

# Battery Application (04-19) 102.04-18-010-27W1

## Appendix B- Gas Dispersion Modelling

Screen3 Calculator Assumptions						
Company	Tundra Oil & Gas		Date Reviewed	7-Dec-22		
Facility	(04-19) 102.04-18-10-27		Name	J. Abel, S. Benko		
RED are inputs						
Oil ( m3)	18		Treater	Flare	Tank Vent	
H2O (m3)	12	% volume of total	0	100	0	100
GOR (m3/m3)	52	m3	0	936	0	936
Total Gas=	936 m3					
Mole Fraction	0.004	Date of test	September 6, 2022 at Wellhead Casing			
	Treater	Flare	Tank Vent			
Vent Height ( m)	4.5	Vent Height (m)	12.2	Vent Height (m)	10	
Stack ID (m)	0.4573	Stack ID (m)	0.0762	Stack ID (m)	0.0762	
	point	point	point	point	Source	
<b>RESULTS</b>						
Flare						
Vent stack Exit Flow Rate	4.33333E-05 m3/s					
Emission Rate	H2S	0.0624611 g/s				
	SO2	0.117410367 g/s				
Vent stack area	0.004560233 m2					
Vent stack exit velocity	2.375609705 m/s					



## Sour Gas Flare Properties

Company **Tundra Oil & Gas**  
 Facility **(4-19) 102.4-18-10-27 Wellhead**  
 Case **Solution Gas**

### Flow Rate

Gas Stream	flare	scrubber	total gas	
Flow Rate	0.936	0.000	0.936	10 <sup>3</sup> m <sup>3</sup> /d at 15°C and 101.3 kPa
Percentage	100.0	0.0	100.0	%
Reference Temp	15	15	15	°C

### Composition (dry)

				Mole Fraction
H <sub>2</sub>	0.0001		0.0001	
He	0.0002		0.0002	
N <sub>2</sub>	0.2075		0.2075	
CO <sub>2</sub>	0.0128		0.0128	
H <sub>2</sub> S	0.0040		0.0040	
C <sub>1</sub>	0.0579		0.0579	
C <sub>2</sub>	0.2254		0.2254	
C <sub>3</sub>	0.3207		0.3207	
iC <sub>4</sub>	0.0415		0.0415	
nC <sub>4</sub>	0.0875		0.0875	
iC <sub>5</sub>	0.0159		0.0159	
nC <sub>5</sub>	0.0139		0.0139	
C <sub>6</sub>	0.0073		0.0073	
C <sub>7+</sub>	0.0053		0.0053	
Total	1.0000	0.0000	1.0000	

### Gas Stream Properties

Molecular Mass	39.17	0.00	39.17	kg/kmole
Net Heating Value	64.20	0.00	64.20	10 <sup>3</sup> m <sup>3</sup> /d at 15°C and 101.3 kPa
Net Heat Release Rate	166,118	0	166,118	cal/s
Equivalent SO <sub>2</sub> Inlet	0.010	0.000	0.010	t/d
Equivalent SO <sub>2</sub> Inlet	0.12	0.00	0.12	g/s

### Stack Parameters

Flare Stack Height	12.2	m		
Flare Stack Diameter	76.00	mm		
Actual Exit Velocity	2.39	m/s		
Length of Flame:	1.80	m		
Heat Intensity at Base	1.11	kW/m <sup>2</sup>		Background = 1.04 kW/m <sup>2</sup>
Conversion Efficiency	100.00	%		
Radiation Loss	25	%		(Brode => 55%, AENV => 25%)
Sensible Heat Release	124,589	cal/s		Based on conversion efficiency & radiation loss

### Model Input Parameters

Effective Stack Height	13.63	m		(per EPA and Beychok, M.; 1979)
Pseudo-diameter	1.009	m		based on actual exit velocity
Actual Exit Velocity	2.39	m/s		
Exit Temperature	1273	K	1000	°C
Ambient temperature	288	K		Pseudo temperature for modelling

### Emissions

SO <sub>2</sub> Emission	0.117	g/s		Based on user-specified conversion efficiency
H <sub>2</sub> S Emission	0.000	g/s		Based on user-specified conversion efficiency
NO <sub>x</sub> Emission	0.020	g/s		Based on US EPA AP-42

**RWDI West Inc.**  
 Consulting Engineers  
 1800, 840-7<sup>th</sup> Avenue S.W.  
 Calgary, Alberta, T2P 3G2

Tel: (403) 232-6771  
 Fax: (403) 232-6762  
 Email: info@rwdiwest.com  
 Website: www.rwdiwest.com

**Model Results:**

12/07/22

10:40:20

\*\*\* SCREEN3 MODEL RUN \*\*\*

\*\*\* VERSION DATED 13043 \*\*\*

SIMPLE TERRAIN INPUTS:

SOURCE TYPE = FLARE

EMISSION RATE (G/S) = 0.117000

FLARE STACK HEIGHT (M) = 12.2000

TOT HEAT RLS (CAL/S) = 166118.

RECEPTOR HEIGHT (M) = 0.0000

URBAN/RURAL OPTION = RURAL

EFF RELEASE HEIGHT (M) = 13.6267

BUILDING HEIGHT (M) = 0.0000

MIN HORIZ BLDG DIM (M) = 0.0000

MAX HORIZ BLDG DIM (M) = 0.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.

THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

BUOY. FLUX = 2.754 M\*\*4/S\*\*3; MOM. FLUX = 1.680 M\*\*4/S\*\*2.

\*\*\* FULL METEOROLOGY \*\*\*

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\*\*\* SCREEN AUTOMATED DISTANCES \*\*\*

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\*\*\* TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES \*\*\*

DIST	CONC	U10M	USTK	MIX HT	PLUME	SIGMA	SIGMA		
(M)	(UG/M**3)	STAB (M/S)	(M/S)	(M)	HT (M)	Y (M)	Z (M)	DWASH	

1.	0.000	1	1.0	1.0	320.0	58.45	1.00	0.93	NO
100.	4.499	1	3.0	3.1	960.0	28.57	27.19	14.59	NO
200.	6.212	2	3.0	3.1	960.0	28.57	36.42	20.68	NO
300.	6.570	3	3.0	3.1	960.0	28.43	34.55	20.76	NO
400.	6.180	3	2.0	2.1	640.0	35.83	45.10	27.20	NO
500.	5.640	3	1.5	1.5	480.0	43.23	55.42	33.52	NO
600.	5.474	4	2.5	2.6	800.0	31.12	43.01	21.79	NO
700.	5.247	4	2.5	2.6	800.0	31.12	49.44	24.55	NO
800.	5.026	4	2.0	2.1	640.0	35.49	55.92	27.50	NO
900.	4.739	4	2.0	2.1	640.0	35.49	62.20	30.12	NO
1000.	4.531	4	1.5	1.6	480.0	42.78	68.63	33.16	NO
1100.	4.299	4	1.5	1.6	480.0	42.78	74.78	35.13	NO
1200.	4.061	4	1.5	1.6	480.0	42.78	80.87	37.04	NO
1300.	3.829	4	1.5	1.6	480.0	42.78	86.92	38.90	NO
1400.	3.607	4	1.5	1.6	480.0	42.78	92.93	40.72	NO
1500.	3.450	4	1.0	1.0	320.0	57.36	99.33	43.50	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

286.	6.592	3	3.0	3.1	960.0	28.43	33.19	19.97	NO
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DWASH= MEANS NO CALC MADE (CONC = 0.0)

DWASH=NO MEANS NO BUILDING DOWNWASH USED

DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED

DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED

DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3\*LB

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\*\*\* SUMMARY OF SCREEN MODEL RESULTS \*\*\*

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CALCULATION	MAX CONC	DIST TO	TERRAIN
PROCEDURE	(UG/M**3)	MAX (M)	HT (M)

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SIMPLE TERRAIN	6.592	286.	0.
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\*\* REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS \*\*

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