

**APPENDIX 'F'**

**Screening Level Air Quality Assessment Results**



## EMISSION RATE CALCULATION

**Source ID:** Headworks  
**Source Type:** Point Source  
**Description:** Headworks ventilation stack

### 1. Data:

Headworks dimensions: Length (m) Width (m) Height (m)  
 24 10 5  
 Air Exchange in Headworks 12 air changes per hour  
 estimated ventilation flow rate: 14400 m<sup>3</sup>/hr = 4 m<sup>3</sup>/s

Contaminant	CAS	Odorous Contaminants Concentration	MW	Flow Rate (m <sup>3</sup> /s)	Emission rate without Odour control	Removal Efficiency	Emission rate with odour control
Odour	na	4180 OU/m <sup>3</sup>	na	4.0	1.67E+04 OU/s	95.0%	8.36E+02 OU/s
Hydrogen Sulfide	7783-06-4	16.9 ppmv	34	4.0	9.58E-02 g/s	95.0%	4.79E-03 g/s
*Mercaptan (as methyl mercaptan)	74-93-1	0.256 ppmv	48	4.0	2.05E-03 g/s	95.0%	1.02E-04 g/s
Ammonia	7664-41-7	0.025 ppmv	17	4.0	7.08E-05 g/s	95.0%	3.54E-06 g/s
**Total reduced sulfide (TRS)	na	17.18 ppmv	34	4.0	9.72E-02 g/s	95.0%	4.86E-03 g/s

NOTE:

\* Mercaptan includes methyl mercaptan, ethyl mercaptan, 1-propyl mercaptan. The emission rate of mercaptan is expressed as methyl mercaptan.

\*\*Total reduced sulfur (TRS) compounds means a mixture that includes at least one reduced sulfur compound of reduced sulfur compounds. As H<sub>2</sub>S is the Major component in Headworks TRS, MW of H<sub>2</sub>S is used as MW of TRS.

### Example Calculation of Emission Rate for H<sub>2</sub>S:

$$\begin{aligned}
 \text{mg/m}^3 &= (\text{ppmV})(12.187)(\text{MW})/(273.15 + \text{ }^\circ\text{C}) \\
 \text{H}_2\text{S concentration (mg/m}^3) &= 16.9 \times 12.187 \times 34 / (273.15 + 20) \\
 &= 23.9409 \\
 \text{H}_2\text{S concentration (g/m}^3) &= 0.02394 \\
 \\ 
 \text{H}_2\text{S emission rate (g/s)} &= \text{Concentration (g/m}^3) \times \text{Flow rate (m}^3\text{/s)} \\
 &= 0.02394 \text{ g/m}^3 \times 4 \text{ m}^3\text{/s} \\
 &= 0.09576
 \end{aligned}$$

TABLE 1

**Odour Impact Assessment Summary***Everett WWTP Outfall Class EA Headworks Odour Emission*

Contaminants	CAS Number	Estimated Emission Rates (g/s)	Air Dispersion model used	Maximum POI Concentration ( $\mu\text{g}/\text{m}^3$ )	Time period	MOE POI Limits ( $\mu\text{g}/\text{m}^3$ )
<b>Baseline Condition without odour control</b>						
Odour	na	1.67E+04	AERSCREEN	12.41	10-min	1
Hydrogen Sulfide	7783-06-4	9.58E-02	AERSCREEN	51.70	1/2 hr	10
				71.09	10-min	13
				25.85	24-hr	7
*Mercaptan (as methyl mercaptan)	74-93-1	2.05E-03	AERSCREEN	1.52	10-min	13
				1.11	1/2 hr	10
Ammonia	7664-41-7	7.08E-05	AERSCREEN	0.038	1/2 hr	300
				0.019	24-hr	100
**Total reduced sulfide (TRS)	na	9.72E-02	AERSCREEN	52.43	1/2 hr	10
				72.09	10-min	13
				26.21	24-hr	7
<b>Operational condition with odour control</b>						
Odour	na	8.36E+02	AERSCREEN	0.62	10-min	1
Hydrogen Sulfide	7783-06-4	4.79E-03	AERSCREEN	2.59	1/2 hr	10
				3.55	10-min	13
				1.29	24-hr	7
*Mercaptan (as methyl mercaptan)	74-93-1	1.02E-04	AERSCREEN	0.076	10-min	13
				0.055	1/2 hr	10
Ammonia	7664-41-7	3.54E-06	AERSCREEN	0.0019	1/2 hr	300
				0.0010	24-hr	100
**Total reduced sulfide (TRS)	na	4.86E-03	AERSCREEN	2.62	1/2 hr	10
				3.60	10-min	13
				1.31	24-hr	7

**Sample Calculation:**

Dispersion Factor (DF):

AERSCREEN was conducted for the single stack of headworks based on a emission rate of 1 g/s from headworks ventilation. The maximum predicted off-property concentration in  $\mu\text{g}/\text{m}^3$  per 1 g/s emission is called a dispersion factor. Actual POI concentration of a contaminant equals to the dispersion factor times the actual emission rate of that contaminant.

AERSCREEN modelling DF:

1-hr averaging DF:		449.70 $\mu\text{g}/\text{m}^3$ per 1 g/s
24-hr averaging DF:		269.80 $\mu\text{g}/\text{m}^3$ per 1 g/s
Convert to a 1/2-hr DF	449.70 x 1.2 =	539.64 $\mu\text{g}/\text{m}^3$ per 1 g/s
Convert to a 10-min DF:	449.70 x 1.65 =	742.01 $\mu\text{g}/\text{m}^3$ per 1 g/s