M E M O R A N D U M

DATE: February 8, 2010

BY: Darrin Mehr, Air Quality Analyst, Air Program

PROJECT NUMBER: P-2009.0146

SUBJECT: Modeling Demonstration for the PTC Application for a Proposed Installation of a Landfill Gas-Fired Generator Set and an Open Flare at Bannock County's Fort Hall Mine Road Landfill Facility near Pocatello, Idaho

1.0 Summary

The Bannock County Solid Waste Department (Bannock County) submitted an application for a PTC to install an exposed flare and an internal combustion engine for an electrical generator set at the existing Fort Hall Mine Road Landfill (FHMRL). The project will create electricity for the power grid.

This modeling analysis was based on the permit application and modeling files received on December 22, 2009, January 12, 2010, February 3, 2010, and February 4, 2010. Please refer to the permit statement of basis to review a complete history for this project.

The facility is not a *designated facility*, as defined in IDAPA 58.01.01.006, Rules for the Control of Air Pollution in Idaho (Rules). The facility's potential to emit (PTE) of particulate matter with an aerodynamic diameter of ten microns or less (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), and nitrogen oxides (NO_x) each is less than 100 tons per year (T/yr). The facility is therefore a major facility under the New Source Review (NSR) PSD program.

The proposed project is subject to review under Section 200 of the Rules. Section 203.02 of the Rules requires the facility to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS). Section 210 of the Rules requires the facility to demonstrate compliance with the toxic air pollutants (TAPs) increments, which are listed in Sections 585 and 586 of the Rules.

The modeling analyses: 1) utilized appropriate methods and models; 2) were conducted using reasonably accurate or conservative model parameters and input data; 3) adhered to established DEQ guidelines for new source review dispersion modeling; 4) showed that predicted pollutant concentrations from emissions associated with the facility were below national ambient air quality standards and other applicable increments at all ambient air locations.

This modeling analysis was conducted by Parallax, an Energy Solutions Company (Parallax), on behalf of the applicant, Bannock County Solid Waste Department (Bannock County) for their FMHRL facility.

Key assumptions and results that should be considered in the development of the permit are shown in Table 1.

Table 1. KEY ASSUMPTIONS USED IN MODELING ANALYSES	
Criteria/Assumption/Result	**Explanation/Consideration**
The flare was modeled at an annual NO_2 emission rate of 2.5 tons per year. The IC engine was modeled at an annual NO_2 emission rate of 45.4 tons per year.	Only modeling for compliance with annual averaging periods was required for this project at the emission rates listed in Exhibit 8-5 of the permit application. These sources were modeled as operating concurrently at these emission rates. NO_2 impacts were well below the NAAQS. NO_2 impacts were at 23% of NAAQS including the ambient background concentration.
No non-carcinogenic TAPs emissions exceeded the screening emission limits (EL) specified in Section 585 of the Rules. Carcinogenic TAP emissions that exceeded the EL values were modeled and found to have minimal ambient impacts.	Carcinogenic TAPs impacts were well below all allowable increments. Under the assumptions used in the emission estimates and with the exhaust parameters for the flare and the IC engine, predicted ambient impacts of carcinogenic TAPs were all less than 1% of the allowable increment with the IC engine and the flare operating concurrently.
Emissions of all criteria air pollutants except NO_2, were below secondary modeling thresholds. A NAAQS compliance demonstration was not required for PM_{10} ($PM_{2.5}$), SO_2, NO_x, or lead.	

2.0 Background Information

2.1 Applicable Air Quality Impact Limits and Modeling Requirements

This section identifies applicable ambient air quality limits and analyses used to demonstrate compliance.

2.1.1 Area Classification

The FHMRL facility is located in Bannock County, which is designated as an attainment or unclassifiable area for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), lead (Pb), ozone (O_3), and particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM_{10}).

There are no Class I areas within 10 kilometers of the facility.

2.1.2 Significant and Full Impact Analyses

If estimated maximum pollutant impacts to ambient air from the emissions sources at the facility exceed the significant contribution levels (SCLs) of Section 006.102 of the Rules, then a full impact analysis is necessary to demonstrate compliance with Section 203.02. A full impact analysis for attainment area pollutants involves adding ambient impacts from facility-wide emissions, and emissions from any identified co-contributing sources, to DEQ-approved background concentration values that are appropriate for the criteria pollutant/averaging-time at the facility location and the area of significant impact. The resulting maximum pollutant concentrations in ambient air are then compared to the National Ambient Air Quality Standards (NAAQS) listed in Table 2. Table 2 also lists SCLs and specifies the modeled value that must be used for comparison to the NAAQS.

Table 2. CRITERIA AIR POLLUTANTS APPLICABLE REGULATORY LIMITS				
Pollutant	**Averaging Period**	**Significant Contribution Levels[a] ($\mu g/m^3$)[b]**	**Class II NAAQS Regulatory Limit [c] ($\mu g/m^3$)**	**Modeled Value Used[d]**
PM_{10}[e]	Annual	1.0	50[f]	Maximum 1st highest[g]
	24-hour	5.0	150[h]	Maximum 6th highest[i]
Carbon monoxide (CO)	8-hour	500	10,000[j]	Maximum 2nd highest[g]
	1-hour	2,000	40,000[j]	Maximum 2nd highest[g]
Sulfur Dioxide (SO_2)	Annual	1.0	80[f]	Maximum 1st highest[g]
	24-hour	5	365[j]	Maximum 2nd highest[g]
	3-hour	25	1,300[j]	Maximum 2nd highest[g]
Nitrogen Dioxide (NO_2)	Annual	1.0	100[f]	Maximum 1st highest[g]
Lead (Pb)	Quarterly	NA	1.5 [k,l]	Maximum 1st highest[g]

[a.] Idaho Air Rules Section 006.102
[b.] Micrograms per cubic meter
[c.] National Ambient Air Quality Standards specified by Idaho Air Rules Section 577 for criteria pollutants
[d.] The maximum 1st highest modeled value is always used for significant impact analysis
[e.] Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
[f.] Never expected to be exceeded in any calendar year
[g.] Concentration at any modeled receptor
[h.] Never expected to be exceeded more than once in any calendar year.
[i.] Concentration at any modeled receptor when using five years of meteorological data
[j.] Not to be exceeded more than once per year
[k] Measured as total suspended particulates
[l.] Not to be exceeded in any quarter

2.1.3 TAPs Analyses

The increase in emissions from the proposed project are required to demonstrate compliance with the toxic air pollutant (TAP) increments, with an ambient impact dispersion analysis required for any TAP having a requested potential emission rate that exceeds the screening emission rate limit (EL) specified by Idaho Air Rules (Rules) Section 585 or 586.

This project is for an existing landfill facility which proposes to install two emissions sources to combust captured landfill gas. Any TAP emissions increases associated with this project are subject to the requirements of the TAPs regulations. The analyses submitted in the application and supplemental addenda included a TAPs compliance demonstration per the requirements of Section 210 of the Rules. A compliance demonstration was included for emission increases requested with this permitting action. Only carcinogenic TAPs regulated by Section 586 of the Rules were expected to increase. No increase in non-carcinogenic TAPs emissions, which are regulated by Section 585 of the Rules, was requested.

2.2 Background Concentrations

Background concentration values were provided by DEQ for this project. Default rural agricultural background values were provided in the modeling protocol approval letter. Only NO_2 emissions were expected to exceed modeling thresholds and a background concentration of 17 $\mu g/m^3$, annual average, was used for the facility's NAAQS demonstration.

3.0 Modeling Impact Assessment

3.1 Modeling Methodology

Table 3 provides a summary of the modeling parameters used in the submitted modeling analyses.

Table 3. MODELING PARAMETERS		
Parameter	**Description/ Values**	**Documentation/Additional Description**
Model	AERMOD	AERMOD, Version 07026
Meteorological data	2006	DEQ provided a pre-processed 2006 met data set to Parallax/Energy Solutions. The applicant rotated the windfield 135 degrees clockwise for this modeling demonstration.
Land Use (urban or rural)	Rural	Urban heat rise coefficients were not used. DEQ agrees with the applicant's assessment that a rural land use designation is appropriate.
Terrain	Considered	3-dimensional receptor coordinates were obtained from Digital Elevation Model (DEM) files for Pocatello and Inkom.
Building downwash	Downwash algorithm	AERMOD, Version 07026 uses BPIP-Prime and the PRIME algorithms to evaluate structure-induced downwash effects.
Receptor grid	Grid 1	100-meter spacing in a 1,500 meter (X) by 1,500 meter (Y) grid centered on the emission sources. On-site (non-ambient air) receptors were not deleted.
	Grid 2	North Grid: 200-meter spacing in a grid placed external to Grid 1 and extending out to 5,000 meters north of the facility.
	Grid 3	South Grid: 200-meter spacing in a grid placed external to Grid 1 and extending out to 5,000 meters south of the facility.
	Grid 4	East Grid: 200-meter spacing in a grid placed external to Grid 1 and extending out to 5,000 meters east of the facility.
	Grid 5	West Grid: 200-meter spacing in a grid placed external to Grid 1 and extending out to 5,000 meters west of the facility.
	Grid 6	Ambient air boundary receptors were placed with 100 meter spacing.
	Grid 7	100-meter spacing in a grid located along the northern edge of the facility in the region of maximum ambient impacts. Because this 100-meter grid was situated by an offset of 50 meters in relation to Grid 2, the resulting receptor resolution was 50 meters where the two grids overlap. These two grids combined were used to resolve the maximum ambient impacts.
	Sensitive Receptor	A single receptor was placed at the Century High School.

3.1.1 Modeling protocol

A modeling protocol was submitted to DEQ by Parallax, an Energy Solutions Company, on behalf of Bannock County, on October 14, 2009. This modeling protocol was approved, with comments, by DEQ, on October 19, 2009.

Modeling was conducted using methods documented in the modeling protocol and the *State of Idaho Air Quality Modeling Guideline*.

3.1.2 Model Selection

AERMOD, Version 07026, was used by Parallax, on behalf of Bannock County, to conduct the ambient air analyses for NAAQS and TAPs compliance demonstrations. AERMOD, Version 07026 was replaced by AERMOD, Version 09292 on October 23, 2009—just after DEQ approval of the modeling protocol on October 19, 2009. Use of the older version of the model is approvable for this project.

3.1.3 Meteorological Data

DEQ provided Parallax with a single full year of processed met data from 2006. The met tower monitoring data that was gathered by P4 Production, LLC, at their facility's on-site met tower which is located on the northern edge of the town of Soda Springs, Idaho. This met data set has undergone a quality assurance/quality control (QA/QC) review of the data for a prior project, and this data was

determined to meet QA/QC requirements. Of the 10-, 37-, and 65-meter data available in the dataset, only the 10-meter data was used as input data in AERMET for the surface data component. Salt Lake City, Utah data was used as for the upper air data inputs to AERMET.

Parallax examined the wind rose for 10-meter met data collected on-site at the FHMRL facility and compared it to the wind rose for the 2006 P4 met data set. Parallax rotated the wind field by 135 degrees in a clockwise direction to account for a predominantly south and south east flow pattern exhibited by the FHMRL on-site data.

3.1.4 Terrain Effects

The modeling analyses conducted by Bannock County/Parallax considered elevated terrain. The elevation of each receptor was obtained from United Geological Survey (USGS) digital elevation map (DEM) files for the area surrounding the facility. Elevations for emission sources and buildings were determined by Parallax/Bannock County.

3.1.5 Facility Layout

DEQ checked Google Earth to verify the facility's property boundary. There are no existing structures on-site according to the mid-2004 era Google Earth images. The proposed layout of emissions sources and the generator set structure was accepted as submitted.

3.1.6 Building Downwash

Plume downwash effects caused by structures at the facility were accounted for in the modeling analyses. The Building Profile Input Program-Plume Rise and Building Downwash Model (BPIP-PRIME) was used by the applicant to calculate direction-specific building dimensions and Good Engineering Practice (GEP) stack height information from building dimensions/configurations and emissions release parameters. The output from BPIP-PRIME was used as input to AERMOD, Version 07026, to account for building-induced downwash effects.

3.1.7 Ambient Air Boundary

Ambient air was determined to exist for all areas immediately exterior to the facility's property boundary. The modeling protocol described a fenceline around the entire facility perimeter to prohibit access by any member of the general public. A fenced property boundary is sufficient to establish as the ambient air boundary, in accordance with the methods specified in the *State of Idaho Air Quality Modeling Guideline*.

3.1.8 Receptor Network

The receptor grids used by NWI met the minimum recommendations specified in the *State of Idaho Air Quality Modeling Guideline*. DEQ determined the receptor grid was adequate to reasonably resolve the maximum modeled ambient impacts.

3.2 Emission Rates

3.2.1 Modeled Emission Rates

Emissions rates used in the dispersion modeling analyses submitted by the applicant were reviewed against those in the permit application. The following approach was used for Bannock County's modeling demonstration:

- All modeled criteria air pollutant and TAP emissions rates were equal to or greater than the facility's emissions calculated in the PTC application and the requested permit allowable emission rates listed in the air quality permit.

Table 4 lists the hourly emission rates that were modeled to demonstrate compliance with the significant contribution levels (SCLs) with annual averaging periods. Note that Table 4 lists NO_2 emissions—not NO_x emissions. The emission rates listed in the table below were modeled continuously for 8,760 hours per year.

Table 4. MODELED ANNUAL AVERAGE EMISSIONS RATES

Source ID	Description	Emission Rates (lb/hr)[a]
		NO_2[b]
E1	Internal Combustion Engine-Landfill Gas-Fired	10.36
F1	Open Flare	0.58

[a.] Pounds per hour
[b.] Nitrogen dioxide

The carcinogenic toxic air pollutant (TAP) annual average emission rates listed below in Table 5 were modeled to demonstrate compliance with the applicable acceptable ambient concentration (AACC) increments. Emissions of all other TAPs were estimated to be below emissions screening levels (ELs) listed in Sections 585 and 586 of the Rules, and air impact analyses were not required. The emission rates were modeled continuously for 8,760 hours per year without any additional restrictions on the emission rates or hours of operation. Multiply the hourly emission rates listed in Table 5 by 8,760 hours per year to obtain the annual emissions of each TAP represented in the modeling demonstration.

Table 5. MODELED CARCINOGENIC TOXIC AIR POLLUTANT EMISSIONS RATES

TAP	CAS #	IC Engine (lb/hr)[a]	Flare (lb/hr)
1,1,2,2-Tetrachloroethane	79-34-5	1.5E-04	3.4E-04
1,1-Dichloroethane	75-34-3	3.3E-04	7.7E-04
1,3-Butadiene	106-99-0	1.5E-05	3.3E-05
Dichloromethane	75-09-2	8.6E-04	2.0E-03

[a.] Pounds per hour

3. 3 Emission Release Parameters

3.3.1 Point Sources

Table 8 provides emissions release parameters, including stack height, stack diameter, exhaust temperature, and exhaust velocity for point sources. The application goes into detail on creating the assumptions used in establishing the IC engine's exhaust parameters. The resulting stack gas temperature and exit velocity are both regarded by DEQ to be conservative values for the modeling demonstration.

Values used in the analyses appeared reasonable and within expected ranges for the assumptions used in the submitted analyses.

Table 8. POINT SOURCE STACK PARAMETERS					
Release Point	**Description**	**Stack Height (m)[a]**	**Stack Gas Flow Temperature (K)[b]**	**Stack Gas Flow Velocity (m/sec)[c]**	**Stack Diameter (m)**
E1	Internal Combustion Engine Fired on Landfill Gas	10	333	6.3	0.457

[a] Meters
[b] Kelvin
[c] Meters per second

3.3.3 Flare Sources

Flare source exhaust parameters are listed below in Table 9, and were accepted as submitted in the application. The release height and heat release are calculated values based on the design of the flare, the quantity of landfill gas incinerated, and the heat content of the landfill gas.

Table 9. FLARE STACK PARAMETERS						
Release Point	**Description**	**Release Height (m[a])**	**Stack Temperature (Kelvin)**	**Stack Velocity (m/s[c])**	**Heat Release (MMBtu/hr[d])**	**Radiation Loss (%)**
F1	Flare	12.5	974	23.2	15.93	25

[a] Meters
[b] Meters per second
[c] Million British thermal units per hour

3.4 Results for Ambient Impact Analyses

3.4.1 Significant Impact Analyses

A significant impact analysis was not performed for this project. Emissions of PM_{10}, SO_2, CO, and lead were below modeling applicability thresholds.

3.4.2 Full Impact Analyses

A full impact analysis was performed by Bannock County for this project.

Table 10. RESULTS OF FULL IMPACT ANALYSES						
Pollutant	**Averaging Period**	**Modeled Design Concentration ($\mu g/m^3$)[a]**	**Background Concentration ($\mu g/m^3$)**	**Total Ambient Impact ($\mu g/m^3$)**	**NAAQS[b] ($\mu g/m^3$)**	**Percent of NAAQS**
NO_2[c]	Annual	5.5	17	22.5	100	23 %

[a] Micrograms per cubic meter
[b] National ambient air quality standards
[c] Nitrogen dioxide

3.4.3 Toxic Air Pollutant Impact Analyses

Dispersion modeling for TAPs was required to demonstrate compliance with TAP increments specified by Idaho Air Rules Section 586. No increase in TAPs emissions with a 24-hour averaging period (non-carcinogenic TAPs) was requested for this project. This project's caused emission increases that exceeded the screening emission rate limits. The requested emission increases were modeled to demonstrate compliance with the allowable TAP increments.

The results of the TAPs analyses are listed in Table 11. The predicted ambient TAPs impacts were well below allowable increments.

Table 11. RESULTS OF CARCINOGENIC TAPs ANALYSES				
Toxic Air Pollutant	**CAS No.[a]**	**Maximum Modeled Concentration ($\mu g/m^3$)[b]**	**AACC[c] ($\mu g/m^3$)**	**Percent of AACC**
1,1,2,2-Tetrachloroethane	79-34-5	1.3E-04	1.7E-02	0.8%
1,1-Dichloroethane	75-34-3	3.0E-04	3.8E-02	0.8%
1,3-Butadiene	106-99-0	Below 1.0E-05	3.6E-03	Less than 0.3%
Dichloromethane	75-09-2	7.5E-04	2.4E-01	0.3%

[a.] Chemical Abstract Service Number
[b] Micrograms per cubic meter
[b] Acceptable ambient concentration for carcinogens

4.0 Conclusions

The ambient air impact analysis submitted demonstrated to DEQ's satisfaction that emissions from the facility, as represented by the applicant in the permit application, will not cause or significantly contribute to a violation of any air quality standard.