APPENDIX C – AIR QUALITY ANALYSIS

Colt Engineering Corporation

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Job No. 05C5482

04th April 2007

Ms. Cory Hemmingway
Talisman Energy Inc.

Dear Ms. Hemmingway:

Re: Dispersion Analysis for SO_2 emissions at Talisman's Proposed Bear Canyon Well Site

We have, as requested, conducted a dispersion analysis to predict ambient SO_2 concentrations associated with the proposed Incinerator at Talisman Energy's proposed Bear Canyon Well Site. The dispersion modeling was conducted using CALPUFF model and the predicted concentrations are compared against Wyoming Ambient Air Quality Standards (WAAQS).

INTRODUCTION

Talisman Energy intends to incinerate waste gas streams continuously during normal operations at their Bear Canyon Well Site located within Uinta County, Wyoming, USA.

In order to assess potential air quality impacts resulting from SO_2 emissions due to incineration of waste gas streams, dispersion modelling was conducted by Colt Engineering Corporation. Ambient SO_2 concentrations in the vicinity of the subject site associated with the normal operations scenario were predicted. This report presents the modelling methodology and provides predictions of ground-level ambient sulphur dioxide (SO_2) concentrations.

ASSUMPTIONS

- An oil battery configuration was assumed for the well site facility for the purposes of this study.
- The gas processing configuration would only result in the worst case scenario of emergency flaring event for a maximum duration of 15 minutes and hence was not included in this study.

METHODOLOGY

Model Selection

The US EPA CALPUFF Model (in 2-dimensional mode) was used to predict the SO_2 ground-level concentrations for 3-hour, 24-hour and annual averaging periods. CALPUFF is an advanced non-steady-state puff dispersion model recommended for use in complex terrain situations for modelling ground-level and ambient concentrations of pollutants from industrial sources. CALPUFF model is one of the recommended models for conducting refined assessments and is acceptable by USEPA.

Meteorology

SAMSON (Solar and Meteological Surface Observation Network) Data from Rock Springs and SCRAM Mixing Height Archived Data for Wyoming State were utilized for this study. Utilizing PCRAMMET, a meteorological time series was prepared using the dataset to contain hourly observations for four years, from 01 January, 1987 to 31 December, 1990.

Modelling Domain and Receptors

The Universal Transverse Mercator (UTM, NAD 83) co-ordinate system was used for the purpose of this modelling. With the Well Site located near the center, a 50 km × 50 km receptor grid formed the modeling domain. Topography was derived from 1-degree USGS DEM terrain data, with receptors placed at:

- 50 m spacing within 0.5 km from the well site boundary;
- 250 m spacing from 0.5 km to 2.5 km from the well site;
- 500 m spacing from 2.5 km to 5 km from the well site;
- 1000 m spacing from 5 km to the outer range of the domain;

SO_2 Emissions at Bear Canyon Well Site

Table 1 summarizes the emission parameters associated with the proposed Incinerator, that were provided by the Incinerator manufacturer and used in the CALPUFF modelling.

Table 1 Gas Composition and Emission Parameters associated with the proposed Incinerator at the Talisman Bear Canyon Well Site

Emission Parameter	Incinerator
Stack Height (m)	12.2
Stack Diameter (m)	1.556
Exit Temperature (K)	1254
Exit Velocity (m/s)	12.71
SO_2 Emission Rate (g/s)	0.27

MODELING RESULTS

The air dispersion modeling was conducted using Rock Springs Meteorological data set, in conjunction with the above emission parameters, and terrain data to predict ground-level SO_2 concentrations. The maximum predicted ambient ground-level concentrations of SO_2 associated with emissions from the proposed Incinerator are presented in Table 2.

Table 2 Maximum predicted ambient ground-level SO_2 concentrations associated with the proposed Incinerator at the Talisman Bear Canyon Well Site

Averaging Time	Maximum Predicted SO_2 Concentration [µg/m^3]	Background Concentration* [µg/m^3]	Maximum Predicted SO_2 Concentration including background concentrations [µg/m^3]	Wyoming Ambient Air Quality Standards [µg/m^3]
3-hour	7.5	93	100.5	1300
24-hour	2.2	32	34.2	260
Annual	0.33	4	4.33	60

* Data collected at Lost Cabin Gas Plant (preconstruction monitoring) Fremont County, WY 1986-1987 La Barge Study Area at the Northwest Pipeline Craven Creek site, 1982-1983 (WDEQ).

CONCLUSIONS

All the predicted three-hour, 24-hour and annual average ambient SO_2 concentrations in the vicinity of the Talisman Bear Canyon Wellsite associated with the proposed Incinerator, including background concentrations are below the Wyoming Ambient Air Quality Standards (WAAQS). Therefore, based on these modelling results, normal operations at Talisman Bear Canyon Wellsite should not result in any violations of WAAQS.

We hope that this letter is sufficient for your informational needs. If you have any additional questions please do not hesitate to contact me directly at (403) 640-3970.

Amit Bhargava, P. Eng.
Senior Environmental Engineer

H2S and SO2 Calculations

	Stream 1	*Stream 2 (4*	*Combined*
Composition	**Mole fraction**		
Hydrogen	0.0002	0.0000	0.0002
Nitrogen	0.0610	0.0086	0.0598
CO2	0.0422	0.0324	0.0420
H2S	0.0005	0.0007	0.0005
Methane	0.5595	0.1889	0.5512
Ethane	0.1342	0.1577	0.1347
Propane	0.0951	0.2234	0.0980
i-Butane	0.0223	0.0717	0.0234
n-Butane	0.0442	0.1524	0.0466
i-Pentane	0.0114	0.0447	0.0121
n-Pentane	0.0102	0.0405	0.0109
n-Hexane	0.0067	0.0275	0.0072
n-Heptane+	0.0051	0.0209	0.0055
Flowrate (MMSCF	0.02426	0.0006	0.0248151

Ambient Pr. (kPa)	101.325
Volumetric flowrate of H2S (Sm3/s)	9.84685E-05
Rydberg's Constant (R)	8.3144
Temperature (K)	288
No. of moles of H2S (moles/s	n= PV/R
Incinerator conversion efficiency	99.9%
No. of moles of SO2 (moles/s)	0.004162515
Mol. Wt. Of SO2 (g/mol)	64
SO2 emission rate (g/s)	**0.27**