Date: January 10, 2013

To: Phillip D'Amo, BLM Winnemucca District Office

From: Craig L. Nicholls, BLM National Operations Center

Subject: Dispersion Modeling for New York Canyon Geothermal Environmental Assessment - Revised

A screening-level dispersion modeling effort was performed for potential future emissions of Hydrogen Sulfide (H_2S) from the proposed New York Canyon Geothermal plant in Pershing and Churchill counties Nevada. Geothermal energy plants generally have very low of emissions of criteria pollutants (Nitrogen dioxide, particulate matter, etc.), so that typical air quality dispersion modeling is not performed.

However, these plants can have potentially significant emissions of Hydrogen Sulfide (H_2S). In addition, the State of Nevada, Bureau of Air Quality Planning (BAQP) has a state Ambient Air Quality Standards for H_2S, which 112 $\mu g/m^3$ (1-hour average), and cannot be exceeded more than once per year. Therefore, the BLM initiated this screening modeling analysis as part of the NEPA process. The modeling for this analysis was conducted at the BLM National Operations Center (NOC) air quality modeling staff.

The EPA-recommended near-field American Meteorological Society/EPA Regulatory Model (AERMOD) modeling suite was utilized for this analysis. The AERMOD suite consists of three primary models: a meteorological data preprocessor (AERMET), a terrain data preprocessor and the main dispersion module, AERMOD. The model utilizes stack parameters (release height, etc.) and meteorological data to predict ground level ambient air concentration at specified receptor locations. The AERMOD model may be found on the EPA SCRAM website (http://www.epa.gov/scram001/), and the most recent version (12060), as part of the Lakes Environmental AERMOD View software was utilized for this project.

Table 1 lists the assumptions used in the analysis.

Table 1. Modeling Assumptions

Assumption Used	Notes/Comments
Regulatory default switch	Sets all model switches to EPA-recommended values
Flat Terrain	Plant location not known
No H_2S Background concentration	No data available; rural location

Source and emissions information for possible future cooling tower were provided by Terra-Gen power and are listed in Table 2 below. These values are largely based on one or more existing geothermal plants.

Table 2. Source and Emissions Values

Parameter	Value (units)
Release Height (top of cooling tower)	45.6 feet (13.9 meters)
Footprint of tower structure	300 long feet by 65 wide (91.5 m by 19.8 m)

H2S emission rate	43.38 lbs/hour (5.466 grams/sec)
Distance to possible fenceline	2000 feet (609.6 m)
Exit Velocity	36 ft/sec (10.9 m/sec)
Exit Temperature	83.8 ^{o}F (302 Kelvin)

The most appropriate way to characterize a cooling tower in the model is as a "volume" source (a 3-D box). However, the model algorithms for a volume source currently do not accept temperature and exit velocity inputs. Therefore, the methodology used by Terra Gen for the modeling for a Nevada BAPC permit for the Dixie Valley facility was applied for the New York Canyon modeling.

The cooling tower was represented as a point source, using the parameters listed above. However, a single "stack" diameter had to be derived based on the size of each of the release points of the 7 cooling tower cells ("equivalent stack diameter"). This equivalent diameter stack was then place at the center of the hypothetical cooling tower structure. Unlike the permit modeling, a single exit temperature value was for all hours of the year.

Meteorological (met) data needed to drive the model was obtained from the National Weather Service station in Winnemucca. Four years of both surface and upper air data for the years 1984-1987 were selected (see http://www.webmet.com for details). The AERMET program was used to process this data into a format that AERMOD can use. The land surrounding both the project area and the airport were characterized as "desert shrubland" to derive additional information needed by AERMET.

Model receptors (points beyond the facility where the model estimates concentrations) were laid out in a regular (Cartesian) grid spaced at 100 meters from the center of the facility out to 10 kilometers in all directions. The estimated plant boundary was input and all receptors inside the boundary were removed as ambient air, where state and federal standards are applicable, is at or beyond the property boundary.

The results of the modeling are shown below in Table 3.

Table 3. AERMOD Results of H_2S Modeling for New York Canyon Geothermal

Year of Met Data	Second High Maximum 1-Hour Average Concentration ($\mu g/m^3$)[a]	Nevada H_2S Ambient Standard ($\mu g/m^3$)	Modeled Concentration Less Than Standard?
1984	4.59	112	Yes
1985	6.51	112	Yes
1986	5.05	112	Yes
1987	9.33	112	Yes

a – The state standard is defined as "cannot be exceeded more than once per year." Therefore the second highest one-hour concentration from each year was compared to the standard.

The results above need to be understood in the proper context. While this modeling analysis shows results below the standard, this does not mean that, once the actual facility is constructed, these exact impacts will occur. All of the inputs to this analysis are estimates and professional judgments based on one or more existing geothermal facilities and past experience.

For example, the H_2S content of the geothermal fluid is unknown at this time. In addition, as the geothermal fluid is cycled through the plant and back out to the well field, the concentration of H_2S in the fluid will gradually taper off to near zero, such that modeled H_2S concentrations would also gradually decrease to near zero.

All model input and output files, meteorological data and all other files used in this analysis will be available from the BLM National Operations Center air quality modeling staff or NEPA staff at the Winnemucca District office.