TECHNICAL SUPPORT DOCUMENT
(STATEMENT of BASIS)

for Permit Issuance

TECHNICAL INFORMATION PRESENTED IN REVIEW OF AN
APPLICATION FOR AN AUTHORITY TO CONSTRUCT FOR A PART 70 SOURCE

SUBMITTED BY

DCO Energy

for

Republic Services Renewable Energy, LLC

ATC Operating Permit Number: 16539
SIC Code - 4911: Electric Utility Services
NAICS Code – 221119: Other Electrical Power Generation

Clark County
Department of Air Quality
Permitting Section

March 1, 2018

EXECUTIVE SUMMARY

Republic Services Renewable Energy (RSRE) is located within the boundaries of the Apex Waste Management site. The legal description of the source location is: portions of T18S, R63E, Section 24 in Apex Valley, County of Clark, State of Nevada. RSRE is situated in the Garnet Valley Hydrographic Basin 216. Garnet Valley is designated as attainment for all regulated air pollutants.

The source operates two 5.334 MW landfill gas turbines with Selective Catalytic Reduction (SCR) and one flare (with propane pilot fuel) for combustion of landfill gas (LFG) during the siloxane removal system regeneration cycle. The two gas turbines are subject to the regulatory requirements of 40 CFR Part 60, Subpart KKKK. The source is categorized under SIC Code 4911: Electrical Services and NAICS Code 221119: Other Electrical Power Generation. RSRE is a Major Part 70 Source for CO and is minor for PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOC and HAP. The RSRE is a source of greenhouse gases (GHG). This ATC addresses the request to increase the sulfur concentration in the landfill gas from 100 ppm H_2S to 304 ppm total reduced sulfur (TRS) which will result in an increase in Turbine SO_2 potential emissions. The facility potential to emit (PTE) is as follows:

Pollutant	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAPs
Tons/year	13.32	13.32	63.23	129.20	51.78	18.47	0.84
Major Source Thresholds (Title V)	100	100	100	100	100	100	10/25[1]
Major Stationary Source Thresholds	250	250	250	250	250	250	10/25[1]

[1]Ten tons for any individual HAP or 25 tons for combination of all HAPs.

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I. ACRONYMS

Table I-1: List of Acronyms

Term	
Air Quality	Clark County Department of Air Quality
AQR	Clark County Air Quality Regulations
ATC	Authority to Construct
BACT	Best Available Control Technology
CFR	United States Code of Federal Regulations
GHG	Green House Gases
CO	Carbon Monoxide
EPA	United States Environmental Protection Agency
EU	Emission Unit
HAP	Hazardous Air Pollutant
H_2S	Hydrogen Sulfide
LGF	Landfill Gas
LHV	Lower Heating Value
MMBtu	Millions of British Thermal Units
MW	Megawatt
NAICS	North American Industry Classification System
NO_x	Nitrogen Oxides
NRS	Nevada Revised Statutes
OP	Operating Permit
PM_{10}	Particulate Matter less than 10 microns
ppm	Parts per Million
ppmvd	Parts per Million, Volumetric Dry
PSD	
PTE	Potential to Emit
RACT	Reasonable Acceptable Control Technology
RSRE	Republic Services Renewable Energy
SCR	Selective Catalytic Reduction
scf	Standard Cubic Feet
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
TRS	Total Reduced Sulfur
VOC	Volatile Organic Compound

II. SOURCE INFORMATION

A. General

Permittee	Republic Services Renewable Energy, LLC
Mailing Address	770 East Sahara Ave
Responsible Official	Mark Clinker
Phone Number	(702) 599-5901
Email Address	mclinker@republicservices.com
Contacts	Catherine Macdougall
Phone Number	(702) 599-5930
Source Location	13550 North Highway 93, Las Vegas, NV 89165
Hydrographic Area	216, Garnet Valley
Township, Range, Section	T18S, R63E, S24
SIC Code	4911: Electric Services
NAICS Code	22111: Electric Power Generation

B. Description of Process

Republic Services Renewable Energy is located at the Apex Regional Landfill Waste Management Center which is owned and operated by Republic Dumpco, Inc., a subsidiary of Republic Services of Southern Nevada. RSRE combusts LFG in turbines to produce electricity. The energy produced is sold to NV Energy to assist in meeting the 25 percent renewable energy mandate set forth by the State of Nevada (by 2025).

RSRE operates two (2) Solar Taurus landfill gas turbines and a John Zink off-gas flare. RSRE is a major Part 70 source for CO and minor for PM_{10}, NO_X, SO_2, VOC and HAP.

Landfill gas is collected by Republic Services through a system of wells located throughout the Apex Waste Management Center. The collected gas is piped to the RSRE facility. The LFG is passing through chillers prior to reaching the siloxane treatment skids where 60 percent of siloxane compounds are removed from the LFG. From the siloxane removal system the gas travels to the compressor skids where it is compressed for combustion in two 5.334 MW LFG turbines. The gas is combusted and the associated thermal energy is then converted into electrical energy. The exhaust gases will exit to the atmosphere after leaving the turbine and passing through a SCR system for NO_x control. The two gas turbines are subject to the regulatory requirements of 40 CFR Part 60, Subpart KKKK.

RSRE uses a SCR system as the NO_X emissions control system. The original 60 percent manufacturer's guarantee for the catalyst's NO_X removal efficiency was based on an average siloxane concentration of less than 75 ppb in pretreated LFG. This maximum SCR catalyst loading rate and an influent LFG concentration of 2,000 mg/m^3 for non-methane organic compounds (NMOC), were the basis for the design of the Venture system for the siloxane removal and its efficiency. However, the

LFG has higher loading rates for both siloxane and NMOC. As a result, the current NO_X removal efficiency has been set to 30 percent by control analysis triggered by a significant revision of the ATC issued on May 19, 2014.

The filters in the siloxane system are regenerated on a regular basis to ensure maximum removal of the siloxane by the system. During the regeneration process, regen gas is sent to a small flare for destruction.

C. Permitting History

RSRE was originally permitted with an ATC on October 5, 2010, with a significant revision issued on May 19, 2014. The ATC included the two Solar Taurus gas turbines (EUs: A01 and A02) and the Jon Zink flare (EU: A03). In the ATC application, the source was anticipating the landfill gas provided by Apex Landfill to have a H_2S content at or below 100 ppmvd. Therefore, the ATC was issued with a control technology analysis and SO_2 emission limits corresponding to the anticipated landfill gas H_2S concentration.

The May 19, 2014, significant revision updated the controlled NO_x emission rate for the turbines and reduced the control efficiency of the SCR system. It was found that siloxane and non-methane organic compounds concentrations found in the LFG have increased since the initial design of RSRE's LFG pretreatment system. The NO_x control system had degraded as a result of the quality of the LFG. The BACT analysis in the significant revision resulted in a reduction in control efficiency of the SCR system.

It is speculated that the LFG degradation noticed in 2014 that affected NO_x emission may have had an effect on SO_2 emissions.

Table II-C-1: Source Permitting History

Application Date	Issuance Date	Permitting Action	Description
10/13/09	10/05/10	Initial ATC	Initial request for 2 turbines and a flare.
1/15/13	2/27/15	Initial Title V Permit	Request for Initial Title V Operating Permit.
2/19/13	5/19/14	Significant Revision to ATC	Request for an increase in NOx emissions.
8/28/15	11/4/15	Minor Revision to OP	Clarify conditions related to the sulfur content of the LFG.
4/22/16	12/29/16	Minor Revision to OP (Open for Cause)	Source attempted to correct that 100 ppm SO_2 is the exhaust concentration, not the LFG concentration (inlet). Air Quality rejected that argument and issued a revision maintaining all existing emission limits.
12/12/16	N/A	Minor Revision to OP	Request to increase SO_2 emissions. This request was cancelled and the source submitted a revision to the ATC.
2/9/17	2/17/17	Transfer of Permit	The source was sold from Clark County Landfill Energy to Republic Services Renewable Energy.
2/15/17	Current Action	Significant Revision to ATC	This ATC addresses the request to increase the sulfur concentration in the landfill gas from 100 ppm H_2S to 304 ppm TRS which will result in an increase in turbine SO_2 potential emissions.

D. Current Permitting Action

RSRE is requesting to increase the sulfur content of the landfill gas from 100 ppmv H_2S to 304 ppmv TRS. Based on this increase, the SO_2 PTE will increase to 51.78 tons per year, as the SO_2 emissions are directly proportional to the sulfur content of the LFG. As this is not an administrative revision, per AQR 12.4.3.4(a)(3), this action is a significant revision to the ATC.

On December 12, 2016, RSRE submitted a minor revision to the Part 70 OP to make this change. Air Quality informed RSRE that as the SO_2 emissions were subject to BACT in the original ATC, the ATC need to be revised. Therefore, RSRE submitted the current application to revise the ATC.

RSRE is subject to 40 CFR Part 60, Subpart KKKK, which includes requirements for SO_2 emissions. RSRE will continue to comply with these standards.

To demonstrate compliance with the SO_2 PTE, RSRE is required to combust landfill gas with a TRS content of 304 ppm on a 365-day average. To demonstrate compliance with the NAAQS, RSRE is required to combust landfill gas with a TRS content of 463.4 ppm on an hourly average. The 463.4 ppm is subject to change if the EPA model or meteorological data changes, as these items are beyond the source's control.

In addition, the source determined that 19.2 lb/hr SO_2 emissions will demonstrate compliance with the NAAQS. Based on the maximum landfill gas usage, that equates to the TRS limit of 463.4 ppm in the LFG. Both limits are in the permit as the source can more readily demonstrate compliance with the stricter LFG TRS limit. However, the source may alternatively demonstrate compliance with the NAAQS by demonstrating compliance with the SO_2 lb/hr limit.

On January 19, 2018, RSRE submitted a supplemental document outlining the procedures and calculations they will perform to demonstrate compliance with the sulfur limits in the permit. The monthly LFG analysis will result in a TRS value in ppmv. It will be assumed that all sulfur compounds in the LFG are oxidized to SO_2. Additional monitoring and recordkeeping conditions have been added to the permit because of this submittal.

Background

RSRE, in the initial ATC application, assumed the H_2S content of the LFG at a maximum of 100 ppmvd based on information available at the time. Air Quality issued the initial permit based on this. The H_2S content of the incoming landfill gas has been on an increasing trend since 2014, as measured by the H_2S analyzer. This trend is believed to have occurred due to the prolonged drought in the region as no operational changes at the landfill have been identified which would have caused an increase in sulfur content of the LFG.

The landfill (Apex Waste Management Center, Clark County Source 395 – Owned by Republic Services) originally estimated the controlled H_2S content of the LFG to be 304 ppm in the permitting action completed on January 10, 2012. The TSD from the December 29, 2016, permitting action referenced a letter from December, 2009, stating that the LFG was anticipated to be supplied to the turbines at a total sulfur concentration of 100 ppm. It appears there was an error in stating that 100 ppm is in the exhaust instead of the LFG in the application. Also in that TSD is a section from an April 22, 2016, letter from CCLE (who previously operated the source) stating the following:

> "The Best Available Control Technology (BACT) analysis for sulfur dioxide (SO_2) emissions from the gas turbines included in CCLE's original air permit application assumed SO_2 emissions of 100 parts per million volume (ppmv) in exhaust stacks from two site turbines. Subsequently, CCLE's air construction permit was issued in August

> 2010 with a sulfur content standard of 100 ppmv in LFG flow combusted in site turbines and flare (Specific Condition No. III.B.3.b.), rather than reflecting 100 ppmv SO_2 in gas turbine emissions. Since 100 ppmv sulfur in LFG is not representative of the LFG supply obtained from the adjacent Apex Landfill operated by Republic Dumpco, Inc. (Republic), CCLE is requesting that the Part 70 permit condition is corrected to reflect the original exhaust based limitation of 100 ppmv SO_2 rather than a 100 ppmv sulfur LFG standard."

Air Quality's response in the TSD clarifies and corrects the above error:

> The initial ATC application submitted on October 13, 2009, estimated the SO_2 emissions based on the fuel sulfur content with the assumption of 100% conversion of fuel sulfur to SO_2 (Attachment D and F). Therefore, the only method of estimating the SO_2 emissions identified in the application was conversion of the fuel sulfur content. Attachment F of the application is an estimation of the turbine SO_2 emissions based on 100 ppmv sulfur in the LFG at site specific conditions. This emission estimation was prepared by the turbine manufacturer, Solar. However, it was noticed in few places in the application that the applicant used SO_2 and H_2S concentrations interchangeably, which resulted in a confusion. In order to clarify this confusion, Air Quality sent a clarification request to the source on November 19, 2009 and a response was received on December 3, 2009. According to the response, the applicant confirmed that "At this time, the CCLC model is anticipating delivery of the landfill gas at a total sulfur concentration of 100 ppm and was incorporated into the permit application as an emissions estimate". Again in the November 19, 2009 email to the source, Air Quality stated that, "The SO_2 emissions are based on the assumption that the sulfur content in the LFG is 100 ppm. This assumption cannot be enforceable until the Republic Services apply for a permit modification for the H_2S removal process. The response from the source reiterated the use of 100 ppmv H_2S concentration in the LFG "Republic Services is anticipating submittal of a permit modification within the first quarter of 2010. CCLE and Republic Services will utilize the same total sulfur concentration once the scrubber design is confirmed".

E. Operating Scenario

The proposed change in the operating scenario is to increase the sulfur content of the LFG from 100 ppmv H_2S to 304 ppmv TRS, averaged on a 365-day basis, and 463.4 ppmv TRS, averaged on a 1-hour basis. The 304 ppm TRS is used to calculate the source PTE of 51.78 tons per year SO_2 and the 463.4 ppm TRS is used to calculate the 19 lb/hr SO_2 emissions.

No other operational limits are affected in this permitting action.

III. EMISSIONS INFORMATION

A. Source-wide PTE

RSRE is a major Part 70 source for CO and a minor source for PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOC, and HAP. All emissions except for SO_2 remain unchanged in this action.

Table III-A-1: Source-wide Allowable Emissions (tons per year)

PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC	HAPs
13.32	13.32	63.23	129.20	51.78	18.47	0.84

Table III-A-2: Emission Unit PTE (tons per year)

EU	PM_{10}	$PM_{2.5}$	NO_x	CO	SO_2	VOC	HAP
A01[1]	6.32	6.32	31.21	63.25	25.12	9.16	0.41
A02[1]	6.32	6.32	31.21	63.25	25.12	9.16	0.41
A03	0.68	0.68	0.81	2.70	1.54	0.15	0.02

[1]Annual emissions are based on 238,988 ft^3/hour of LFG combustion and 16,664 hours of operation for the two turbines. (EUs: A01 and A02). The average fuel flow rate is 447 MMBtu/hr (LHV).

B. PTE SO_2 Emissions

SO_2 emissions are based on the following:

Molecular weight of Sulfur = 32.06 lb/lb-mole
Molecular weight of SO_2 = 64.06 lb/lb-mole
Molecular weight of H_2S = 34.08 lb/lb-mole
Molecular weight of LFG = 26.34 lb/lb-mole (based on most recent fuel analysis dated May 17, 2016)
Sulfur content of LFG weight basis = 463.4 ppmw
LFG density = 0.0684 lb/ft^3
Total LFG flowrate (volume) = 238,988 ft^3/hr

LFG flow to both turbines (mass):

$$238{,}988\ \frac{ft3}{hr} \times 0.0684\ \frac{lb}{ft3} = 16{,}346.8\ \frac{lb}{hr}$$

H_2S content of LFG:

$$463.4\ ppmv \times 34.08 \frac{lb}{lb-mole} H2S \div 26.34 \frac{lb}{lb-mole} LFG = 599.7\ ppmw\ H2S$$

SO_2 content of LFG (both turbines):

$$599.7\ ppmw\ H2S \div 1{,}000{,}000 \times 16{,}346.8\ \frac{lb}{hr} x\ 64.06 \frac{lb}{lb-mole} SO2 \div 34.08 \frac{lb}{lb-mole} H2S$$
$$= 18.4 \frac{lb}{hr} SO2$$

SO_2 content of LFG (per turbine): 9.2 lb/hr

LFG flow to one turbine = 119,494 ft^3/hr
LFG heating value = 499.7 Btu/ft^3 (LHV) or 549.6 Btu/ft^3 (HHV) (based on LFG sampling analysis dated May 17, 2016)

Heat input rate for one turbine:

$$119{,}494\ \frac{ft3}{hr} \times 549.6 \frac{Btu}{ft3} x\ \frac{1}{1{,}000{,}000} = 65.67\ \frac{MMBtu}{hr}\ (HHV)$$

SO_2 Emissions Rate:

$$9.2\,\frac{lb}{hr} \div 65.67\,\frac{MMBtu}{hr} = 0.14\ \frac{lb}{MMBtu}$$

SO_2 PTE for the turbines (EUs: A01 and A02):

$$16{,}346.8\ \frac{lb}{hr} \times \frac{392.41}{1{,}000{,}000} \times 64.06\,\frac{lb}{lb-mole}\,SO2 \div 34.06\,\frac{lb}{lb-mole}\,H2S = 12.075\ \frac{lb}{hr}$$

$$12.075\ \frac{lb}{hr} \times 8{,}322\ \frac{hr}{yr} \times 2{,}000\ \frac{lb}{ton} = 50.24\ \frac{ton}{yr}$$

SO_2 PTE for the flare (EU: A03)

LFG flow to A03: 9,000 ft^3/hr

$$9{,}000\ \frac{ft3}{hr} \times 0.0684\,\frac{lb}{ft3} = 615.6\ \frac{lb}{hr}$$

SO_2 Emissions:

$$615.6\ \frac{lb}{hr} \times \frac{392.41}{1{,}000{,}000} \times 64\,\frac{lb}{lb-mole}\,SO2 \div 34\,\frac{lb}{lb-mole}\,H2S = 0.455\ \frac{lb}{hr}$$

$$0.455\ \frac{lb}{hr} \times 6{,}750\ \frac{hr}{yr} \times 2{,}000\ \frac{lb}{ton} = 1.54\ \frac{ton}{yr}$$

Total SO_2 Emissions:

$$50.24\ \frac{ton}{yr}\ +\ 1.54\ \frac{ton}{yr} = 51.78\ \frac{ton}{yr}$$

This methodology is consistent with previous permits and results in SO_2 emissions of 51.78 tons per year.

C. Performance Testing

No new performance testing requirements are added in this permitting action. RSRE is subject to 40 CFR Part 60, Subpart KKKK, and is required to conduct a fuel analysis for sulfur content annually, per 60.4415(a)(1).

D. RACT Analysis

The determination of RACT involves the feasibility of applying emission controls alternatives to an emission unit taking in account technological and economic feasibility, energy, and secondary environmental impacts. This permitting action will exceed the significance threshold of 20 tons per year for SO_2, as illustrated in Table III-D-1. Baseline actual emissions were calculated based on the 2012 and 2013 emissions: 12.84 tons per year and 13.95 tons per year, respectively.

2014 and 2015 operating years are not most representative of normal operations because of unscheduled total plant maintenance outages. In year 2014 the generating facility was offline for approximately 350 hours (1/2 month) for unscheduled mechanical corrective repairs associated with its siloxane removal system. In year 2015 the generating facility was offline approximately 3 months (2,010 hours) for unscheduled mechanical H_2S system repairs.

Note that scheduled NVE maintenance outages annually are limited to a total of 360 hours as part of RSRE annual operating plan.

The source stated in the application that these two years are most representative of normal source operation during the most recent 5-year period as these two years did not experience extended periods of unscheduled maintenance, which are not expect to recur in the future.

This modification is not a significant increase per AQR 12.2.2, but is a significant increase per AQR 12.4.2.1, therefore it is a significant revision, but not a major modification.

Table III-D-1: Significant Levels PTE (tons/year):

	PM_{10}	$PM_{2.5}$	NO_X	CO	SO_2	VOC
12.4.2.1 Significant Levels	7.5	5.0	20.0	50.0	20.0	20.0
Emissions Increase	0.00	0.00	0.00	0.00	32.82	0.00
Exceeds	No	No	No	No	Yes	No

Currently, the LFG passes through a desulfurization system at the landfill to reduce the H_2S content prior to exiting the landfill. This control device is covered in Source 395. Source 395 is not required to provide LFG at or below a set sulfur ppm limit. Instead, they are required to meet a control efficiency in the desulfurization system.

A RACT analysis submitted in this permitting action included fuel treatment and flue gas desulfurization (FGD). FGD is not technically feasible and was eliminated as an option. Three fuel treatment controls were evaluated and the source concluded that these options are cost prohibitive. This concludes that the currently-installed controls, which met the original BACT requirement, meet RACT.

IV. REGULATORY REVIEW

This permitting action does not subject the source to any additional local or federal requirements.

With the installed control devices and utilizing LFG at 304 ppm total sulfur, RSRE will not be in violation of the 40 CFR Part 60, Subpart KKKK, SO_2 standard.

V. COMPLIANCE

This permitting action does not subject the source to any additional compliance requirements.

VI. PUBLIC NOTICE

RSRE has requested to receive the enhanced public participation notice as outlined in AQR 12.2.16.6. This ATC will be subject to a 30-day public review period and a 45-day EPA review period.

VII. ADMINISTRATIVE REQUIREMENTS

AQR Section 12.4 requires that Air Quality identify the original authority for each term or condition in the ATC permit. Such reference of origin or citation is denoted by [italic text in brackets] after each ATC permit condition. Air Quality proposes to issue the ATC permit.

VIII. MODELING

RSRE is a major Title V source in the Hydrographic Area 216 (Garnet Valley). Permitted emission units include automobile manufacturing processes. RSRE submitted modeling analysis to Air Quality in accordance with AQR Section 12.4.3.2.

INCREMENT ANALYSIS

Since minor source baseline dates for PM_{10} (December 31, 1980), NO_2 (January 24, 1991) and SO_2 (December 31, 1980) have been triggered in HA 216, Prevention of Significant Deterioration (PSD) increment analysis is required.

Air Quality modeled the source with the information provided by Golder Associates using AERMOD to track the increment consumption. Average actual emissions for 2015-2016 for some emission units were used in the model. On-site meteorological data collected at the source from July 2011 to July 2012 were used in the model. United States Geological Survey (USGS) National Elevation Data (NED) terrain data was used to calculate elevations. Table VII-1 shows the location of the maximum impact and the potential PSD increment consumed by the source at that location. The impacts are below the PSD increment limits.

Table VIII-1: PSD Increment Consumption

Pollutant	Averaging Period	PSD Increment Consumption by the Source (µg/m³)	Location of Maximum Impact	
			UTM X (m)	UTM Y (m)
SO_2	3-hour	81.23[1]	689700	4025800
SO_2	24-hour	17.93[1]	690200	4025900
SO_2	Annual	3.39	690251	4026463
PM_{10}	24-hour	16.54[1]	690602	4026324
PM_{10}	Annual	6.63	689401	4028556
NO_X	Annual	4.64	693200	4029500

[1]Second High Concentration.

NAAQS ANALYSIS

Air Quality also reviewed the NAAQS modeling submitted by Golder Associates on behalf of Republic Services Renewable Energy. Using the information from the submittal, Air Quality modeled the source with AERMOD to evaluate the impacts with NAAQS. Table VIII-2 shows that the source will be in compliance with the NAAQS.

Table VIII-2: NAAQS Analysis

Pollutant	Averaging Period	Source Impact (µg/m³)	Background Concentration (µg/m³)	Total Impact (µg/m³)	NAAQS (µg/m³)
SO_2	1-hour	176.66[1]	18.34[2]	195	196

[1]Fourth high concentration.
[2]2013-15 Design Value at Jerome Mack monitoring station.

Emission Units List

Source: 16539

EU	Rating	EU Description	SCC
A01	66.400 MMBTU/HR	5.334 MW SIMPLE CYCLE GAS TURBINE > MANF - SOLAR TAURUS, MOD # - 60-7901, SER # - TG11146	20100801
A02	66.400 MMBTU/HR	5.334 MW SIMPLE CYCLE GAS TURBINE > MANF - SOLAR TAURUS, MOD # - 60-7901, SER # - TG11147	20100801
A03	4.000 MMBTU/HR	CONTROL DEVICE - LANDFILL GAS FLARE > MANF - JOHN ZINC CO., MOD # - ZTOF, SER # - 9108856	50100410