

# **Sludge Treatment Facility Stack Gas Monitoring Report October 2016**

## **I. INTRODUCTION**

This Monthly Report aims to provide a summary of environmental performance of the Sludge Treatment Facility (STF) over the monitoring period, which includes the air emission data collected by a Continuous Emission Monitoring System (CEMS), and the periodic monitoring of heavy metals, dioxins and furans.

## **II. THE ENVIRONMENTAL MONITORING RESULTS**

The STF is required to undertake regular checks on the air emission during the operation of the plant. There are four incineration trains, namely, Train AF, Train AE, Train BF and Train BE in the STF. Air emissions from the incineration trains under operation are closely monitored through a comprehensive management and monitoring programme to ensure that the plant is being operated safely and in an environmentally acceptable manner.

The CEMS on key parameters is installed in each incineration train to ensure combustion and air pollutant removal processes are functionally well. Furthermore, each incineration train is equipped with an automatic sludge feed cut-off system. In the event that the CEMS picks up any potential sign of exceedance of any of the control parameters, sludge feed to the incineration train will be stopped automatically.

In October 2016, four incineration trains AE, AF, BE and BF were in operation.

For stack gas monitoring, emission rate of the key parameters are summarized in the tables below. All emission records and test results by the respective accredited laboratories have been checked and certified by the Consultants before publication. The results of stack gas monitoring are in compliance with all stack gas control parameters with respect to the mass emission limit.

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**Stack AE**

|   | Parameters   | Emission Limits <sup>(i)</sup><br>(kg/hr) | Range<br>(kg/hr) | Mean<br>(kg/hr) | Compliance<br>(Y/N) |
|---|--|---|------------------|-----------------|---------------------|
| <b>(a) Continuous Monitoring – Hourly Average (Measurement by CEMS)</b> |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 2.277                                     | 0.00 – 1.65      | 0.03            | Y                   |
|   | Total organic carbon   | 1.512                                     | 0.00 – 1.15      | 0.12            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 4.545                                     | 0.03 – 0.96      | 0.27            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.306                                     | 0.00 – 0.20      | 0.05            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 15.147                                    | 0.13 – 7.77      | 2.97            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 7.578                                     | 0.00 – 0.47      | 0.04            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 30.303                                    | 1.69 – 13.58     | 5.53            | Y                   |
| <b>(b) Continuous Monitoring – Daily Average (Measurement by CEMS)</b>  |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 0.756                                     | 0.01 – 0.50      | 0.05            | Y                   |
|   | Total organic carbon   | 0.756                                     | 0.01 – 0.26      | 0.11            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 0.756                                     | 0.17 – 0.40      | 0.26            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.072                                     | 0.02 – 0.06      | 0.05            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 3.789                                     | 2.35 – 3.40      | 2.96            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 3.789                                     | 0.02 – 0.15      | 0.05            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 15.147                                    | 2.77 – 9.29      | 5.71            | Y                   |

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|  | Parameters                             | Emission Limits <sup>(i)</sup><br>(kg/hr) | Result<br>(kg/hr)        | Compliance<br>(Y/N) |
|--|--|---|--------------------------|---------------------|
| <b>(c) Monthly Monitoring (Measurement by accredited laboratory)</b> |  |   |                          |                     |
|  | Mercury                                | 0.003789                                  | 0.0006                   | Y                   |
|  | Total Cadmium &<br>Thallium            | 0.003789                                  | <0.0012                  | Y                   |
|  | Total Heavy<br>Metals <sup>(iii)</sup> | 0.0378                                    | <0.0053                  | Y                   |
|  | Dioxins and<br>Furans <sup>(iv)</sup>  | $7.575 \times 10^{-9}$                    | $<5.797 \times 10^{-10}$ | Y                   |

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**Stack AF**

|   | Parameters   | Emission Limits <sup>(i)</sup><br>(kg/hr) | Range<br>(kg/hr) | Mean<br>(kg/hr) | Compliance<br>(Y/N) |
|---|--|---|------------------|-----------------|---------------------|
| <b>(a) Continuous Monitoring – Hourly Average (Measurement by CEMS)</b> |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 2.277                                     | 0.00 – 0.76      | 0.01            | Y                   |
|   | Total organic carbon   | 1.512                                     | 0.00 – 0.58      | 0.06            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 4.545                                     | 0.00 – 0.40      | 0.14            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.306                                     | 0.00 – 0.13      | 0.04            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 15.147                                    | 0.00 – 6.21      | 2.61            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 7.578                                     | 0.00 – 0.18      | 0.03            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 30.303                                    | 0.97 – 13.19     | 4.57            | Y                   |
| <b>(b) Continuous Monitoring – Daily Average (Measurement by CEMS)</b>  |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 0.756                                     | 0.00 – 0.34      | 0.03            | Y                   |
|   | Total organic carbon   | 0.756                                     | 0.01 – 0.13      | 0.05            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 0.756                                     | 0.02 – 0.21      | 0.13            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.072                                     | 0.01 – 0.06      | 0.04            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 3.789                                     | 1.10 – 3.32      | 2.61            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 3.789                                     | 0.01 – 0.07      | 0.03            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 15.147                                    | 2.53 – 7.28      | 4.70            | Y                   |

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|  | Parameters                             | Emission Limits <sup>(i)</sup><br>(kg/hr) | Result<br>(kg/hr)        | Compliance<br>(Y/N) |
|--|--|---|--------------------------|---------------------|
| <b>(c) Monthly Monitoring (Measurement by accredited laboratory)</b> |  |   |                          |                     |
|  | Mercury                                | 0.003789                                  | <0.0003                  | Y                   |
|  | Total Cadmium &<br>Thallium            | 0.003789                                  | <0.0011                  | Y                   |
|  | Total Heavy<br>Metals <sup>(iii)</sup> | 0.0378                                    | <0.0047                  | Y                   |
|  | Dioxins and<br>Furans <sup>(iv)</sup>  | $7.575 \times 10^{-9}$                    | $<5.166 \times 10^{-10}$ | Y                   |

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**Stack BE**

|   | Parameters   | Emission Limits <sup>(i)</sup><br>(kg/hr) | Range<br>(kg/hr) | Mean<br>(kg/hr) | Compliance<br>(Y/N) |
|---|--|---|------------------|-----------------|---------------------|
| <b>(a) Continuous Monitoring – Hourly Average (Measurement by CEMS)</b> |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 2.277                                     | 0.00 – 0.62      | 0.01            | Y                   |
|   | Total organic carbon   | 1.512                                     | 0.00 – 1.41      | 0.11            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 4.545                                     | 0.00 – 1.64      | 0.15            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.306                                     | 0.01 – 0.20      | 0.04            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 15.147                                    | 0.06 – 7.26      | 2.91            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 7.578                                     | 0.00 – 0.31      | 0.03            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 30.303                                    | 0.96 – 8.93      | 4.06            | Y                   |
| <b>(b) Continuous Monitoring – Daily Average (Measurement by CEMS)</b>  |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 0.756                                     | 0.00 – 0.28      | 0.02            | Y                   |
|   | Total organic carbon   | 0.756                                     | 0.03 – 0.35      | 0.11            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 0.756                                     | 0.08 – 0.23      | 0.15            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.072                                     | 0.02 – 0.05      | 0.04            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 3.789                                     | 1.99 – 3.27      | 2.88            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 3.789                                     | 0.01 – 0.07      | 0.03            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 15.147                                    | 2.55 – 6.04      | 4.16            | Y                   |

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|  | Parameters                             | Emission Limits <sup>(i)</sup><br>(kg/hr) | Result<br>(kg/hr)        | Compliance<br>(Y/N) |
|--|--|---|--------------------------|---------------------|
| <b>(c) Monthly Monitoring (Measurement by accredited laboratory)</b> |  |   |                          |                     |
|  | Mercury                                | 0.003789                                  | <0.0003                  | Y                   |
|  | Total Cadmium &<br>Thallium            | 0.003789                                  | <0.0013                  | Y                   |
|  | Total Heavy<br>Metals <sup>(iii)</sup> | 0.0378                                    | <0.0061                  | Y                   |
|  | Dioxins and<br>Furans <sup>(iv)</sup>  | $7.575 \times 10^{-9}$                    | $<6.731 \times 10^{-10}$ | Y                   |

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**Stack BF**

|   | Parameters   | Emission Limits <sup>(i)</sup><br>(kg/hr) | Range<br>(kg/hr) | Mean<br>(kg/hr) | Compliance<br>(Y/N) |
|---|--|---|------------------|-----------------|---------------------|
| <b>(a) Continuous Monitoring – Hourly Average (Measurement by CEMS)</b> |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 2.277                                     | 0.00 – 0.72      | 0.01            | Y                   |
|   | Total organic carbon   | 1.512                                     | 0.00 – 1.36      | 0.11            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 4.545                                     | 0.01 – 0.59      | 0.15            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.306                                     | 0.00 – 0.16      | 0.04            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 15.147                                    | 0.05 – 6.56      | 2.33            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 7.578                                     | 0.00 – 0.10      | 0.01            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 30.303                                    | 0.63 – 8.96      | 3.54            | Y                   |
| <b>(b) Continuous Monitoring – Daily Average (Measurement by CEMS)</b>  |  |   |                  |                 |                     |
|   | Particulates <sup>(ii)</sup>   | 0.756                                     | 0.00 – 0.12      | 0.02            | Y                   |
|   | Total organic carbon   | 0.756                                     | 0.01 – 0.31      | 0.11            | Y                   |
|   | Hydrogen Chloride<br>(HCl)   | 0.756                                     | 0.08 – 0.35      | 0.15            | Y                   |
|   | Hydrogen Fluoride<br>(HF)  | 0.072                                     | 0.03 – 0.05      | 0.04            | Y                   |
|   | Sulphur Dioxide<br>(SO <sub>2</sub> )  | 3.789                                     | 1.71 – 2.78      | 2.32            | Y                   |
|   | Carbon Monoxide<br>(CO)  | 3.789                                     | 0.00 – 0.05      | 0.02            | Y                   |
|   | Nitrogen Oxides<br>(NO <sub>x</sub> ) as<br>Nitrogen Dioxide<br>(NO <sub>2</sub> ) | 15.147                                    | 2.00 – 5.32      | 3.56            | Y                   |



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|  | Parameters                             | Emission Limits <sup>(i)</sup><br>(kg/hr) | Result<br>(kg/hr)        | Compliance<br>(Y/N) |
|--|--|---|--------------------------|---------------------|
| <b>(c) Monthly Monitoring (Measurement by accredited laboratory)</b> |  |   |                          |                     |
|  | Mercury                                | 0.003789                                  | <0.0004                  | Y                   |
|  | Total Cadmium &<br>Thallium            | 0.003789                                  | <0.0014                  | Y                   |
|  | Total Heavy<br>Metals <sup>(iii)</sup> | 0.0378                                    | <0.0063                  | Y                   |
|  | Dioxins and<br>Furans <sup>(iv)</sup>  | $7.575 \times 10^{-9}$                    | $<7.090 \times 10^{-10}$ | Y                   |

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Explanatory Notes

- (i) The results of measurements are standardized at the reference conditions of 0°C temperature, 101.325 kPa pressure, dry and 11% oxygen content conditions.
- (ii) The particulates mean the respirable suspended particulates, which are suspended particulates in air with a nominal aerodynamic diameter of 10 µm or smaller.
- (iii) Average values over a sampling period of a minimum of 30 minutes and a maximum of 8 hours, including Sb, As, Pb, Co, Cr, Cu, Mn, V and Ni.
- (iv) Average values over a sampling period of 6 to 8 hours.