

Appendix 8.2 Detailed Assessment Results of Ecological Risk Assessment – Aquatic Life

Table 1 Ecological Risk to Aquatic Life at edge of Mixing Zone due to Contaminants of Concern (Scenario 1)

| COC | Conc. in Effluent (mg/L) | Conc. in Seawater (mg/L) | Conc. at edge of Mixing Zone – Daily Max. (mg/L) | Conc. at edge of Mixing Zone – Annual Avg. (mg/L) | Conc. at edge of Mixing Zone – 4-day Avg. (mg/L) | Conc. at edge of Mixing Zone – Lowest Seasonal Avg. Dilution Factor (mg/L) | Conc. at edge of Mixing Zone – 10%tile dilution factor (mg/L) | Toxicity Reference Value (mg/L) | Hazard Quotient | Hazard Quotient (due to background) | |
|--|--------------------------|--------------------------|--|---|--|--|---|---------------------------------|---------------------|-------------------------------------|-------------|
| <i>Potential CBPs</i> | | | | | | | | | | | |
| Total Residual Chlorine | 0.1 | 0 | 1.85E-03 | 6.76E-04 | 5.81E-04 | 8.00E-04 | 1.22E-03 | 0.013 | 1.42E-01 | 0 | |
| Chloroform | 0.007 | 0 | 1.30E-04 | 4.73E-05 | 4.07E-05 | 5.60E-05 | 8.54E-05 | 0.012 | 3.94E-03 | 0 | |
| Chloroacetic acid | 0.004 | 0 | 7.41E-05 | 2.70E-05 | 2.33E-05 | 3.20E-05 | 4.88E-05 | 32 | 1.00E-06 | 0 | |
| Dibromoacetic acid | 0.004 | 0 | 7.41E-05 | 2.70E-05 | 2.33E-05 | 3.20E-05 | 4.88E-05 | 0.69 | 4.64E-05 | 0 | |
| Dichloroacetic acid | 0.0459 | 0 | 8.50E-04 | 3.10E-04 | 2.67E-04 | 3.67E-04 | 5.60E-04 | 0.23 | 1.60E-03 | 0 | |
| Trichloroacetic acid | 0.022 | 0 | 4.07E-04 | 1.49E-04 | 1.28E-04 | 1.76E-04 | 2.68E-04 | 93 | 1.89E-06 | 0 | |
| Tetrachloroethylene | 0.0013 | 0 | 2.41E-05 | 8.78E-06 | 7.56E-06 | 1.04E-05 | 1.59E-05 | 0.00885 | 9.93E-04 | 0 | |
| Trichloroethylene | 0.002 | 0 | 3.70E-05 | 1.35E-05 | 1.16E-05 | 1.60E-05 | 2.44E-05 | 0.01 | 1.35E-03 | 0 | |
| 2,4,6-trichlorophenol | 0.002 | 0 | 3.70E-05 | 1.35E-05 | 1.16E-05 | 1.60E-05 | 2.44E-05 | 0.0121 | 1.32E-03 | 0 | |
| Hexachlorobenzene | 0.00025 | 0 | 4.63E-06 | 1.69E-06 | 1.45E-06 | 2.00E-06 | 3.05E-06 | 0.00003 | 5.63E-02 | 0 | |
| b-BHC | 0.0005 | 0 | 9.26E-06 | 3.38E-06 | 2.91E-06 | 4.00E-06 | 6.10E-06 | 0.000046 | 7.34E-02 | 0 | |
| g-BHC | 0.0005 | 0 | 9.26E-06 | 3.38E-06 | 2.91E-06 | 4.00E-06 | 6.10E-06 | 0.000063 | 5.36E-02 | 0 | |
| <i>Contaminants present in CEPT Effluent</i> | | | | | | | | | | | |
| Aluminum | 0.0159 | 0.0156 | 1.56E-02 | 1.56E-02 | 1.56E-02 | 1.56E-02 | 1.56E-02 | 1.5 | 1.04E-02 | 1.04E-02 | |
| Antimony | 0.000721 | 0.000258 | 2.67E-04 | 2.61E-04 | 2.61E-04 | 2.62E-04 | 2.64E-04 | 4.3 | 6.07E-05 | 6.00E-05 | |
| Barium | 0.0232 | 0.00665 | 6.96E-03 | 6.76E-03 | 6.75E-03 | 6.78E-03 | 6.85E-03 | 5 | 1.36E-03 | 1.33E-03 | |
| Chromium III | 0.00958 | 0.00028 | 4.52E-04 | 3.43E-04 | 3.34E-04 | 3.54E-04 | 3.93E-04 | 0.0274 | 1.25E-02 | 1.02E-02 | |
| Copper | 0.00859 | 0.00002 | 1.79E-04 | 7.79E-05 | 6.98E-05 | 8.86E-05 | 1.25E-04 | 0.005 | 2.49E-02 | 4.00E-03 | |
| Lead | 0.000128 | 0.000055 | 5.64E-05 | 5.55E-05 | 5.54E-05 | 5.56E-05 | 5.59E-05 | 0.0081 | 6.84E-03 | 6.79E-03 | |
| Nickel | 0.0262 | 0.00077 | 1.24E-03 | 9.42E-04 | 9.18E-04 | 9.73E-04 | 1.08E-03 | 0.005 | 2.16E-01 | 1.54E-01 | |
| Selenium | 0.00031 | 0.00007 | 7.44E-05 | 7.16E-05 | 7.14E-05 | 7.19E-05 | 7.29E-05 | 0.071 | 1.01E-03 | 9.86E-04 | |
| Silver | 0.000182 | 0.000006 | 9.26E-06 | 7.19E-06 | 7.02E-06 | 7.41E-06 | 8.15E-06 | 0.0014 | 5.14E-03 | 4.29E-03 | |
| Tin | 0.000844 | 0.00014 | 1.53E-04 | 1.45E-04 | 1.44E-04 | 1.46E-04 | 1.49E-04 | 0.0816 | 1.78E-03 | 1.72E-03 | |
| Vanadium | 0.0295 | 0.00173 | 2.24E-03 | 1.92E-03 | 1.89E-03 | 1.95E-03 | 2.07E-03 | 0.1 | 1.92E-02 | 1.73E-02 | |
| Zinc | 0.0141 | 0.00237 | 2.59E-03 | 2.45E-03 | 2.44E-03 | 2.46E-03 | 2.51E-03 | 0.02 | 1.26E-01 | 1.19E-01 | |
| Ammonia | 22 | 0.23 | 6.33E-01 | 3.77E-01 | 3.57E-01 | 4.04E-01 | 4.95E-01 | 0.91 | 4.14E-01 | 2.53E-01 | |
| Sulphide | 4.9 | 0.048 | 1.38E-01 | 8.08E-02 | 7.62E-02 | 8.68E-02 | 1.07E-01 | 0.1 | 8.68E-01 | 4.80E-01 | |
| TCDD | 1E-10 | 3.9E-11 | 4.01E-11 | 3.94E-11 | 3.94E-11 | 3.95E-11 | 3.97E-11 | 3.8E-08 | 1.04E-03 | 1.03E-03 | |
| Toluene | 0.012 | 0 | 2.22E-04 | 8.11E-05 | 6.98E-05 | 9.60E-05 | 1.46E-04 | 0.04 | 2.03E-03 | 0 | |
| Diazinon | 0.000048 | 0 | 8.89E-07 | 3.24E-07 | 2.79E-07 | 3.84E-07 | 5.85E-07 | 0.00001 | 3.24E-02 | 0 | |
| Malathion | 0.000031 | 0 | 5.74E-07 | 2.09E-07 | 1.80E-07 | 2.48E-07 | 3.78E-07 | 0.00002 | 1.05E-02 | 0 | |
| | | | | | | | | | Hazard Index | 2.09 | 1.06 |

Concentration adopted for Hazard Quotient calculation

Table 2 Ecological Risk to Aquatic Life at edge of Mixing Zone due to Contaminants of Concern (Scenario 2)

| COC | Conc. in Effluent (mg/L) | Conc. in Seawater (mg/L) | Conc. at edge of Mixing Zone – Daily Max. (mg/L) | Conc. at edge of Mixing Zone – Annual Avg. (mg/L) | Conc. at edge of Mixing Zone – 4-day Avg. (mg/L) | Conc. at edge of Mixing Zone – Lowest Seasonal Avg. Dilution Factor (mg/L) | Conc. at edge of Mixing Zone – 10%tile dilution factor (mg/L) | Toxicity Reference Value (mg/L) | Hazard Quotient | Hazard Quotient (due to background) |
|--|--------------------------|--------------------------|--|---|--|--|---|---------------------------------|-----------------|-------------------------------------|
| <i>Potential CBPs</i> | | | | | | | | | | |
| Total Residual Chlorine | 0.1 | 0 | 2.33E-03 | 8.85E-04 | 7.81E-04 | 8.85E-04 | 1.30E-03 | 0.013 | 2.20E-01 | 0 |
| Chloroform | 0.007 | 0 | 1.63E-04 | 6.19E-05 | 5.47E-05 | 6.19E-05 | 9.09E-05 | 0.012 | 9.72E-03 | 0 |
| Chloroacetic acid | 0.004 | 0 | 9.30E-05 | 3.54E-05 | 3.13E-05 | 3.54E-05 | 5.19E-05 | 32 | 2.19E-06 | 0 |
| Dibromoacetic acid | 0.004 | 0 | 9.30E-05 | 3.54E-05 | 3.13E-05 | 3.54E-05 | 5.19E-05 | 0.69 | 1.02E-04 | 0 |
| Dichloroacetic acid | 0.0459 | 0 | 1.07E-03 | 4.06E-04 | 3.59E-04 | 4.06E-04 | 5.96E-04 | 0.23 | 3.50E-03 | 0 |
| Trichloroacetic acid | 0.022 | 0 | 5.12E-04 | 1.95E-04 | 1.72E-04 | 1.95E-04 | 2.86E-04 | 93 | 4.15E-06 | 0 |
| Tetrachloroethylene | 0.0013 | 0 | 3.02E-05 | 1.15E-05 | 1.02E-05 | 1.15E-05 | 1.69E-05 | 0.00885 | 2.45E-03 | 0 |
| Trichloroethylene | 0.002 | 0 | 4.65E-05 | 1.77E-05 | 1.56E-05 | 1.77E-05 | 2.60E-05 | 0.01 | 3.33E-03 | 0 |
| 2,4,6-trichlorophenol | 0.002 | 0 | 4.65E-05 | 1.77E-05 | 1.56E-05 | 1.77E-05 | 2.60E-05 | 0.0121 | 2.90E-03 | 0 |
| Hexachlorobenzene | 0.00025 | 0 | 5.81E-06 | 2.21E-06 | 1.95E-06 | 2.21E-06 | 3.25E-06 | 0.00003 | 1.39E-01 | 0 |
| b-BHC | 0.0005 | 0 | 1.16E-05 | 4.42E-06 | 3.91E-06 | 4.42E-06 | 6.49E-06 | 0.000046 | 1.81E-01 | 0 |
| g-BHC | 0.0005 | 0 | 1.16E-05 | 4.42E-06 | 3.91E-06 | 4.42E-06 | 6.49E-06 | 0.000063 | 1.32E-01 | 0 |
| <i>Contaminants present in CEPT Effluent</i> | | | | | | | | | | |
| Aluminum | 0.0159 | 0.0156 | 1.56E-02 | 1.56E-02 | 1.56E-02 | 1.56E-02 | 1.56E-02 | 1.5 | 1.04E-02 | 1.04E-02 |
| Antimony | 0.000721 | 0.000258 | 2.69E-04 | 2.62E-04 | 2.62E-04 | 2.62E-04 | 2.64E-04 | 4.3 | 6.18E-05 | 6.00E-05 |
| Barium | 0.0232 | 0.00665 | 7.03E-03 | 6.80E-03 | 6.78E-03 | 6.80E-03 | 6.86E-03 | 5 | 1.39E-03 | 1.33E-03 |
| Chromium III | 0.00958 | 0.00028 | 4.96E-04 | 3.62E-04 | 3.53E-04 | 3.62E-04 | 4.01E-04 | 0.0274 | 1.59E-02 | 1.02E-02 |
| Copper | 0.00859 | 0.00002 | 2.19E-04 | 9.58E-05 | 8.70E-05 | 9.58E-05 | 1.31E-04 | 0.005 | 3.90E-02 | 4.00E-03 |
| Lead | 0.000128 | 0.000055 | 5.67E-05 | 5.56E-05 | 5.56E-05 | 5.56E-05 | 5.59E-05 | 0.0081 | 7.05E-03 | 6.79E-03 |
| Nickel | 0.0262 | 0.00077 | 1.36E-03 | 9.95E-04 | 9.69E-04 | 9.95E-04 | 1.10E-03 | 0.005 | 2.58E-01 | 1.54E-01 |
| Selenium | 0.00031 | 0.00007 | 7.56E-05 | 7.21E-05 | 7.19E-05 | 7.21E-05 | 7.31E-05 | 0.071 | 1.08E-03 | 9.86E-04 |
| Silver | 0.000182 | 0.000006 | 1.01E-05 | 7.56E-06 | 7.38E-06 | 7.56E-06 | 8.29E-06 | 0.0014 | 6.38E-03 | 4.29E-03 |
| Tin | 0.000844 | 0.00014 | 1.56E-04 | 1.46E-04 | 1.46E-04 | 1.46E-04 | 1.49E-04 | 0.0816 | 1.87E-03 | 1.72E-03 |
| Vanadium | 0.0295 | 0.00173 | 2.38E-03 | 1.98E-03 | 1.95E-03 | 1.98E-03 | 2.09E-03 | 0.1 | 2.19E-02 | 1.73E-02 |
| Zinc | 0.0141 | 0.00237 | 2.64E-03 | 2.47E-03 | 2.46E-03 | 2.47E-03 | 2.52E-03 | 0.02 | 1.30E-01 | 1.19E-01 |
| Ammonia | 22 | 0.23 | 7.36E-01 | 4.23E-01 | 4.00E-01 | 4.23E-01 | 5.13E-01 | 0.91 | 6.51E-01 | 2.53E-01 |
| Sulphide | 4.9 | 0.048 | 1.61E-01 | 9.09E-02 | 8.59E-02 | 9.09E-02 | 1.11E-01 | 0.1 | 1.33E+00 | 4.80E-01 |
| TCDD | 1E-10 | 3.9E-11 | 4.04E-11 | 3.95E-11 | 3.95E-11 | 3.95E-11 | 3.98E-11 | 3.8E-08 | 1.05E-03 | 1.03E-03 |
| Toluene | 0.012 | 0 | 2.79E-04 | 1.06E-04 | 9.38E-05 | 1.06E-04 | 1.56E-04 | 0.04 | 5.00E-03 | 0 |
| Diazinon | 0.000048 | 0 | 1.12E-06 | 4.25E-07 | 3.75E-07 | 4.25E-07 | 6.23E-07 | 0.00001 | 8.00E-02 | 0 |
| Malathion | 0.000031 | 0 | 7.21E-07 | 2.74E-07 | 2.42E-07 | 2.74E-07 | 4.03E-07 | 0.00002 | 2.58E-02 | 0 |
| Hazard Index | | | | | | | | | 2.30 | 1.06 |

Concentration adopted for Hazard Quotient calculation

Table 3 Ecological Risk to Aquatic Life at edge of Mixing Zone due to Contaminants of Concern (Scenario 3)

| COC | Conc. in Effluent (mg/L) | Conc. in Seawater (mg/L) | Conc. at edge of Mixing Zone – Daily Max. (mg/L) | Conc. at edge of Mixing Zone – Annual Avg. (mg/L) | Conc. at edge of Mixing Zone – 4-day Avg. (mg/L) | Conc. at edge of Mixing Zone – Lowest Seasonal Avg. Dilution Factor (mg/L) | Conc. at edge of Mixing Zone – 10%tile dilution factor (mg/L) | Toxicity Reference Value (mg/L) | Hazard Quotient | Hazard Quotient (due to background) | |
|---|--------------------------|--------------------------|--|---|--|--|---|---------------------------------|---------------------|-------------------------------------|-------------|
| <i>Potential CBPs</i> | | | | | | | | | | | |
| Total Residual Chlorine | 0.01 | 0 | 2.33E-04 | 8.85E-05 | 7.81E-05 | 8.85E-05 | 1.30E-04 | 0.013 | 1.79E-02 | 0 | |
| Bromoform | 0.049 | 0 | 1.14E-03 | 4.34E-04 | 3.83E-04 | 4.34E-04 | 6.36E-04 | 0.36 | 1.20E-03 | 0 | |
| Dibromochloromethane | 0.008 | 0 | 1.86E-04 | 7.08E-05 | 6.25E-05 | 7.08E-05 | 1.04E-04 | 0.034 | 2.08E-03 | 0 | |
| Dibromoacetic acid | 0.01 | 0 | 2.33E-04 | 8.85E-05 | 7.81E-05 | 8.85E-05 | 1.30E-04 | 0.69 | 1.28E-04 | 0 | |
| Dichloroacetic acid | 0.003 | 0 | 6.98E-05 | 2.65E-05 | 2.34E-05 | 2.65E-05 | 3.90E-05 | 0.23 | 1.15E-04 | 0 | |
| Trichloroacetic acid | 0.007 | 0 | 1.63E-04 | 6.19E-05 | 5.47E-05 | 6.19E-05 | 9.09E-05 | 93 | 6.66E-07 | 0 | |
| Hexachlorobenzene | 0.00025 | 0 | 5.81E-06 | 2.21E-06 | 1.95E-06 | 2.21E-06 | 3.25E-06 | 0.00003 | 7.37E-02 | 0 | |
| b-BHC | 0.0005 | 0 | 1.16E-05 | 4.42E-06 | 3.91E-06 | 4.42E-06 | 6.49E-06 | 0.000046 | 9.62E-02 | 0 | |
| g-BHC | 0.0005 | 0 | 1.16E-05 | 4.42E-06 | 3.91E-06 | 4.42E-06 | 6.49E-06 | 0.000063 | 7.02E-02 | 0 | |
| <i>Contaminants present in Secondary Treated Effluent</i> | | | | | | | | | | | |
| Antimony | 0.000782 | 0.000258 | 2.70E-04 | 2.63E-04 | 2.62E-04 | 2.63E-04 | 2.65E-04 | 4.3 | 6.11E-05 | 6.00E-05 | |
| Barium | 0.0237 | 0.00665 | 7.05E-03 | 6.80E-03 | 6.78E-03 | 6.80E-03 | 6.87E-03 | 5 | 1.36E-03 | 1.33E-03 | |
| Chromium III | 0.00844 | 0.00028 | 4.70E-04 | 3.52E-04 | 3.44E-04 | 3.52E-04 | 3.86E-04 | 0.0274 | 1.29E-02 | 1.02E-02 | |
| Copper | 0.00663 | 0.00002 | 1.74E-04 | 7.85E-05 | 7.16E-05 | 7.85E-05 | 1.06E-04 | 0.005 | 2.12E-02 | 4.00E-03 | |
| Nickel | 0.0223 | 0.00077 | 1.27E-03 | 9.61E-04 | 9.38E-04 | 9.61E-04 | 1.05E-03 | 0.005 | 2.10E-01 | 1.54E-01 | |
| Selenium | 0.00013 | 0.00007 | 7.14E-05 | 7.05E-05 | 7.05E-05 | 7.05E-05 | 7.08E-05 | 0.071 | 9.93E-04 | 9.86E-04 | |
| Silver | 0.000099 | 0.000006 | 8.16E-06 | 6.82E-06 | 6.73E-06 | 6.82E-06 | 7.21E-06 | 0.0014 | 4.87E-03 | 4.29E-03 | |
| Tin | 0.000457 | 0.00014 | 1.47E-04 | 1.43E-04 | 1.42E-04 | 1.43E-04 | 1.44E-04 | 0.0816 | 1.75E-03 | 1.72E-03 | |
| Vanadium | 0.0313 | 0.00173 | 2.42E-03 | 1.99E-03 | 1.96E-03 | 1.99E-03 | 2.11E-03 | 0.1 | 1.99E-02 | 1.73E-02 | |
| Zinc | 0.00979 | 0.00237 | 2.54E-03 | 2.44E-03 | 2.43E-03 | 2.44E-03 | 2.47E-03 | 0.02 | 1.23E-01 | 1.19E-01 | |
| Ammonia | 4.2 | 0.23 | 3.22E-01 | 2.65E-01 | 2.61E-01 | 2.65E-01 | 2.82E-01 | 0.91 | 2.91E-01 | 2.53E-01 | |
| Sulphide | 0.053 | 0.048 | 4.81E-02 | 4.80E-02 | 4.80E-02 | 4.80E-02 | 4.81E-02 | 0.1 | 4.80E-01 | 4.80E-01 | |
| TCDD | 6.2E-11 | 3.9E-11 | 3.95E-11 | 3.92E-11 | 3.92E-11 | 3.92E-11 | 3.93E-11 | 3.8E-08 | 1.03E-03 | 1.03E-03 | |
| Diazinon | 0.000058 | 0 | 1.35E-06 | 5.13E-07 | 4.53E-07 | 5.13E-07 | 7.53E-07 | 0.00001 | 5.13E-02 | 0 | |
| Malathion | 0.000015 | 0 | 3.49E-07 | 1.33E-07 | 1.17E-07 | 1.33E-07 | 1.95E-07 | 0.00002 | 6.64E-03 | 0 | |
| | | | | | | | | | Hazard Index | 1.49 | 1.06 |

Concentration adopted for Hazard Quotient calculation