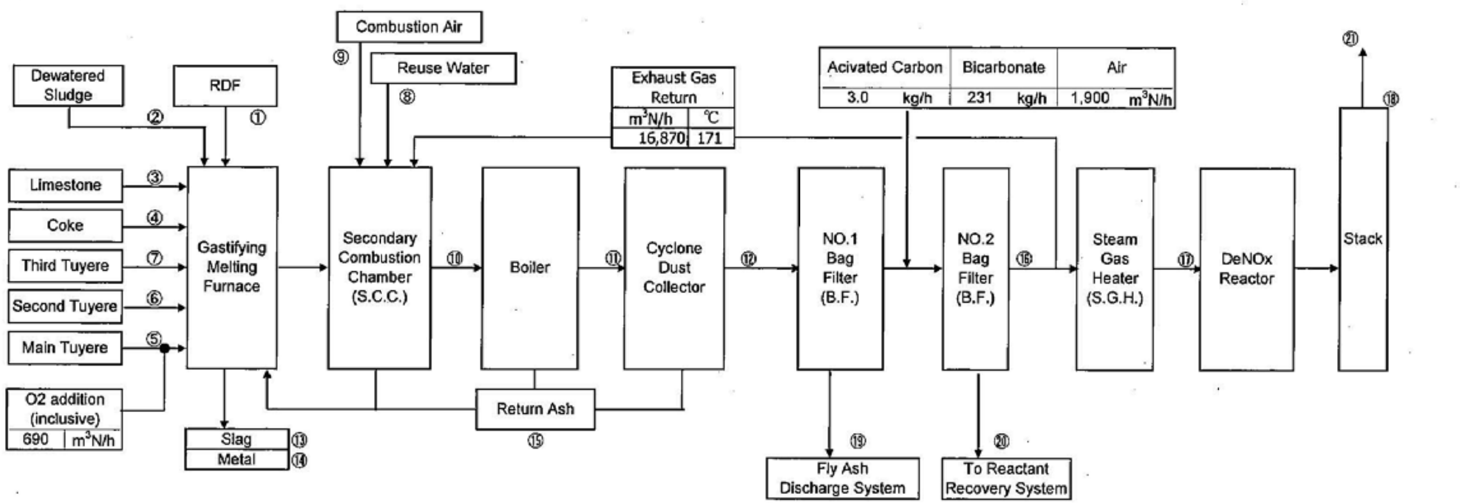
2-6.MASS BALANCE (Case2-3 : Lower Bound)

RDF/Air/Flue Gas/Fry Ash Mass Balance (Per 1 line) - Case2-3 (237 mT/d × 2 lines)



Hu		① RDF		② Dewatered Sludge		③ Limestone	④ Coke	⑤ Main Tuyere Air		⑥ Second Tuyere Air		⑦ Third Tuyere Air		⑧ Reuse Water	⑨ Combustion Air		⑩ S.C.C. Outlet Gas		⑪ Boiler Outlet Gas		⑫ No.1 B.F Inlet Gas	
MJ/kg	kcal/kg	mT/d	kg/h	mT/d	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	m³N/h	℃
17.1	4,090	208	8,667	29	1,208	465	685	3,400	200	10,260	40	2,220	20	1,915	55,220	20	97,130	900	97,130	180	97,130	177

Hu		⑬ Slag	⑭ Metal	⑮ Return Ash	⑯ NO.2 B.F Outlet Gas		⑰ S.G.H Outlet Gas		⑱ Stack Outlet Gas		⑲ Fly Ash	⑳ Reactant
MJ/kg	kcal/kg	kg/h	kg/h	kg/h	m³N/h	℃	m³N/h	℃	m³N/h	℃	kg/h	kg/h
17.1	4,090	1,147	201	1,080	99,030	171	82,170	190	82,170	182	360	200

㉑ Total GHG Emissions *1 (as CO_2 equivalent)	Gas Component *2,3 Dust	SOx *4	NOx *4	CO	Dioxin *4
mT-CO_2/mT-(①+②)	kg/h	kg/h	kg/h	kg/h	ng-TEQ/h
0.66	<0.08	15.30	10.14	0.63	4.43

*1 except GHG emissions from paper, green waste, wood and organics which are carbon free materials

*2 Each value is calculated from records of a certain reference plant in Japan.

*3 Normal Condition : 273.15K, 101.3kPa, Dry, 7%-O_2

*4 These are values after gas treatment sysytem and depend on the emission limit control.

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都市環境本部		
環境ﾌﾟﾗﾝﾄ事業部		
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設	部長	
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	機器設計	
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JFE

JFE Engineering Corporation

SUMMARY OF
JFE GASIFYING AND DIRECT MELTING FURNACE PROCESS DATA
[365 days version]

JFE
JFE ENGINEERING CORPORATION
ENGINEERING DEPARTMENT
OVERSEAS BUSINESS SECTOR
- 6 FEB 2014
YOKOHAMA JAPAN

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APPENDIX 6

CONTENTS

SUMMARY OF JFE ENGINEERING THERMAL GASIFICATION AND ASH MELTING PROCESS DATA

CASE OF RDF	Gross Emissions (MTCO2E per Year)	Emissions from biogenic materials (MTCO2E per Year)	Emissions from non-biogenic materials*1 (MTCO2E per Year)	Indirect Emissions*2,3 (MTCO2E per Year)	Avoided Emissions (from electricity generated) (MTCO2E per Year)	Net Emissions (MTCO2E per Year) [A+D−E]	Total Energy Generated (MW)	Energy to Operate (Parasitic Load) MW	Net Energy (MW) Provided to Grid [G−H]	Percent of Energy Generated from Biogenic and Non-biogenic Materials: Biogenic	Non-biogenic
	A	B (B/A×100)	C (C/A×100)	D	E	F	G	H	I	J (J/(J+K)×100)	K (K/(J+K)×100)
1-1 Upper Bound	333,766	202,205 (60.6%)	131,562 (39.4%)	20,396	174,911	179,251	31.6	3.3	28.3	10.4 (36.9%)	17.9 (63.1%)
1-2 Average	300,877	181,513 (60.3%)	119,364 (39.7%)	19,160	157,605	162,431	28.6	3.1	25.5	9.4 (37.0%)	16.1 (63.0%)
1-3 Lower Bound	267,929	160,788 (60.0%)	107,141 (40.0%)	17,306	140,300	144,935	25.5	2.8	22.7	8.4 (37.1%)	14.3 (62.9%)
CASE OF RDF and DEWATERED SLUDGE											
2-1 Upper Bound	372,287	230,655 (62.0%)	141,631 (38.0%)	25,341	173,057	224,570	32.1	4.1	28.0	11.4 (40.8%)	16.6 (59.2%)
2-2 Average	334,499	206,638 (61.8%)	127,860 (38.2%)	21,632	157,606	198,525	29.0	3.5	25.5	10.4 (40.6%)	15.1 (59.4%)
2-3 Lower Bound	297,897	183,789 (61.7%)	114,108 (38.3%)	19,160	153,897	163,160	28.0	3.1	24.9	10.0 (40.3%)	14.9 (59.7%)

*1 GHG emissions values as set forth in submitted mass balances are based on non-biogenic emissions data.

*2 Indirect Emissions means carbon dioxide generated from self-consumption electricity in the plant.

*3 CO_2 output emission rate : 7.0555×10^{-4} metric tons CO_2 /kWh (Sources : US EPA data)

CALCULATION METHODOLOGY

1 GHG Emissions

(A). Gross emissions

Gross emissions count only CO_2 emission because the records of CH_4 and N_2O emissions in JFE's reference gasification plants are below measurable limits.

$$E_G = (C_w \times W_w + C_c \times W_c) \times \frac{44}{12} \times 24 \times 365 / 1000$$

E_G : Gross emissions ($MTCO_2E$ per year)

C_w : Amount of carbon in RDF and dewatered sludge (kg/kg)

$C_w = \frac{R_c}{100} \times \frac{R_s}{100}$ (kg/kg)

R_c : Combustible component in RDF and dewatered sludge (%)

R_s : Ratio of carbon content in combustible component (%)

	Case1-1	Case1-2	Case1-3	Case1-4	Case1-5	Case1-6
R_c	71.73	72.04	72.43	69.17	69.44	69.77
R_s	58.88	59.10	59.36	58.16	58.35	58.56

W_w : Total capacity of RDF and dewatered sludge (kg/h)

	Case1-1	Case1-2	Case1-3
W_w	21,917 (=526MTPD/24hours)	19,667 (=472MTPD/24hours)	17,417 (=418MTPD/24hours)
	Case1-4	Case1-5	Case1-6
W_w	24,875 (=597MTPD/24hours)	22,250 (=534MTPD/24hours)	19,750 (=474MTPD/24hours)

C_c : Amount of carbon in coke (kg/kg) = 0.8797

W_c : Amount of coke usage (kg/h)

	Case1-1	Case1-2	Case1-3	Case1-4	Case1-5	Case1-6
W_c	1,290	1,130	970	1,800	1,590	1,370

(Calculation based on 365 days per year)

(B). Emissions from biogenic materials

$$E_{bio} = (C_w \times W_w \times R_{bio}) \times \frac{44}{12} \times 24 \times 365/1000$$

E_{bio} : Emissions from biogenic materials*1 ($MTCO_2E$ per year)

C_w : Amount of carbon in RDF and dewatered sludge (kg/kg)

W_w : Total capacity of RDF and dewatered sludge (kg/h)

R_{bio} : Capacity ratio of biogenic materials in RDF and dewatered sludge (kg/h)

	Case1-1	Case1-2	Case1-3	Case1-4	Case1-5	Case1-6
R_{bio}	0.6801	0.6749	0.6685	0.7176	0.7136	0.7091

*1 Biogenic materials mean paper, green waste, wood, organics and dewatered sludge.

(D). Indirect emissions..(D)

$$E_I = E_O \times K \times 1000 \times 24 \times 365$$

E_I : Indirect emissions ($MTCO_2E$ per year)

E_O : Energy to operate (MW) ....(H)

K : CO_2 emission factor = 7.0555×10^{-4} $MTCO_2$/kWh (Sources: US EPA data)

(E). Avoided Emissions (from electricity generated) ....(E)

$$E_A = E_S \times K \times 1000 \times 24 \times 365$$

E_A : Avoided emissions ($MTCO_2E$ per year)

E_S : Net energy provided to grid (MW) ....(I)

K : CO_2 Emission Factor = 7.0555×10^{-4} $MTCO_2$/kWh (Sources: US EPA data)

2 Energy generated

(I). Energy generated from biogenic materials .... (J)

$P_{bio} = P_{net} \times T_{bio}/100$

P_{bio} : Energy generated from biogenic materials in RDF and dewatered sludge (MW)

P_{net} : Net energy provided to grid (MW) .... (I)

T_{bio} : Percent of energy generated from biogenic materials (%)

	Case1-1	Case1-2	Case1-3	Case1-4	Case1-5	Case1-6
T_{bio}	36.9	37.0	37.1	40.8	40.6	40.3

APPENDIX 6

JFE GHG Emissions Estimation

Gross Emissions	$E_G = (C_W{*}W_W + C_C{*}W_C){*}(44/12){*}24$ hr/day * 365 days/year		
	Symbol	**Description**	**Unit**
	E_G	Annual Gross Emissions	MT CO2e/yr
	C_W	Amount of Carbon in RDF and dewatered digestate	Kg/Kg
	R_C	Combustable component in RFD and dewatered digestate	%
	R_S	Ratio of carbon content in combustable component	%
	W_W	Total Capacity of RDF and dewatered digestate	Kg/hr
	C_C	Amount of Carbon in Coke	kg/kg
	W_C	Amount of coke Usage	kg/hr
	CO2 MW	44	
	C MW	12	
	Hr/day	24	
	Annual Operation Period in Days/Yr	365	
	C_C in Kg/kg	0.8797	
	K in MTCO2e/kWh - CA-WEEC eGrid	0.000298771	
s	C_W	$(R_C/100){*}(R_S/100)$	kg/kg

Biogenic Emissions	$E_{BIO} = (C_W * W_W * R_{BIO}){*}(44/12) {*}24{*}365$		
	E_{BIO}	Annual Emissions from biogenic materials	MT CO2e/yr
	R_{BIO}	Capacity Ratio of biogenic materials in RDF and dewatered digestate	kg/hr

Indirect Emissions	$E_I = E_O * K {*}1000{*} 24 {*}365$		
	E_I	Annual Indirect emissions	MTCO2e/yr
	E_O	Energy to operate	MW
	K	CO2 emission factor USEPA	MTCO2e/kWl

Avoided Emissions	$E_A = E_S * K {*}1000 {*}24 {*}365$		
	E_A	Annual Avoided emissions	MTCO2e/yr
	E_S	Net energy provided to grid	MW
	K	CO2 emission factor USEPA	MTCO2e/kWl

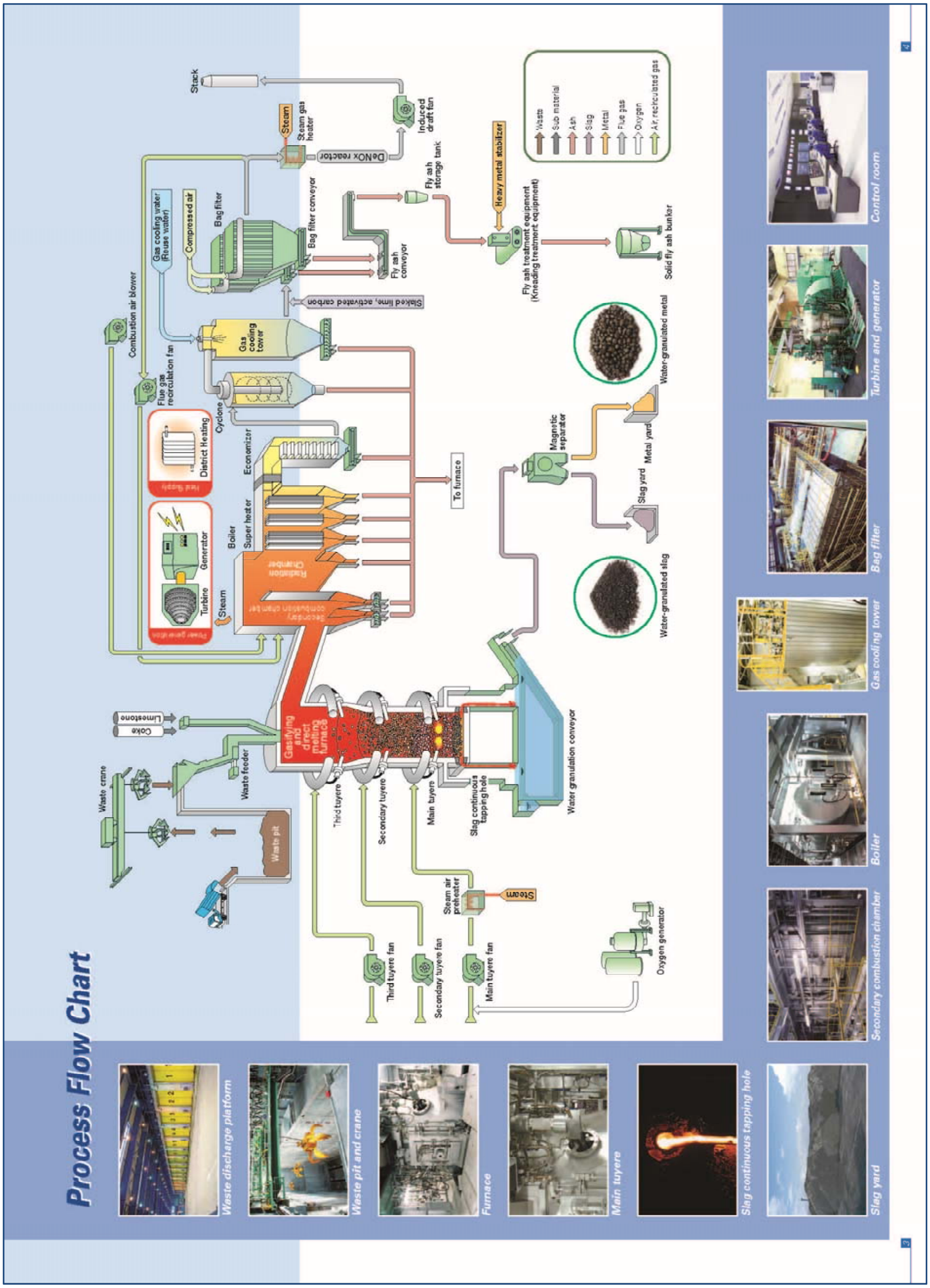
Energy Generated	$P_{BIO} = (P_{NET} * T_{BIO})/100$		
	P_{BIO}	Energy generated from biogenic materials in RDF and dewatered digestate	MW
	P_{NET}	Net energy provided to grid	MW
	T_{BIO}	Percent energy generated from biogenic materials	%

WECC California EF CO2	0.65868	lb/kwh
	0.000298771	MT/kwh
US National EF CO2	0.00070555	MT/kwh

APPENDIX 6

	Case 1 - RDF only			Case 2 - RDF + dewatered digestate		
Parameters	Case 1-1 (Upper)	Case 1-2 (Average)	Case 1-3 (Lower)	Case 2-1 (Upper)	Case 2-2 (Average)	Case 2-3 (Lower)
R_C (%)	71.73	72.04	72.43	69.17	69.44	69.77
R_S (%)	58.88	59.1	59.36	58.16	58.35	58.56
C_W (kg/kg)	0.42234624	0.4257564	0.42994448	0.40229272	0.4051824	0.40857312
Total Capacity (MT/day)	526	472	418	597	534	474
Total Capacity W_W (Kg/hr)	21917	19667	17417	24875	22250	19750
W_c (kg/hr) - coke/one line	645	565	485	600	530	685
Process capacity per line (MT/day)	263	236	209	199	178	237
# of process line needed	2	2	2	3	3	2
W_C (kg/hr) - All processes coke/hr	1290	1130	970	1800	1590	1370
R_{BIO} (kg/hr) - From CA Waste Composition?	0.6801	0.6749	0.6685	0.7176	0.7136	0.7091
T_{BIO} (%) - From CA Waste Composition?	36.9	37	37.01	40.8	40.6	40.3
Biogenic portion (%) -from CA source?	60.6	60.3	60	62	61.8	61.7
Non-biogenic portion (%) - from CA source?	39.4	39.7	40	38	38.2	38.3

E_{BIO} Annual biogenic emissioins (MTCO2e/yr)	202,205	181,513	160,788	230,655	206,638	183,789
Operating period (yr)	25	25	25	25	25	25
E_{BIO} 25 yr biogenic emissions (MTCO2e)	5,055,120	4,537,816	4,019,707	5,766,380	5,165,959	4,594,729
E_{NONBIO} Annual biogenic emissions (MTCO2e/yr)	131,466	119,503	107,192	141,369	127,728	114,086
Operating period (yr)	25	25	25	25	25	25
E_{NONBIO} 25 yr biogenic emissions (MTCO2e)	3,286,662	2,987,584	2,679,805	3,534,233	3,193,198	2,852,158
Using $E_G = (C_W*W_W + C_C*W_C)*(44/12)*24$ hr/day * 365 days/year						
E_G Annual gross emissions (MTCO2e/yr)	333,766	300,877	267,929	372,287	334,499	297,897
Operating period (yr)	25	25	25	25	25	25
E_G 25 yr Gross emissions (MTCO2e)	8,344,162	7,521,918	6,698,231	9,307,165	8,362,467	7,447,430
Using $E_G = E_{BIO} + E_{NONBIO}$						
E_G Annual gross emissions (MTCO2e/yr)	333,671	301,016	267,980	372,024	334,366	297,875
Operating period (yr)	25	25	25	25	25	25
E_G 25 yr Gross emissions (MTCO2e)	8,341,782	7,525,400	6,699,511	9,300,612	8,359,157	7,446,887
Diff in %	100.03%	99.95%	99.98%	100.07%	100.04%	100.01%
$E_I = E_O * K *1000* 24 *365$						
JFE Parasitic load in MW	3	3	3	5	4	3
E_I Annual Indirect Emissions (MTCO2e/yr) from JFE parasitic load	8,637	8,113	7,328	11,778	9,160	8,113
Operating period (yr)	25	25	25	25	25	25
E_I 25 YR Indirect Emissions (MTCO2e/yr) from JFE parasitic load	215,922	202,835	183,206	294,438	229,008	202,835
P_{NET} Net energy provided to grid (MW) from JFE in MW	28	26	23	28	26	25
P_{BIO} Net energy provided to grid (MW) Biogenic from JFE in MW	10	9	8	11	10	10
P_{NONBIO} Net energy provided to grid (MW) Non-biogenic from JFE in MW	18	16	14	17	15	15
Total energy generated (MW) = PNET + Parasitic Load	32	29	26	33	29	28
$E_A = E_S * K *1000 *24 *365$						
E_A Annual avoided emissions in MTCO2e/yr	74,068	66,739	59,411	73,282	66,739	65,169
Operating period (yr)	25	25	25	25	25	25
E_A 25 yr Avoided emissioins (MTCO2e)	1,851,691	1,668,485	1,485,279	1,832,062	1,668,485	1,629,226


Process Flow Chart
Waste crane
Waste pit
Waste feeder
Coke
Limestone
Gasifying and direct melting furnace
Third tuyere
Secondary tuyere
Main tuyere
Slag continuous tapping hole
Water granulation conveyor
Steam air preheater
Steam
Third tuyere fan
Secondary tuyere fan
Main tuyere fan
Oxygen generator
Secondary combustion chamber
Radiation Chamber
Boiler
Super heater
Economizer
Turbine
Generator
District Heating
Flue gas recirculation fan
Combustion air blower
Cyclone
Gas cooling tower
Gas cooling water (Reuse water)
Compressed air
Bag filter
Slaked lime, activated carbon
Bag filter conveyor
Fly ash conveyor
Fly ash storage tank
Heavy metal stabilizer
Fly ash treatment equipment (Kneading treatment equipment)
Solid fly ash bunker
DeNOx reactor
Steam gas heater
Induced draft fan
Stack
To furnace
Magnetic separator
Slag yard
Metal yard
Water-granulated slag
Water-granulated metal
Waste
Sub material
Ash
Slag
Metal
Flue gas
Oxygen
Air, recirculated gas
Waste discharge platform
Waste pit and crane
Furnace
Main tuyere
Slag continuous tapping hole
Slag yard
Secondary combustion chamber
Boiler
Gas cooling tower
Bag filter
Turbine and generator
Control room

Total 25 Year Avoided GHG Emissions in MTCO2E for Recycled Slag and Metal from JFE Engineering Thermal Gasification and Ash Melting Process

Description	Rate of Production for JFE Thermal Gasification and Ash Melting Process		Total Metric Tons Recycled in 25 Years			Total 25 Year Avoided Emissions (MTCO2E)		
	Slag (Kg/Hour) per line	Metal (Kg/Hour) per line	Slag	Metal		Slag	Metal	Total Avoided Emissions for Recycled Slag and Metal
JFE-RDF (Upper bound)	1,084	190	474,792	83,220		132,942	149,796	282,738
JFE-RDF (Average)	947	166	414,786	72,708		116,140	130,874	247,014
JFE-RDF (Lower bound)	809	142	354,342	62,196		99,216	111,953	211,169
JFE-RDF+Dewatered Sludge (Upper bound)	1,008	177	441,504	77,526		123,621	139,547	263,168
JFE-RDF+Dewatered Sludge (Average)	888	156	388,944	68,328		108,904	122,990	231,895
JFE-RDF+Dewatered Sludge (Lower bound)	1,147	201	502,386	88,038		140,668	158,468	299,136

Note: Avoided emissions factors for recycling from WARM v12.1; glass (slag) = 0.28 and steel (metal) = 1.8 MTCO2E/ton recycled (slag used as glassphalt, and metal to foundary); upper and lower bound refers to the variation in component composition of the waste characterization of the 1000 tons/day post recycled mixed waste MRF residual; JFE Engineering process for the White Paper scenario requires two process lines.

APPENDIX 7

Expanded Emissions Calculations Table for Various Scenarios

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EXPANDED EMISSIONS CALCULATIONS TABLE FOR VARIOUS SCENARIOS

Following is an expanded table that shows the 125-year cumulative GHG emissions for all modeled components and scenarios performed for the White Paper, provided for additional informational purposes. The scenarios include assumptions for digestate from anaerobic digestion, which is assumed to not be composted, but sent to an energy recovery facility (gasification or incineration). The expanded table also shows the gasification emissions for the average, upper, and lower bound waste composition variations. Additionally, the LandGEM model was utilized to calculate the 125-year GHG emissions for a landfill with a cap and flare, and for a scenario in which landfill gas is collected for a landfill gas to energy scenario.

The table references the corresponding White Paper appendices from which the results were derived, and highlights the results used in the White Paper Executive Summary (Table 1-ES).

COMPARATIVE GREENHOUSE GAS EMISSIONS FOR YEARS 2014 TO 2138 FOR THE TREATMENT OF 1000 TON PER DAY (FOR 25 YEARS) OF POST RECYCLED MRF RESIDUAL
(in metric tons of carbon dioxide equivalent, MTCO2E)

SCENARIO	EMISSIONS (Years 2014 TO 2138): 125 Years						
BASELINE SCENARIO: POST RECYCLED RESIDUAL TO LANDFILL (1000 TPD)	**TOTAL EMISSIONS**	**BIOGENIC EMISSIONS**	**NON-BIOGENIC EMISSIONS**	**INDIRECT EMISSIONS**	**AVOIDED EMISSIONS**	**NET EMISSIONS (biogenic and non-biogenic)**	**NET EMISSIONS (only non-biogenic emissions)**
TOTAL OF TRANSPORTATION AND LANDFILL OPERATONS EMISSIONS (Cap / LFG-to-Energy)	**5,357,275**	**2,479,735**	**2,877,540**	**0**	**1,241,000**	**4,116,275**	**1,636,540**
Transportation to Landfill (25-yr Landfill Operation) (EMFAC2011)	25,946	-	25,946			25,946	25,946
Landfill Operation (with cap/LFG-to-energy) (CalEEMod, LandGEM) Lo = 100, Capture rate = 83%	5,331,329	2,479,735	2,851,594		1,241,000	4,090,329	1,610,594
ALTERNATIVE SCENARIO: INTEGRATED MRF WITH CONVERSION TECHNOLOGY	**TOTAL EMISSIONS**	**BIOGENIC EMISSIONS**	**NON-BIOGENIC EMISSIONS**	**INDIRECT EMISSIONS**	**AVOIDED EMISSIONS**	**NET EMISSIONS (biogenic and non-biogenic)**	**NET EMISSIONS (only non-biogenic emissions)**
TOTAL OF INTEGRATED MRF AND CONVERSION TECHNOLOGY COMPONENTS	**8,931,770**	**5,462,299**	**3,266,635**	**202,835**	**4,135,493**	**4,796,277**	**(666,022)**
MRF Preprocessing (Anaergia EpE) [a]	0	-	-	-	1,646,938	(1,646,938)	(1,646,938)
Anaerobic Digestion (Digestate to Composting) (EpE) [a]	842,815	740,338	102,477	-	563,389	279,426	(460,912)
Anaerobic Digestion (Digestate to Incineration) (Anaergia EpE) [a]	909,848	740,338	169,509	-	563,389	346,459	(393,879)
Composting of Digestate (Anaergia EpE) [a]	342,435	177,942	164,493	-	9,667	332,768	154,826
Incineration RDF (Digestate Composted) (EpE) [a]	7,924,617	3,567,428	4,357,189	-	1,317,734	6,606,884	3,039,456
Incineration RDF + Digestate (EpE) [a]	8,977,602	4,606,509	4,371,092	-	1,427,986	7,549,615	2,943,106
Landfill Operation (with cap/flare) (EpE) [a b]						161,855	161,855
Incineration - Digestate Land Applied (WARM)	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	1,432,625
Incineration - Digestate to Gasification (WARM)	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	1,213,625
RDF (Upper bound) Gasification and Ash Melting	8,557,703	5,055,120	3,286,662	215,922	1,851,691	6,706,013	1,650,893
RDF (Average) Gasification and Ash Melting	7,728,236	4,537,816	2,987,584	202,835	1,668,485	6,059,751	1,521,935
RDF (Lower bound) Gasification and Ash Melting	6,882,717	4,019,707	2,679,805	183,206	1,485,279	5,397,439	1,377,732
RDF+Digestate (Upper bound) Gasification and Ash Melting	9,595,051	5,766,380	3,534,233	294,438	1,832,062	7,762,989	1,996,610
RDF+Digestate (Average) Gasification and Ash Melting	8,588,165	5,165,959	3,193,198	229,008	1,668,485	6,919,680	1,753,721
RDF+Digestate (Lower bound) Gasification and Ash Melting	7,649,722	4,594,729	2,852,158	202,835	1,629,226	6,020,496	1,425,767
RDF, Slag and Metal Recycling from Ash Melting Process (Upper Bound) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	282,738	(282,738)	(282,738)
RDF, Slag and Metal Recycling from Ash Melting Process (Average) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	247,014	(247,014)	(247,014)
RDF, Slag and Metal Recycling from Ash Melting Process (Lower Bound) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	211,169	(211,169)	(211,169)
RDF+Digestate, Slag and Metal Recycling from Ash Melting Process (Upper Bound) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	263,168	(263,168)	(263,168)
RDF+Digestate, Slag and Metal Recycling from Ash Melting Process (Average) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	231,895	(231,895)	(231,895)
RDF+Digestate, Slag and Metal Recycling from Ash Melting Process (Lower Bound) (WARM)	Included in Process	Included in Process	Included in Process	Included in Process	299,136	(299,136)	(299,136)
Landfill of Post Integrated MRF Residuals							
Transportation to Landfill (25-yr Landfill Operation) (EMFAC2011)	4,404		4,404			4,404	4,404
Landfill Operation (with cap/flare) (CalEEMod, LandGEM)	13,880	6,202	7,678			13,880	7,678

Definitions:

Direct Emissions - Emissions directly related to solid waste management activities such as at a landfill site. In this comparative study, direct emissions are further divided into biogenic and non-biogenic [CO_2] emissions

Biogenic [CO_2] Emissions – Emissions resulting from production, harvest, combustion, digestion, fermentation, decomposition, and processing of biologically based materials or biomass, such as combustion of biogas collected from biological decomposition of waste in landfills or combustion of the biological fraction of municipal solid waste or biosolids. Biogenic [CO_2] emissions are carbon neutral and has zero GHG impact

Non-Biogenic [CO_2] Emissions – Emissions that are not considered as biogenic CO_2 emissions, such as emissions from combustion of fossil fuels, of materials of fossil fuel origin (e.g., plastics) and from other non-combustion processes, such as fugitive methane emissions from landfill operation or oil and gas production. Methane emissions is not carbon neutral, regardless of its source, biogenic or non-biogenic, it is considered as non-biogenic [CO_2] emission in this study

Indirect Emissions – Emissions from purchased electricity, heat, or steam

Avoided Emissions – Emissions avoided due to power generation (replacing fossil fuels) or from emissions avoided by recycling (e.g., energy savings)

Total Emissions = Biogenic + Non-Biogenic Emissions

Net Emissions = Total Emissions – Avoided Emissions

a. All Source 2 Emissions, all Avoided Emissions and Scope 1 Natural Gas Emissions were derived from factors which were CO2 Equivalent factors, rather than factors for CO2, CH4 and N2O individually, so these numbers could not be updated to Global Warming Potentials based on the 5th Assessment Report or modified to California Grid numbers. Only Scope 1 Emissions were updated.

b. Landfill numbers are based on US EPA WARM Model which could not be updated to Fifth Assessment Report GWP factors, and Biogenic could not be separated from Non-Biogenic. Pacific Region was used for calculations.

APPENDIX 8

Peer Reviewer Comments and Responses

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COMPARATIVE GREENHOUSE GAS EMISSIONS ANALYSIS
PEER REVIEW COMMENTS AND RESPONSES

COMMENTER	No.	COMMENT	RESPONSE
Commenter A - RKhoshbin@unex.ucla.edu	A1	Just one comment, the UCLA Extension Engineering Certificate student should be the title on the acknowledge page. Currently it reads: UCLA Engineering ….	Comment Noted; text has been revised.
Commenter B - jrmiller@jrma.com	B1	I found one typo – But should be BTU in the fourth line under Table 7 on Page 30.	Comment Noted; text has been revised.
Commenter C - Robert B. Williams, P.E. Development Engineer Bio. & Agr. Engineering California Biomass Collaborative University of California, Davis, CA 95616 (o) 530.752.6623	C1	A basic, low-level description of how processes within the scenarios actually work and create emissions (landfills, composting, AD, gasifier, MRF, etc.) to bring along readers who are unfamiliar would be helpful (I saw some of this in the appendices).	Figure 4 has been added to the text to better describe GHG emissions, sinks and GHG emissions offsets for the types of processes analyzed. Further description of the various technologies has been added to Section 5 and Appendices 3 through 6.
	C2	I think some more discussion of results would be helpful, what do they mean, how sensitive are they to changes in assumptions, how do they compare to other studies, etc.	More discussion has been added to Section 7 to further explain results in Table 12. An alternative model run was performed for the baseline (see Section 4) which showed that GHG emissions are still greater for the baseline landfill disposal scenario due to higher avoided emissions with the alternative scenario.
	C3	Figure ES-1 : It would be helpful to explain / describe the individual cells in this table near where you call out the table in the text. For example, what emissions are avoided in the MRF preprocessing stage (-1.65 million MTCO2e)? & what causes large biogenic emission from the gasifier. Landfill scenario has significant fugitive methane emissions which is why is important to not bury wet biomass, etc. Are you sure the Alt. Scenario has -600,000 tonnes of net non-biogenic emissions? What does it meant to have 'avoided emissions'. Some discussion on meaning of results and sensitivity to assumptions is needed here and in main text.	The Executive Summary has been shortened to provide high level overview with details in the body of the White Paper and appendices. Additional explanation of results in Table 12 has been added to Section 7.
	C4	It is implied that non-biogenic emissions = anthropogenic emissions (Exec. Summary): This appears to be non-standard definition and is confusing. By definition, ALL emissions from waste management sector are anthropogenic (anthropogenic emissions can include both biogenic and fossil derived C in the CO2e emissions – methane can be biogenic or fossil derived as well, but biogenic methane is not neutral or zero unless it is oxidized to (biogenic) CO2).	Definitions have been revised for additional clarity in Tables 11 and 12.
	C5	Carbon is defined as either biogenic (from recently living plant or animal matter) or fossil derived (which includes Pete). CO2 emissions are therefore biogenic or of fossil origin. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/0_Overview/V0_2_Glossary.pdf	Definitions have been revised for additional clarity in Tables 11 and 12.
	C6	SECTION 5 Would like to see a summary results table and discussion here for MBT pre-proc, AD and composting rather than going to the appendix. These should be same numbers used to build table ES1.	A results table for pre-processing, AD, and composting has been added to Section 5. Additional summary discussion has been added to Section 5.
	C7	FIGURE 3 Mass Balance: Mass balance is incomplete. To improve credibility, should fix the mass balance (otherwise, can lead critics to wonder what else is omitted from the analysis).	Footnote has been added to Figure 3 regarding input tons.
	C8	1000 t/d enters system from the left but only 362.3 t/d is shown leaving the system (as horizontal arrows pointing to the right). Where is missing 640 t/d?	1,000 tpd = 518.4 t/p (dry fraction) + 302.5 t/p (wet fraction) + 128.6 t/d (non acceptable/non-putrescible materials) + 50.4 t/d (recyclables).
	C9	Missing is mass in the biogas, and producer gas from the gasifier, gaseous emissions from composting and water vapor from various processes and ??. If you use mass of exhaust from biogas combustion and producer gas combustion, then need to include mass of air & oxygen used for gasification and combustion.	This is a general mass flow of tons of actual materials (e.g., MSW, and resulting tonnage to recyclables, disposal to compost, etc.). A footnote has been added to Figure 3 to clarify.
	C10	Also missing is coal/coke input to gasifier, which is ~ 6 -8% of RDF mass depending on case. Should be upfront with coal input to gasifier and include it here in the mass balance diagram (goes to transparency and credibility).	A Process Flow graphic for modelled gasifier (in Appendix 6) has been added to the text.

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COMPARATIVE GREENHOUSE GAS EMISSIONS ANALYSIS
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COMMENTER	No.	COMMENT	RESPONSE
	C11	THERMAL GASIFICATION EMISSIONS Section: The schematic of the JFE gasifier-close-coupled -combustion system should be included in this section rather than buried in the Appendix to give the reader a better idea of the system being modeled (transparency). Describe how the gasifier system works and produces electricity, emissions, solids, etc..	A Process Flow graphic for modelled gasifier (in Appendix 6) has been added to the text.
	C12	(Above Tables 3&4)The emissions definitions are as follows: Similar to comment in executive summary: This is non-standard definition and use of terms (or there is a misconception). By definition, all emissions from the waste management sector are anthropogenic (anthropogenic does NOT = fossil emissions). Suggest the following definitions and nomenclature: Direct Emissions (which include biogenic and fossil CO2e and fugitive methane emissions [NOT counted as biogenic CO2e]) Indirect Emissions Avoided Emissions Total = Direct +Indirect Net = Total – Avoided and finally, assuming biogenic C is neutral or has zero GHG impact, Net(biogenic C=0) = Total-Avoided-biogenic CO2	Definitions have been revised (above Table 3 and 4) to provide additional clarity.
	C13	TABLES 3 & 4: It would be helpful to explain the basics of the emissions categories and the gasifier process that is modeled. Because the gasification section accounts for the lion's share of GHG emissions in the Alt. Scenario it would be helpful to lay readers to explain why each of the emissions types in the table are so high; Why are total emissions and biogenic emissions are so large? What accounts for biogenic emissions in the gasifier process (it is biogenic components of the RDF but should be made clear)? What causes the fossil CO2 emissions in the process? (coal/petcoke co-feed and plastics in the RDF and other?). How does the gasifier create avoided emissions?	Expanded emissions definitions for Tables 3 and 4 are included just prior to the tables in Section 5 (as revised in Response to Comment C12 above). The Biogenic Emissions for the gasification process are large due to the conversion of biogenic components of RDF to carbon dioxide and water. The fossil CO2 emissions due to the use of coke as a heat source are higher for the reference facility than a facility that would be permitted in SCAQMD in Southern CA. The avoided emissions for the gasifier are due to power generation replacing fossil fuels. This information and additional language explaining the results of the analysis presented in Table 12 is included in Section 7.
Commenter D - Keith Thomsen kdthomsen@tricity.wsu.edu	D1	Section 1 - I'm curious if you considered the impacts of combining the "MRF-First" option with generator separation methods (wet/dry; paper, plastic, glass, etc.) that have been used in Europe, Canada and to a lesser extent, in the US?	This is what is modeled. MRF first means that the mixed waste is dirty MRFed, or the waste that went through the transfer station portion of the dirty MRF was already source separated (e.g., residential curbside).
	D2	Section 1 - Is there a specific technical reason not to at least consider the GHG impacts of using AD for all organics, not just those that are wet?	The AD process modelled doesn't work well on plastics, textiles, rubber, etc.. The process flow analysis is based on an actual wet / dry system employed in European facilities.
	D3	Section 2 - A major limitation of any GHG model that uses a lifecycle viewpoint is the need for careful definition of the boundaries and boundary conditions. As such, it is vital to carefully define both. I had a difficult time finding this explicitly defined in this study.	The original title of the White Paper has been revised to remove "Life Cycle". The study assumptions used for the models are summarized in the text and appendices. The manuals for the models describe the limitations. The input parameters for models and assumptions were referenced in the text.
	D4	Section 3 - Did the waste comp data use the assumption that the data are normally, or log-normally, distributed? I did an analysis of the distribution of waste comp data in 2000 using data from SRREs in Southern California that indicated that many of the component waste streams may be log-normally distributed.	The composition is based on the CalRecycle Statewide study of residuals from mixed waste MRFs. A link to the study has been provided for Table 1 that provides detailed information on the study methodology and assumptions.

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COMPARATIVE GREENHOUSE GAS EMISSIONS ANALYSIS
PEER REVIEW COMMENTS AND RESPONSES

COMMENTER	No.	COMMENT	RESPONSE
	D5	Section 6 - I'm curious as to why you didn't consider the impact of PM as an important pollutant impact from solid waste systems? The impacts in terms of the human population can be significant and solid waste activities can be a major source of PM 10 and PM 2.5, both of which have major human health impacts.	Data sources for PM for each of the processes analyzed were not available.
	D6	Section 7 - You should include a clear definition in the narrative that makes the distinction between biogenic emissions and non-biogenic emissions. It is difficult from the data to understand how these two terms differ.	See response to Comment C12.
Bureau Manager City of Long Beach - SERRF 120 Pier S Ave. Long Beach, CA 90802 Ph. 562.570-7840 Charlie.Tripp@LongBeach.gov	E1	The flow diagram of the AD process shows a 17% reduction in the wet waste going into the AD vessel when compared to the leftover digestate . 302.5 tons in and 250 tons out based on a days operation. If this digestate is used for compost, the mobile source gHg's maybe significantly more then out of county landfill disposal since compost use sites are greater distances then Orange County and Riverside County landfills. Is this small reduction in organic waste by employing AD really economical?	Cost was not considered in the analysis. The study goal was to evaluate a scenario that maximized beneficial use of materials and diversion from landfills. Comment noted regarding mobile source GHG emissions for transport to compost use sites out-of-County. The analysis boundary did not include transport of compost to a receiving facility which would likely be a greater distance than an out-of-County landfill which emissions were 4,404 $MTCO_2E$ for transporting 136.5 tpd. The transport emissions did not have a material effect on the analysis results so a longer haul distance and higher tons associated with transport to a distant compost use site are not antipated to have significant effect on the analysis results.
	E2	It would also be interesting to compare the actual costs of implementing and operating a MRF/Conversion Technology facility vs. MRF/ landfill if Anthropogenic Carbon credits are required to be purchased. Perhaps the carbon credit purchase savings could justify the added expense of implementing and operating a MRF/Conversion Technology program. This could level the playing field with landfilling.	Comment noted. A cost analysis was outside the scope of this White Paper.
Commenter F - Nurit Katz Chief Sustainability Officer and Lecturer, UCLA Instructor, UCLA Extension (310) 206-6667 (818) 384-9493 m www.sustain.ucla.edu	F1	Finally had a chance to read the report last night! What an exciting and important paper and so fitting since I was just arguing with someone this week about waste conversion (she's from Sierra Club zero waste). The methodology seems sound, I realize you have technical experts reviewing it as well for those parts. I found it clear and readable and well organized. I'm not sure what sort of feedback you'd like. I definitely want to share it with our UC Policy group when its ready. I am VERY supportive of this approach. I really like the pyramid/hierarchy design and I think this paper may be critical in getting the anti waste to energy people to take a more nuanced view and understand that it is a critical part of zero waste	Thanks for the comments.
Commenter G - Professor Jocelyn Lin University of West Los Angeles Law School International Environmental Sustainability Law and Policy	G1	The integrated "MRF" first method with conversion technology used in comparing different scenarios is consistent with the generally accepted international (EU/Asia) and U.S. EPA's integrated waste management hierarchy that promotes source reduction and reuse first, recycling/composting second, energy recovery third and then treatment and disposal.	Thanks for the comments.
	G2	The data from this report shows and supports that an integrated MRF with conversion technology comprised of a selected combination of best-in-class technologies will achieve a net reduction in cumulative GHG emissions as compared to direct landfill transport and disposal.	Thanks for the comments.
Commenter H - Gary M. Petersen, Chairman Green Seal	H1	In keeping with the goals that were developed in 2006 to further the support and development of emerging technologies I found that the document prepared by the County of Los Angeles, Tetra Tech Inc., HDR Engineering and E. Tseng & Associates met the intent of the CIWMB/CR's Strategic Directive (SD-9).	Thanks for the comments.

COMMENTER	No.	COMMENT	RESPONSE
	H2	Particularly, Strategic Directive 9.2 which calls for the encouragement of the development of alternative energy and biofuels. This also relates to the significant reduction of greenhouse gas emissions created by solid waste that is produced every day here in California. The document clearly demonstrates the need for the development of Conversion Technologies in the state and for the significant reduction of our reliance on landfills.	Thanks for the comments.
	H3	"The comparative Life Cycle Greenhouse Gas Emissions Analysis of Alternative Scenarios for Treatment and/or Disposal of 1000 tons per Day of Post-Recycled Residuals from a Mixed-Waste Materials Recovery Facility" clearly shows a defining impact these technologies can have to greatly improving the recovery of more materials for recycling, the production of energy or fuels and the reduction of greenhouse gases.	Thanks for the comments.
	H4	Another observation with regard to the Waste Management Hierarchy Graphic is that it should be called out under the conversion/compost section that other products that these technologies produce are "Energy, Fuels and other High End Organic Products". This would clearly delineate the benefits that these processes produce to help decision makers and stakeholders to understand at a glance how the hierarchy has changed and developed because of emerging technologies.	Thanks for the comments A footnote has been added to the Waste Management Hierarchy graphic for Conversion saying " Conversion refers to energy, fuels and/or products."
	H5	In discussions with peers and the environmental community a new concurrence was reached to define MRF residuals as "residual materials" not " residual waste". It is not correct to label these materials as residual waste if used to produce other products such as energy, fuels or other high end organics. Only when MRF residuals are delivered to a landfill should the term "waste" be used. Again, this is to clearly define to decision makers and stakeholders what is actually occurring in the process of handling our "discarded materials".	Thanks for the comments. Reference to "residual waste" has been revised to "residuals" in the White Paper.
	H6	The document was well researched and written and exhibited the environmental benefits the phase-out of landfilling our waste will have and instead using these materials as product producers. It also shows that CalRecycle needs to support these technologies to further the goals set by the old CIWMB Board and the future of maximizing the use of our resources.	Thanks for the comments.
Commenter I - Russ Kingsley, Principal Engineer, Yorke Engineering, LLC Rkingsley@YorkeEngr.com 31726 Rancho Viego Road, Suite 218, San Juan Capistrano, CA 92675	I1	The White Paper concludes that the conversion technology, including thermal gasification, is the preferred alternative based on minimizing the quantity of material to landfill, despite having higher greenhouse gas (GHG) emissions (i.e., a smaller GHG reduction) than the non-conversion technology alternative presented. Several aspects of the analysis lead us to believe that this conclusion may be considered insufficiently substantiated, including:	
	I2	The minimization of waste to landfill applies what may be perceived as a subjective prioritization of landfill space above GHG emissions reductions. Given the potential consequences of global warming, California's very aggressive goals for GHG emissions reductions, and the stated intent of the White Paper to evaluate the GHG lifecycle of the disposal alternatives, consider giving the minimization of GHG emissions a higher priority in the analysis.	Reduction in GHG emissions is a priority for the White Paper as the alternative scenario is intended to address AB 32 and associated regulations to reduce GHG emissions (see Page 16 of the White Paper). Minimization of landfill disposal and maximum beneficial use of materials is a facility design priority to meet the State's MRF first policy.

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COMPARATIVE GREENHOUSE GAS EMISSIONS ANALYSIS
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COMMENTER	No.	COMMENT	RESPONSE
	I3	The thermal conversion technology relies on coke combustion. Given that coke is a fossil fuel and has a very high rate of GHG emissions per unit of heat input, promoting a technology that encourages the combustion of coke could be considered contrary to California's GHG reduction goals. In addition, the South Coast Air Quality Management District (SCAQMD) has determined natural gas fuel to be the Best Available Control Technology (BACT) for combustion sources in the South Coast Air Basin; thus, coke combustion is generally discouraged.	Emissions calculated for the reference facility are conservative for Southern California. The reference facility assumes electricity generation through combustion in an internal combustion engine which may not be permitted by SCAQMD and a coke-fired furnace would likely not be permitted. Wood biomass as charcoal may be used instead of coke which would reduce emissions (Page 41 of the White Paper). The reference facility was selected due to availability of very detailed mass, energy and emissions data.
	I4	One stated benefit for encouraging the thermal gasification option is the production of a recyclable byproduct of vitrified ash for "use as paving blocks, road base, and other construction materials" (page 16). We caution making this claim, as approved use of such materials in California lacks documentation. Many years ago, Marine Shale Processors (MSP) (in Arkansas) attempted a similar strategy in which residuals from hazardous waste incineration were to be recycled into road base. MSP was subsequently sued by the Environmental Protection Agency (EPA) for "sham recycling," as they were unable to consistently find customers for this material while they continued to produce it speculatively. While the proposed process is not processing hazardous waste, based on the technology, it is possible that the residuals will have some heavy metal content. Thus, unless a specific market or customer can be identified, we recommend qualifying the use of this material in some way in the White Paper and omitting the benefits of producing this material from the analysis.	Markets for these recyclables exist in Japan, and the specifications would have to meet standards in the U.S. for use as recyclable products (Page 31 of White Paper).
	I5	Operation of the thermal gasification system generates almost as much GHG [1,521,935 metric tons (MT)] as the Materials Recovery Facility (MRF) Preprocessing (EpE) system eliminates (1,646,938 MT) over the life of the project (Table 1-ES, Table 12). Aside from a minor reduction in the quantity of material going to landfill and the recovery of low-value materials for road base or other fillers, the White Paper may be construed as lacking sufficient justification for pursuing an expensive, complex treatment system. For these reasons, concluding that the thermal conversion technology is the preferred alternative could raise concerns from a lack of support in the analysis. Consider presenting the alternative not involving the conversion technology as an equally viable option in the conclusions, or at least another viable option.	This is a very valid point. A primary study parameter was maximum diversion from landfill to assess GHG emissions impacts (that is why Anaerobic Digestion, thermal gasification and composting were assumed). Cost was outside the scope of this White Paper. Under an alternative scenario with no gasification, the dry material would go to the landfill which would add to the Baseline Scenario GHG emissions.
	I6	We suggest that the nature of the thermal gasification process be explained in the body of the report. While a process flow diagram (PFD) is provided in Appendix 6 (page 162), since thermal gasification is a very complex system, it would benefit the reader to understand the nature of the process that is being proposed via a plain-language description. Please also consider moving the PFD for the process into the body of the report.	The process flow diagram has been included in the text of the White Paper.
	I7	The White Paper refers to an alternative operating scenario in which a flare is used as the control technology for the landfill gas emissions. The justification of "residuals being insufficient for LFG-to-energy" (page 6) was offered. For the purpose of this evaluation, we suggest that the flare option be omitted. A modern, state-of-the-art landfill uses LFG-to-energy, and for the duration of the project being evaluated (i.e., 25 years or 125 years), any landfill considered for disposal of residuals will have sufficient LFG from non-project disposal to supply an LFG-to-energy system with LFG of sufficient heat content for energy production. The residuals from this project would have little or no measurable impact on the heat value of the LFG from an existing landfill. The inclusion of this operating scenario complicates the analysis with perhaps not a large corresponding benefit to the reader.	The calculated GHG emissions for disposal of residuals from the Integrated MRF with Conversion Technologies facility, assuming a landfill with cap and flare, does not have a material effect on the results and the emissions would be lower assuming a landfill with LFG to energy (see Section 7, Table 12 discussion).

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	I8	The GHG emissions summaries (Table 1-ES, Table 12) appear to omit transportation emissions for product or raw material shipment. Slag, metals, and compost produced on-site would need to be trucked to receiving facilities, and coke would need to be shipped to the site. Given the tonnage involved, between 5 and 10 trucks per day would be required (i.e., between 10 and 20% of the trucks required for landfill). Considering the availability of specific of metal recycling and agricultural facilities in the immediate Los Angeles area, the distance to a suitable agricultural area for the compost or a suitable metals recycler for the metal slag may be substantial. Consider including transportation emissions for these materials in the analysis.	The analysis boundary did not include the transport of coke to an Integrated MRF with Conversion Technologies facility or the transport of compost and slag (175.4 tpd) to a receiving facility. The transport emissions would be on the order of transport of post Integrated MRF with Conversion Technologies residuals (136.5 tpd) to a distant landfill (4,404 MTCO2E) which are not on a scale to have a material effect on the results (see Page 43, Section 7, Table 12 discussion in White Paper).
	I9	The basis for calculation of the NOx and SOx emissions in Tables 5 and 10 could be explained better, although Tables 8 and 9 suggest that a NOx concentration of 57.7 ppm and a SOx concentration of 1.5 ppm were used. Neither of these concentrations were the lowest values reported in Table 6. Due to the attainment status of the South Coast Air Basin, the SCAQMD will require the use of BACT to ensure the lowest possible NOx and SOx emission rates from any new emissions unit. As such, use of the lowest emission rates for NOx and SOx achieved in practice would be appropriate for NOx and SOx emission calculation purposes.	The Japanese reference facility was used for consistency with the remainder of the analysis. It has been noted (in discussion of Table 10) that a Los Angeles based facility would have to meet strict SCAQMD air pollution control requirements which should be lower than the calculated emissions of the Japanese reference facility.
	I10	The second sentence in the last paragraph on page 37 reads as follows: "A cap and flare with landfill gas-to-energy scenario emits 3.5 million MTCO2e over a 125 year period." This sentence may cause confusion; we recommend deleting the words "and flare" from the sentence for clarity if that indeed makes sense with the way the analysis was constructed.	This text has been revised with updated analysis results and reference to "and flare" has been removed.
	I11	Appendix 5, in the table entitled "Summary of GHG Emissions from EpE (updated with Climate Registry Factors)," lists GHG emissions for Landfilling, Scope 3 — with Carbon Sequestration and Scope 3 — without Carbon Sequestration in both the Scenario 1 and Scenario 2 sections. Carbon sequestration was not discussed in the White Paper. Carbon sequestration may be extremely challenging to implement and would likely require substantial amounts of electricity (for compression and pumping), resulting in considerable additional indirect GHG emissions. Based on our review, it does not appear that these impacts were accounted for in the analysis. If carbon sequestration is part of the proposed operating scenario, we recommend providing additional explanation; otherwise, consider omitting carbon sequestration from the presentation.	This paper was intended to evaluate non-biogenic emissions and does not consider carbon sequestration.
Commenter J - Robert C. Ferrante, Assistance Chief Engineer and Asst. General Manager, County Sanitation Districts of Los Angeles County, 1955 Workman Mill Road, Whittier, CA 90601, (562) 908-4288, ext. 2475	J1	Because unrealistically low Landfill Gas (LFG) capture efficiency was employed and landfill carbon sequestration benefits were excluded, the white paper does not accurately analyze GHG emissions from landfill.	Additional analysis was performed using 83% landfill gas capture efficiency (per CARB default value) and is being used for the Baseline case.
	J2	**LFG Collection Efficiency:** In the subject white paper, a landfill gas capture efficiency of 70% (or 30% of methane gas emissions) was assumed for the baseline landfilling scenario. The source of the 70% value is not specified and is not consistent with default values normally used or actual measured values for modern sanitary landfills in the South Coast Air Quality Management District (SCAQMD).	See response to J1.

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	J3	The California Air Resources Board (CARB) has been using a default LFG collection efficiency value of 83% to represent Municipal Solid Waste (MSW) landfills in California in its waste management analysis. For landfills in southern California under the more stringent SCAQMD' s landfill methane surface emissions control rules (e.g., SCAQMD Rule 1150.1), landfill gas capture efficiencies should even be higher. For example, the Sanitation Districts of Los Angeles County (Sanitation Districts) has conducted extensive modeling and field studies (including extensive surface flux chamber field studies) on quantifying landfill gas collection efficiencies. These published studies found that all landfills (active and inactive) managed by the Sanitation Districts have LFG collection efficiencies of at least 90%, and based on the surface flux chamber field study, Puente Hills Landfill, has a LFG collection efficiency of 96% (or only 4% of methane gas emissions, less than one-seventh of the assumption used in the paper). Therefore, it would be more appropriate to use LFG capture efficiency of at least 83% which is more representative of a modern sanitary landfill in southern California.	See response to J1.
	J4	**Carbon Sequestration:** In the landfilling GHG emissions analysis (baseline scenario) of the white paper, using the United States Environmental Protection Agency's (USEPA) LandGEM model, landfill carbon sequestration benefits were not incorporated. Disposed waste directly sequesters a large amount of carbon during the decomposition process. It is well known that landfilling provides for carbon sequestration (USEPA, 2006, Bogner et al., 2008). In addition, CARB recognizes carbon sequestration in its greenhouse gas inventory (CARB generically includes sequestration within its "Sinks" line item). In a recently prepared CalRecycle organic waste management LCA study (CalRecycle, 2009), carbon sequestration was considered for organic waste management options involved in the analysis. The USEPA (2006) also recognizes and incorporates carbon storage (sequestration) in landfills in its GHG inventory life-cycle analysis. In short, landfill carbon sequestration is recognized by many leading environmental entities, such as the USEPA, CARB, and CalRecycle, as a significant factor in analyzing GHG impacts of waste management activities, and should be considered in a thorough scientific GHG life-cycle analysis for waste management options. It would be more accurate and more consistent with other research to include carbon sequestration.	This paper was intended to evaluate and compare non-biogenic emissions so does not consider carbon sequestration in either scenario.
	J5	**Landfill Methane Generation Potential:** A potential methane generation capacity (Lo) of 114 m3/Mg has been used for the landfilling scenario (baseline scenario). The source of this Lo is not specified and is not consistent with the default Lo used in most methodologies and is significantly higher than recent analysis from actual landfills. While the current USEPA and CARB GHG inventory methodologies use 100 m3/Mg as default value for L, The USEPA has initiated efforts to refine parameters, including default Lo value (to lower, e.g., Lo=60 m3/Mg), for its Waste Reduction Model and other GHG emissions models. Sanitation Districts' own gas projection modeling work estimated an average Lo of 68 m3/Mg for Sanitation District's six landfills. At a minimum, an Lo of no more than 100 m3/Mg should be used.	Additional analysis was performed using USEPA and CARB default value for landfill methane generation potential L_o = 100m^3/mg and is being used for the Baseline case.

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	J6	**Avoided Emissions from Landfill Gas-to-Energy:** In Table 4 of Appendix 1, it appears that an energy production of 7.65 MW for 125 years was assumed to determine the avoided GHG emissions from alternative fossil-fuel energy production. In reality, the energy production from the landfill gas-to-energy facility will vary over time as gas production changes.	When landfill gas production volume is below the required fuel volume to power the generator, the calculation of avoided emissions ends, so there is no over-estimation of avoided emissions.
	J6	Furthermore, it would be helpful if the emissions factor used to determine avoided emissions was listed; it is not possible to confirm the accuracy of the table without knowing the factor. It appears the factor is not consistent with emissions from incremental natural gas-fired energy production that the landfill gas-to-energy facility offsets.	Avoided emissions (Table 4 of Appendix I) is based on California specific factors (from ARB). Avoided emissions was calculated using USEPA "Emission Reduction and Enviornmantal and Energy Benefits for Landfill Gas Energy Project",, where CA-specific emission factor of 0.0170 MMT CO2/Yr was used. Please see Appendix C of Appendix 1 - Tetra Tech White Paper of LandGEM Landfill Emission Analysis.
Commenter K - Adi Liberman, Environmental Outreach Strategies	K1	Question about scenarios. Am I correct that the two scenarios are as follows? You may need to clarify the comparison? a. Baseline Scenario: Looks at impacts of 25 years of landfilling and the emissions from those 25 years of landfilling, which are expected to be releasing over a 125 year period.	Emissions will continue to be generated (assumed for 100 years) after 25 years of landfilling.
	K2	b. Conversion Scenario: Looks at impacts of 25 years of waste conversion and the related emissions over those 25 years.	After 25 years, landfill emissions for residuals from Integrated MRF with CT facilities (very small) is calculated for 100 years after 25 years of transport to landfill.
	K3	Does your analysis take into account the comparison of the emissions associated with the construction of the landfill vs. the construction of the waste conversion facility?	Yes (very minimal when compared to operations).
	K4	Are there other key differences in infrastructure that might exist between the two scenarios that should be part of the analysis? For example, in Southern California, landfills tend to be located in canyons. Conversion facilities, on the other hand, could be built anywhere. If you follow that logic, you may be able to create smaller and more distributed conversion facilities (as compared to landfills). Could these differences in locations lead to a significant difference in emissions? For example, could one scenario involve much less truck transportation than the other? And the, would less truck transportation lead to less traffic congestion?	Utilized same landfill for disposal from both scenarios and assumed same processing capability. Transport to the conversion technology facility not factored as it was assumed to be co-located with an existing Mixed Waste MRF.
	K5	Does the analysis take into account the life cycle emissions associated with the equipment manufactured for each site? For example, the landfill will be utilizing bulldozers. Manufacture of those bulldozers is associated with emissions. The same goes for the conversion option. How does the study treat these differences?	Not taken into account in the analysis. The study title was revised to remove reference to "lifecycle" analysis.
	K6	In section 3, you describe the composition of the waste stream. The waste stream has changed over times and can vary from location to location. Is there a reason you did not provide ranges to reflect the variability of waste composition?	Ranges were provided (standard deviation and confidence levels) in Table 2. Full details available from CalRecycle for 2005 Waste Composition Study.
	K7	In measuring the benefit of recovering metals and other materials, do you take into account the emissions avoided by the reduction in the demand for virgin materials?	Yes, part of WARM model utilized.

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	K8	P. 5: The graphic illustrations of the two scenarios in the report are very important to the reader's understanding of the how the two scenarios differ in fundamental ways. I suggest that you need to make a fundamental change in these graphics. In particular, I suggest that the alternative scenario show one more arrow pointing away from the box showing "Integrated MRF with Conversion Technology" and towards a box and is representative of the ways in which the converted waste can be usefully reused. The point is to show that the Alternative Scenario takes material away from the linear approach of waste to landfill and instead has a new branch that takes waste towards reuse. If you need me to illustrate my recommendation, I would be glad to do so.	This would create too complicated a figure for the Executive Summary. Figure 2 of the White Paper presents the various end products/materials from the Integrated MRF with Converstion Technologies scenario.
	K9	Table 1-ES is also a very important table. I suggest that you leave this table as it is, but recommend that you break down some of the comparisons in that table into smaller graphics. For example, you may consider separate graphics comparing net emissions, avoided emissions, etc.	The Executive Summary is intended to provide a broad overview of findings. Results are broken down in various tables in the body of the White Paper and in appendices.
	K10	Figure 1-ES is also a key source of information. I suggest that the figure indicate more clearly that the line between the red and green areas is the 0 (zero) net emissions line.	Figure I-ES has been revised accordingly.
	K11	Figure 1 on page 14 is a very important graphic, but what it depicts is not explained in the text. I suggest a more thorough explanation of the two different paradigms that the two triangles represent and then follow that with the graphic.	Additional description of the Waste Management Hierarchy paradigm shift has been added to the text and a reference to the County's web-site is included for further information.
	K12	Provide a simpler explanation of what it means to compare the lifecycle greenhouse gas emissions of the two scenarios. Much good work has already been undertaken in the area, so there is no need to figure this out anew -- there are many sources from which you can borrow a description of the comparison that non-technical readers can understand. You will also find in other sources some excellent graphics that describe the greenhouse gas lifecycle comparison analysis.	A typical life cycle for waste management GHG emissions graphic from EPA has been included in Section 1, Figure 4. Figure 4 presents the life cycle stages of material and solid waste management starting with extraction from the earth through acquisition, manufacturing, human use and management of waste products. For each life cycle stage, Figure 4 shows GHG emissions generation, sinks and emissions offsets associated with material acquisition, manufacturing, recycling, composting, combustion and landfilling.
	K13	For each of your tables, try to use larger fonts. Provide more explanation of what each table is about. After each table, provide an explanation of what we learn from the comparisons in the table. Essentially, make it easier for the reader to figure out what the tables and charts say and what they mean.	Fonts were enlarged where feasible. Additional explanation for tables has been provided, particularly for final results in Table 12.
	K14	While the study focuses on a comparison of greenhouse gas emissions, the two scenarios also represent two very different paradigms of how to view the world. You provide some analysis of this topic in Figure 1: Waste Management Hierarchy. This is a good figure, but I recommend you go further. Going further means acknowledging that the two scenarios see the world in two very different ways. Their landfill scenario is, of course, about managing waste. The goal of that scenario is to efficiently put what we call waste "out of the way" in the safest way possible. The waste conversion scenario looks at the world as having no waste. Everything is to be used in some way. What used to be called waste is now going to become either energy or new materials. When those materials are no longer needed, they will be converted again; and the process continues over and over. I do not mean for you to turn your report into a philosophical treatise, but the world is a very different place when there is no waste, just materials. That view of the world is likely to lead to other changes in behavior, practices, tastes, and lifestyles that could lead to further decreases in the emission of greenhouse gases. The analogy is that once you begin driving a more fuel-efficient car, you might begin to look at other ways to be more fuel efficient in your lifestyle.	Comment noted. Additional text has been added to the Paradigm Shift discussion to emphasize new way of viewing solid waste as a resource.

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Commenter L - Javier Polanco, P.E., Division Manager, Solid Resources Support Services Division, City of Los Angeles, 1149 South Broadway, 5th Floor, Los Angeles, CA 90015	L1	Provide definitions of all terminology used in the report, i.e. Mixed Waste Materials Recovery Facility, Integrated MRF, Conversion Technology, etc.	Additional descriptions have been provided for Conversion Technologies (Section 1, Second Paragraph, Page 13), Mixed Waste MRF (Section 1, Fifth Paragraph, Page 14), Integrated MRF with Conversion Technologies (Section 1, under Alternative Scenario, Page 15), Pre-processing (Section 1, Page 14).
	L2	Provide clear and concise assumptions in the report that connect to the attached appendices in order to eliminate fragmentation and confusion	Additional assumptions have been added to Section 5 and are referenced to attached appendices.
	L3	Provide necessary citations and references to assumptions and/or appendices	Additional assumptions have been added to Section 5 and are referenced to attached appendices.
	L4	The document does not explicitly state the assumptions used to conclude there are no indirect emissions calculated for; the mixed waste material recovery facility (MRF); integrated MRF pre-processing equipment; or anaerobic digestion processes; all of which utilize an extensive array of processing equipment. Please provide further clarification regarding emissions from these unit processes. Appendix 7 (Pg. 166) indicates that the waste-to-energy unit generates electricity equivalent to the electrical consumption of the entire plant, thereby assuming a condition of avoided emissions in totality from the MRF. Therefore, is it assumed that electricity generated is from operation of the waste-to energy facility alone? It is recommended that the document explicitly state all the assumptions in the executive summary to avoid confusion.	See EPE model results in Appendix 5 for Pre-processing front end assumptions. "Indirect emissions are accounted for in the gasification and ash melting process but not for the MRF preprocessing and Anaerobic Digestion process because they are accounted for as part of the parasitic loading in the Anaerobic Digestion process module." Explanation for indirect emissions result has been added to discussion of results in Table 12.
	L5	**Executive Summary:** Pg. 6, 4th paragraph, 2nd sentence: "The integrated MRF facility used in this study is modeled after a combination of best-in-class technologies (e.g. the best individual wet fraction [anaerobic digestion and composting] and dry [thermal gasification] process components). " The use of the term "integrated MRF" in this document is misleading. Primarily, the purpose of a MRF is to recover recyclable materials from a waste stream rather than functioning solely to separate wet and dry fractions of the waste stream for the further treatment. The integrated MRF (iMiFR) recovery rate of recyclables materials is 5.0% (50A tons) as stated on Table 2 (Pg. 21), where 74% (37.5 tons) of the 5.0% are metals, and the recovery rates of plastics and paper fibers are insignificant.	Reference to "integrated MRF facility" has been revised to "Integrated MRF with Conversion Technologies facility" to reflect the pre-processing (additional recyclables recovery), gasification and anaerobic digestion components of the model facility. Cal Recycle definition for MRF is "an intermediate processing facility designed to remove recyclables and other valuable materials from the waste stream". CCR, Title 14 definition is a "facility where solid wastes or recyclable materials are sorted or separated, by hand or by use of machinery, for the purposes of recycling or composting".
	L6	**Executive Summary:** Page 6, 4th paragraph, 414 sentence: "The reference facilities used in this White Paper are based on operating facilities in Europe and Asia, ...goals." Demonstrate the reference facilities are specifically designed and manufactured for feedstock generated and disposed of in Europe and Asia. The feedstocks generated in Europe and Asia are significantly different than feedstock generated in the United States (US), more specifically, Los Angeles County. In Asia, all trash is screened by residents before being disposed in their waste bin. Many of the wet organics such as leftover food, etc. are processed at the residence by drying it prior to being disposed of in a separate plastic bag. Dried wastes are ready to be composted and do not generate odors, or cross contamination with other organic wastes, etc. Therefore, in order to obtain realistic generation of emissions produced from the Alternative Scenario, it is imperative to use US generated wastes as feedstock at those 'reference facilities.'	The White Paper analysis utilized California waste composition as input parameters for modeling as well as CA specific factors for emissions calculation (offsets for fossil fuels). Additional clarification of the use of California waste composition input parameters has been added to the Executive Summary and in Section 1 of the White Paper.

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COMMENTER	No.	COMMENT	RESPONSE
	L7	**Section 1:** Pg. 13, 10 paragraph, 15th sentence: "The purpose of the Integrated MRF with conversion technology is to maximize diversion through additional recovery of recyclables not recovered by source separation programs or by a mixed waste MRF." The sentence should state that the primary functions of the iMRF (or MBT) is to separate the wet (organic material) and dry (high BTU) fractions of the waste stream for biological and thermal treatment respectively, and for the removal of hazardous/special waste and problem materials as indicated in Figure 2 (Pg. 15) and Table 2 (Pg. 21). Whereas the recovery other recyclables is a secondary function of the MBT as indicated in Table 2 (Pg. 21).	Noted. The Integrated MRF with Conversion Technologies facility is more than pre-processing. It includes AD, composting and gasification processes which are all part of material recovery and conversion.
	L8	**Section 1:** Pg. 14, Figure 1: Waste Management Hierarchy, "The New Waste Management Paradigm which reverses the Traditional Waste Hierarchy." The City believes that the new waste management paradigm should preserve the "Recycle and Compost" tier of the Traditional Waste Hierarchy, and combine the "Conversion/Compost and Transformation/Waste-to-Energy" tier (as illustrated under the "New Waste Management Paradigm"), under one "Alternative Technology" tier.	This Hierarchy is used by the Los Angeles County Department of Public Works' who has commissioned the study and was also adopted by the Integrated Waste Management Task Force, of which the City of LA is a member.
	L9	**Section 1:** Pg. 16, 1st, 2nd, and 3rd paragraphs: The descriptions of each process are too general, lack details of the equipment, operation, and processes used. These factors impact the types and concentrations of emissions generated. Also, the reader is left to make assumptions about the relevant unit processes since the tables, flow diagrams, and information provided in Appendix 3 (Pgs. 132 and 133), Appendix 4 (Pgs. 136 and 137), and Appendix 6 (Pgs. 140 through 163) do not provide any narrative nor description of the processes, equipment, etc. It would help if each appendix provided a narrative summary for the reader to understand the assumptions made in determining the emissions. This would help to understand the Best-in-Class technologies for individual wet fraction and dry fraction process components as stated Pg. 16.	Body of text is meant to be a general description with all technical details in the appendices. Process flow diagrams and assumptions are provided in the appendices. A narrative summary has been added to Appendices 3, 4, 5, and 6.
	L10	**Section 3:** Page 19, 1e paragraph: "The mixed-waste MRF residuals composition is based on the existing CalRecycle Statewide Study conducted in 2005," does not offer a fair comparison with current residual waste composition estimations. The 2008 Great Recession and economic downturn have caused consumers to change their buying habits. There was also a change in social awareness about the need to reduce their long-term costs of goods and associated disposal costs. Consequently, the 2005 characterization information is outdated and inappropriate for the study. New data must be collected for the study to form reliable conclusions. In 2015 CalRecycle anticipates having updated statewide waste characterization (WC) available; therefore, this report should not be published until it incorporates data from the latest WC from CalRecycle.	This White Paper study was initiated in late 2013 so the 2005 CalRecycle Statewide Composition data was the latest available data.
	L11	**Section 3:** Pg. 21, Table 2: Residual Composition by Material Type and Quality, Is there any explanation as to how Material Group # 33 (Food, 103.5 tpd) recovered 100% of the digestible component (DC) stream, where Material Group # 7 (#1 PET Bottles/Containers 6.6 tpd [Deposit]) recovered 44% of the recyclable stream and 55% of the Refuse Derived Fuel, RDF). Was this conclusion based upon MBT equipment use?	It is based on reference facility, Anaergia, pre-processing equipment experience.
	L12	**Section 4:** Pg. 23: For landfill disposal, the average trip distance per refuse truck was estimated as 47 trip miles (one-way). How was this determined? Will this landfill continue to receive waste until 2038?	Based on average trip distances to nearest out of County landfills (most of which are permitted to beyond 2038) in Ventura, Orange, Riverside, and San Bernardino counties to a Mixed Waste MRF in LA County.

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	L13	**Section 5:** Pg. 25, Sub-Section: MBT Pre-Processing, Anaerobic Digestion, and Composting Emissions: Does the term MBT Pre-Processing refer to the term integrated MRF used in the early sections of the document? For consistency, the term MBT Pre-processing should be used in the document instead of the term integrated MRF, or else define these terms to avoid confusion.	Pre-processing is part of the Integrated MRF with Conversion Technologies facility (pre-processing is the "front end" of the process). Reference to Integrated MRF in the White Paper has been replaced with Integrated MRF with Conversion Technologies facility to avoid confusion with a MRF only process. The use of MBT has been removed from the White Paper since it's a European term.
	L14	**Section 5:** Pg. 25, Sub-Section: MBT Pre-Processing Anaerobic Digestion, and Composting Emissions: This section and throughout the document does not provide any detail of the Anaerobic Digestion and Composting GHG emissions calculations compared to that for transportation, landfill, and gasification. Appendix 5 only lists output values from the EpE model without providing additional information on how these values come about. Based on the information provided, there are concerns about the following (Comment L15 and L16):	Additional discussion of the Pre-processing, Anaerobic Digestion and Composting emissions analysis has been included in Section 5 and at the beginning of Appendices 3 through 6. An explanation of results for the various technologies analyzed has been included in the discussion of Table 12 in Section 7.
	L15	a) Given that the mechanical separation process is reliable, the composition of the digestible component (DC) is noted in Table 2 (pg. 21). Furthermore, based on the mass flow diagram in Appendix 3 and 4, the DC is 42% (55.5 tpd). The composition of DC includes textiles, leather, paper, and carpet, which may not be readily digestible; in addition wood waste and green waste may require much longer residence times to degrade. The authors should note the digestibility of each component to achieve the 42% solids reduction.	The Digestible Component of the pre-processing is based on Anaergia's processing experience.
	L16	b) Given similar initial conditions as stated above (a), the mass flow diagram in Appendix 3 and 4, indicates that the digester will generate 1286 scfm of biogas at 62% methane. This amounts to an estimated digester yield of 17 scf biogas/lb volatile solids (VS) (assumes 24/7 operation). This is on the higher end of digester efficiencies for food wastes found in industry literature, which may not prove to be a conservative estimate of efficiency for a general MBT system. Calculation: Digester Yield = (1286 scfm * 1440 min/day) ÷ (54.5 tpd VS * 2000 lbs/ton VS) = 17 scf biogas/lb VS	Analysis is based on Anaergia's processing experience.
	L17	The document notes that the models were updated to reflect the most current Global Warming Potential (GWP) values stated in the IPCC Fifth Assessment Report (p. 18). Also, Appendix 2 notes WARM uses the 1996 IPCC model with includes fixed GWP values and therefore cannot be changed, but does not note whether it was corrected per the IPCC fifth Assessment Report.	Appendix 2 WARM model was not adjusted as the latest published model used had not been updated. It is noted in Appendix 2 that the 1996 IPCC GWP values "are hardwired into WARM and cannot be changed by the user." so were not adjusted to the GWP in the IPCCF fth Assessment Report.
	L18	**Section 5:** Pg. 26: Figure 3: The mass balance of Integrated MRF with CT shows that a total of 128.6 tpd of materials after pre-processing would be landfilled. This includes 25.9 tpd of materials that are assumed to be E-waste. This fraction should not be mixed with the other residuals (102.7 tpd) for Class III landfill disposal. Additionally, ash (7.9 tpd) from the thermal treatment process, unless as a non-hazardous waste, may be required to be disposed of at a hazardous waste landfill.	Assuming that e waste is removed as a non-acceptable materials and is taken to a facility equal distant to the landfill, the emissions results would not change significantly. Transport of ash to a hazardous waste facility would likely be a longer distance but the amount is negligible (7.9 tpd) and would not have a material effect on the results. This has been noted in Section 7.
	L19	**Section 6:** Pg. 29: as mentioned, the document includes emissions analysis for GHG,S02, NOx, dioxins, and furans, but not PM. Diesel PM has been named a toxic air contaminant by CARB. PM emissions were included in the Tetra Tech report (Appendix 1). It was not clear why PM emissions were excluded from the main document.	Did not have complete PM emissions source data for each process analyzed and the primary focus of the White Paper was to evaluate GHG emissions.

COMMENTER	No.	COMMENT	RESPONSE
	L20	**Section 6:** Pg. 33, Table 10: The NOx, SO2, dioxin/furan emissions for CT referred to a Japanese Reference Facility. It was not mentioned what the corresponding emission limits for this reference facility were and whether they are comparable to those for new CT equipped with the best available control technologies as mandated by SCAQMD.	See Response to Comment I9. Additional discussion has been added to Section 6 to explain that NOx, SO_2 emissions would likely be lower than the reference facility to meet SCAQMD emission requirements.
	L21	**Section 7:** Pg. 36, Table 12: The authors should discuss the quality of these recyclables that would ensure their practicality and marketability for beneficial use and thereby justify associating a GHG emission avoidance value of 1,646,938 MTCO2e. Since, it is noted that 5.0% of the residual will be recovered as recyclables by the integrated MRF (Pg. 21, Table 2, an associated value of avoided emissions applied due to the recovery of the recyclables listed).	The estimate of quality marketable recovered recyclables is conservative value for pre-processing (EU MBT) front end process. The GHG emissions avoidance value of 1,646,938 MTCO2e also includes power generation (replacing fossil fuels).
	L22	**Appendix 1**: Pg. 13, Table 2, Model Input: A GVWR of 34,000 lbs for a transfer truck is grossly underestimated. A fully-loaded 18-wheeler long-haul transfer truck may have a total estimated weight of 80,000 lbs.	Explanation provided in revised Appendix 1. 34,000 lbs of GVWR is gross vehicle weight rating which is the upper limit to the operational weight for a motor vehicle and any cargo (human or other) to be carried. 80,000 lbs is GCWR - gross combined weight rating, which is the sum of all GVWRs for each unit in a combination-unit motor vehicle, such as the total weight of a tractor and a trailor with cargo. We used GVWR to classify the tractor or transfer truck as a heavy duty truck with associated emission factor. Then, we estimated how many truck trips are required to transfer refuse to the landfill with a truck hauling capacity of 22 tons/truck.
Commenter M - Darby Hoover, Senior Resource Specialist Natural Resources Defense Council 111 Sutter Street, 20th Floor San Francisco, CA 94104 415-875-6157 / dhoover@nrdc.org	M1	Executive Summary - "mixed waste": not clear whether this refers to "dirty MRF" or to single-stream recyclables.	It refers to a dirty MRF. Mixed waste MRFs (or dirty MRFs) do take residuals from "clean MRFs", black bin wastes, waste remaining from source separated programs, and also wastes from generators with no source separation programs. Some mixed waste MRFs operate in a hybrid mode, and can process both as a "clean MRF", and/or as a "dirty MRF".
	M2	Executive Summary - Integrated MRF: This term is also used to mean different things and should be defined up front.	The alternative scenario is based on an Integrated MRF with Conversion Technologies. A detailed description has been added to the Executive Summary and Section 1 at the beginning of the White Paper.
	M3	Executive Summary - Which is designed to achieve maximum diversion from landfills: the CT facility, or the MRF processing? The "maximum diversion" goal should ideally be associated with the materials recovery (recycling) process, in order to assure sending as little material as possible to conversion.	The alternative scenario is a combined systems approach and the sequencing of the unit operational components reflect the MRF first approach and the hierarchy shown in the County's integrated waste management hierarchy.
	M4	Executive Summary - Post-recycled: This term is used to mean several different things and should be defined up front.	The general meaning is "after subjected to initial recycling efforts". This has been defined/clarified in Executive Summary and Section 1.
	M5	Executive Summary - How were biogenic emissions calculated here? What portion of feedstock is considered biogenic? Does it include paper? How is this influenced by feedstock management decisions (e.g. whether organic waste is pre- separated at collection or whether this is a mixed waste feedstock incorporating, organics, recyclables, and "garbage"?)	Definition of biogenic and non-biogenic emissions are included in Section 5.

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COMMENTER	No.	COMMENT	RESPONSE
	M6	Executive Summary - It is problematic to treat biogenic emissions as inherently different from fossil emissions because they will be reabsorbed at some point in the future. Over a long enough timeframe, all biomass looks good, but there are certainly no guarantees that all biomass will regrow (or be replanted, as in the case of forest biomass), or that it will regrow and reabsorb the carbon released when it is combusted within a timeframe relevant to achieving climate goals.	Analysis reflects modeling approach used in US EPA WARM model, and California ARB models, as well as IPCC (Scope 1, 2, and 3), and the EU's EpE model. Method consistent with definition used for determining RPS (renewable energy).
	M7	Executive Summary - need more info on what these "best in class" technologies are, and additional information on how feedstocks are determined - in order to operate at maximum efficiency in processing and recovering recyclables and compostables, there must be analysis and control of not just technologies but also feedstocks (with pre-separation if possible, including pre-separation of organics and recyclables).	Explanation of analysis assumptions, processes and limitations are included in the main body of the White Paper and in appendices (too technical for the Executive Summary). A statement at the end of the Executive Summary has been added that data sources and methodologies (in Part II), process descriptions, emissions analysis and assumptions (in Part III) and results/ conclusions (in Part IV) are included in the full report.
	M8	Executive Summary - "Zero Waste": also need to define this term - the Zero Waste International Alliance's definition of "zero waste" does not include thermal treatment technologies such as gasification as a viable component.	There are many definitions of "zero waste" and "zero waste to landfill". The term "zero waste" in this context refers to zero waste or maximum diversion from landfills.
	M9	Executive Summary - "landfill diversion": It would be ecologically preferable to focus on optimal management of materials for highest and best use, not just landfill diversion.	The Integrated MRF with Conversion Technologies facility reflects optimal management of materials for highest and best use and landfill diversion (for reduction of GHG). This clarification has been added to the Introduction in Section 1.
	M10	Executive Summary - There needs to be more information on how maximum recycling is achieved prior to allocating "residue" to conversion. There should be minimal requirements for recycling thresholds and for achieving minimal residue output, and the ability to improve those over time, before recommending adding on-site conversion to the process.	The analysis approach is based on a MRF First policy and LA County DPW's Integrated Waste Management Hierarchy. A statement has been added to the Introduction, Section 1 that acknowledges that more upstream material removal is best but residuals still need to be handled.
	M11	Part 1, Figure 1: The inverted pyramid is a good visual representation of relative material quantities that should be addressed in each stage. However, composting should be on the same line as recycling, and “conversion” combined with the “transformation/waste to energy” bullet. Composting is not conversion. Conversion focuses on a one-time conversion of materials to energy. Composting (and anaerobic digestion done right) enable the return of nutrients to the nutrient cycle, just as recycling enables the return of materials to the production cycle.	Comment Noted. The waste management hierarchy and paradigm shift is LA County DPW's hierarchy who commissioned the study.
	M12	Part 1, Section 1: not sure what this sentence means - what are "diversion activities" and how do those relate to "organics"?	"Diversion" relates to diverting waste from landfills and the beneficial use of materials destined for disposal including organic material (e.g., food waste) via AD and/or composting, and other material through thermal gasification.
	M13	Part 1, Section 1, Figure 2: What happens to paper in this scenario? How much is able to be recovered for recycling if indeed this is a mixed waste ("garbage" plus recyclables plus organics) facility? Recovering paper for recycling is a higher and better use than recovery for composting - and much paper is not suitable for processing through AD.	Discussed in Section 3, under Composition of Post-Recycled Residuals from Mixed Waste MRF.

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COMMENTER	No.	COMMENT	RESPONSE
	M14	Part 1, Section 1, Figure 2: Is there a stream that is sent directly to composting, or does all organic residue pass through the AD process first? Glad to see a diagram showing digestate going to composting to maximize nutrient recycling (just as important a benefit from AD as is energy recovery).	Feedstock for composting in this scenario is only the digestate from AD. Typically, these facilities can also take source separated materials. The Alternative scenario is only for what would be "going to landfill".
	M15	Part 1, Section 1 (Anaerobic Digestion and Composting): good - important to ensure a process which provides for usable digestate from an AD process (most of which will need to be subsequently composted to meet the proposed contamination limits).	Agreed, comment noted.
	M16	Part 1, Section 2: but isn't the composition of the feedstock different in Japan, where a much higher degree of pre-separated recycling is generally required?	Scenario is based on actual California waste composition assumed as input parameters for process engineering models.
	M17	Part 1, Section 3: still not clear whether this MRF is processing single-stream recyclables or whether it is processing garbage/waste mixed with recyclables.	These integrated MRFs can process in hybrid mode. The primary scenario analyzed is based on processing the "post recycled" residuals of a mixed waste (dirty) MRF that is currently disposed of in landfill. This is clarified up front in Executive Summary and Section 1.
	M18	Part 1, Section 3: "MRF First" - doesn't this mean single-stream recyclables MRF, not "dirty" MRF?	MRF First refers to recycling to the maximum extent possible before utilizing other technologies. The feedstock received has already gone through source separation and dirty MRF separation.
	M19	Part 1, Section 3: "Wet fraction" - is all "wet" waste assumed to be digestible?	Wet fraction refers to the organics residuals from the mixed waste MRF. Not all wet stream materials are digestible. It does not refer to previously source separated materials which are already being composted and/or digested. It should be noted that the selected preprocessing approach is designed to create the optimal AD feedstock, and also create the cleanest digestate to meet the new proposed 0.1% physical contamination standards for land application (either as compost and/or digestate). The goal is to produce the highest quality product to make it more marketable. There is currently a lack of market for compost in Southern California, and with proposed new land application State standards, many of the existing composting operations will not be able to meet the new standards.
	M20	Part 1, Section 3, Table 2: why is such a large percentage of recyclable OCC going to RDF? or is this the amount of residuals FROM the RDF process? Needs to be clearer in both this chart and in the narrative. Again, if this paper is "recyclable," why is it all going to RDF? It is higher and better use for paper to be recycled. Likewise, if compostable, why is this paper not being composted instead of used for RDF? Why would any metals at all go to RDF?	This represents material that has already been source separated at the curb and at a mixed waste MRF so most of the marketable material has been removed. Metals and OCC that is too contaminated to be recyclable (e.g. food contaminated pizza boxes, too high a moisture content, OCC with laminated film, oil stained cardboard, etc.). It should be noted that the selected preprocessing approach is designed to create the optimal AD feedstock, and also create the cleanest digestate to meet the new 0.1% physical contamination standards for land application (either as compost and/or digestate). Note that even a feedstock concentration of 0.1% contaminants will increase after the compost or digestion process, as materials are volatilized.

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	M21	Part 3, Section 4: Doesn't "low decay factor" have more to do with conditions inhibiting biodegradation in most modern landfills than with weather?	Biodegradation influenced by how much moisture/water is in the refuse when buried which is affected by rainfall during disposal operations.
	M22	Part 3, Section 5: "Gasified" - From an ecological perspective, if the digestate contains nutrients, it would be more ideal to return those to soil than to convert to energy.	Primary scenario assumes digestate to composting (in the text). An additional scenario was also performed to show impact if there is no market for composting. Digestate to gasification is not emphasized, it is an alternative analysis. Nutrient recycling is accounted for in the WARM model.
	M23	Part 3, Section 5: Thermal Gasification Emissions - can you clarify this further? What is "alternative" in this scenario?	The Thermal Gasification process is one component of the Alternative scenario "Integrated MRF with Conversion Technologies" (each component is discussed in Section 5).
	M24	Part 3, Section 5: "An integrated MRF with conversion technology (in this case, incineration) resulted in fewer net GHG emissions than landfilling" - It seems like it would also be critical to compare the CT scenario with a scenario that required more recycling/composting up front - again, since it isn't clear whether this study addresses mixed waste/recyclables/organics, or single-stream recyclables only, it's hard to say what goals should be required. But it would seem important to identify what recycling rate is assumed in this model and also model assumptions that improve the recycling rate. Best in class currently does not account for future improvements - and ensuring there is incentive to drive those improvements is important from an ecological perspective. Better to extract energy than to put into a landfill without extracting energy; but better still to recycle as much as possible (which generally results in energy savings at the production level greater than energy potentially recoverable).	Additional recycling in the front end preprocessing is assumed to recover additional materials which may have been missed by source separation programs, and/or by the mixed waste MRF (an additional 5%). It should also be noted that the feedstock to the Integrated MRF with Conversion Technologies facility is the residuals from source separated programs and from MRF activities (and currently being sent to landfill). By inserting this Integrated MRF with Conversion Technologies facility in the waste management system before landfilling, it is for the purpose of extracting the highest and best use of what is being disposed.
	M25	Appendix: Buried Refuse Emissions - see my earlier note regarding the problems with not considering biogenic emissions as contributing to carbon emissions. Also, why does this refer only to CO2 emissions, since there is also C in methane (CH4)? Also, disposed paper contributes significantly to both CO2 and CH4 emissions from landfills - is paper considered as biogenic, even though it is manufactured? This is good, but how does this not contradict the previous paragraph?	Methane is accounted for in the analysis, converted to MTCO2E, as per model, and using latest global warming potential. Paper is considered biogenic (from trees generally). It is acknowledged that there are new paper products made from stone, clay, etc., but this is only a very small fraction of the specialty paper market.
	M26	Appendix: Case 2 - NRDC (along with other groups) does not consider landfill gas as renewable - see for example http://www.nrdc.org/air/energy/lfg/contents.asp	Landfill gas-to-energy is not called renewable; reference is made to landfill gas-to-energy avoiding the use of (non-renewable) fossil fuels.
	M27	Appendix B: Graphs - LA County Landfill Baseline Emissions - why is methane not included in this graph?	Methane is accounted for, converted to MTCO2E, as per model, and using latest global warming potential. A footnote has been added to the graphs to clarify. These graphs are generated by LandGEM model and methane content is 50% (v/v) in landfill gas. Therefore, the graph for methane is identical to the curve of CO2 (also ~50% v/v) and cannot be seen as a separate curve in the graph.
	M28	Appendix B Graphs: why is methane not included in this graph?	Methane is accounted for, converted to MTCO2E, as per model, and using latest global warming potential. A footnote has been added to the graphs to clarify. These graphs are generated by LandGEM model and methane content is 50% (v/v) in landfill gas. Therefore, the graph for methane is identical to the curve of CO2 (also ~50% v/v) and cannot be seen as a separate curve in the graph.

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	M29	Appendix 2, Table 1: does this mean including digestate as an input to the RDF process (if something else, probably should clarify)? If so, why would digestate be included in the RDF process rather than being composted and/or land applied? Also, why would RDF or digestate include metals? shouldn't those be removed in pre-processing?	Both scenarios (digestate to compost and digestate to RDF) were modeled. The digestate to RDF was modelled under a scenario assuming no market for land application of the compost. Certain "metals" do end up in the RDF, but ends up being recycled when recovered as part of the metallic slag. Vitrified slag (glassy non-metallic slag) would also be recovered as potential construction materials.
	M30	Appendix 2, Figure 1: this subtitle is confusing and sounds like the table refers to land-applied digestate from AD as the alternative scenario from landfilling, when the table actually appears to show the RDF alternative to landfilling. RDF should be somewhere in the title of this table if that's correct. Also, again, why would any metals be listed under " tons combusted"? Metals are not combustible.	Refers to land application after composting. A certain amount of metals will end up in the RDF, e.g., metals in aseptic containers, staples in OCC, metals in composite materials. Metals are recovered as metallic slag via the ash melting process to convert gasification ash to beneficial products.
	M31	Appendix 2, Figure 4: This result indicates that from a GHG point of view, it is better to land apply the digestate than to combust it - correct? Might be good to highlight that more in the earlier narrative if so.	This is the primary scenario assumption described in the text and used in the summary of results.
	M32	Appendix 3: This chart is very helpful, but it is very hard to read (even with the view expanded, as then the resolution degrades).	Higher resolution chart is provided.
	M33	Appendix 3: are these organics that have been separated out per the process in the previous chart, or are these organics that are collected separately to begin with? if this is the same as the output "wet fraction to AD" from the previous chart, it would be helpful to say so (be consistent with labelling).	Wet fraction refers to the organics residual from the mixed waste MRF after an initial separation (pre-processing) that concentrates the digestible materials (e.g., food, green waste, etc.). Does NOT refer to previously source separated materials which may be composted and/or digested.
	M34	Appendix 4: are all organics put through this process and sent to AD? is there no part of the process earlier (e.g. manual sort) where some organics (e.g. woody waste that won't break down much in AD anyway) could be separated to be sent directly to composting or AD?	Not all "organics" are sent to composting or AD. Carpet, textile, even "compostable" plastic ware do not break down in composting / AD. Current facilities have processing issues with these materials, and under the new proposed regulations, they should be removed in order to meet the new technical land application standards.
	M35	Appendix 4: This seems to show some organic waste sent directly to composting - at what point in or before this system does that occur? Same question as previously - is this the same as "wet fraction to AD" from previous chart? Suggest harmonizing these labels if so as it's confusing. What does "cellulosic" mean here and why is it all sent to RDF? If it's paper, why not send it to composting?	The model results in Appendix 4 show wet fraction to AD and digestate to composting. Actual operating facility is able to take "additional" source separated organics (e.g. food) and put into either AD or composting (after some preprocessing). For this study, the scope of work was only to use the wet fraction of the post recycled MRF residuals for the feedstock for AD.
	M36	Appendix 6, Table 1: again - do assumptions from Japan apply since feedstock is likely to look different based on the amount of recycling separation required in Japan vs. US?	The composition is based on the (California) CalRecycle Statewide study of residuals from mixed waste MRFs. The modeling is using latest available California composition in a technology that is proven operational in Japan. Does not reflect recycling separation in Japan, it actually reflects California statewide average recycling recovery from a mixed waste MRF. Feedstock to the Integrated MRF with Conversion Technologies represents what would be sent to landfill.
	M37	Appendix 6, Summary of JFE Engineering Thermal Gasification and Ash Melting Process Data: this table is very difficult to read - even with expanded view, as it becomes distorted	Higher resolution scan provided.

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	M38	Appendix 6, Page 4, Calculation Methodology: how is dewatered sludge entering into this picture? I thought the AD was on-site at the MRF - surely dewatered sludge is only relevant if you are using an AD process at a wastewater plant? If this is meant to be "digestate" it should be changed accordingly.	Digestate is the non-converted materials remaining after AD. Dewatered sludge refers to the AD digestate after dewatering by either a filter press and/or some other dewatering process.
	M39	Appendix 6, Process Flow Chart: this says it is a process chart for the gasifier - but I'm confused by the part of the diagram that shows trucks dumping waste into a pit - aren't the trucks dumping waste into a preprocessing area, in which there are a number of stages prior to any part of the stream reaching conversion?	The "pit" is designated as the storage for the RDF. Preprocessing has its own front end storage, back end RDF storage is needed for managing continuous feed for electricity generation.
	M40	Appendix 7, First sentence on page 171: I don't understand this sentence.	Appendix 7 has been removed.
	M41	Appendix 8: "which is assumed to not be composted, but sent to an energy recovery facility (gasification or incineration)" - Why is this emphasized? The following table seems to model both digestate to RDF and digestate to compost. And it would appear that GHG benefits of sending the digestate to compost are greater than conversion - not to mention additional benefits of composting vs conversion to energy such as nutrient recycling to soils, soil improvement, etc.	Primary scenario is digestate to composting (in the text), additional scenario was performed to show results if there is no market for composting. Digestate is NOT emphasized, it is alternative analysis. Nutrient recycling is accounted for in the WARM model to calculate the GHG impact of resource replacement.
Commenter E - Todd Vasquez-Housley, Environmental Resources MRF Manager Todd.Housley@ci.oxnard.ca.us	N1	I prefer you use my legal name and my title has changed since the Council voted to take over the MRF.	Noted and revised.

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