ANNEX F INVESTIGATION REPORT

Investigation Report of CEMS Exceedances	
Date	1 – 31 August 2024
Time	Continuous Monitoring throughout August 2024
Monitoring Location	Continuous Environmental Monitoring Systems (CEMS)
Parameter	Various emission parameters of the Centralised Air Pollution Control Unit (CAPCS), Cogeneration Units (CHPs), Ammonia Stripping Plant (ASP), and Standby Gas Flaring Unit
Exceedance Description	Continuous monitoring was carried out at the CAPCS, CHPs, and ASP throughout the reporting period using the CEMS. According to the EM&A Manual, an exceedance is considered if the emission concentration of the concerned pollutants is higher than the emission limits stated in Tables 2.2, 2.3, 2.4, and 2.5 of the EM&A Manual (Version F) for the CAPCS, CHPs, Standby Flare, and ASP respectively. The concentrations of the concerned air pollutants were monitored on-line by the CEMS. Exceedances of various emission parameters were recorded on the CEMS including: • Total Odour from CAPCS; • NO_x and SO_2 from CHP1; • NO_x from CHP2; • NO_x, SO_2, NH_3, and HCl from the ASP; • VOCs and HF from the Standby Gas Flaring Unit. The Contractor has investigated the cause of the exceedances and identified that: • The exceedances of Total Odour from CAPCS remain under investigation by the Contractor and will be updated in the subsequent monthly EM&A report. • The exceedances of NO_x and SO_2 and from the CHPs; NO_x, SO_2, NH_3, and HCl from the ASP occurred due to system instability. • The exceedances of VOCs and HF from the Standby Gas Flaring Unit occurred when emergency condition required the use of the flare. • Regarding the NO_x exceedances from CHP1, the Contractor has identified that the exceedances may be attributed to the frequent stopping/ starting of the system. • Regarding the NO_x exceedances from CHP2, the Contractor has identified that the exceedances may be attributed to the frequent stopping/ starting of the system. • Regarding the SO_2 exceedances from the CHPs, SO_2 sampling and testing was completed by a third-party laboratory that showed lower SO_2 values than those reported by the CEMS. The lower values measured by the laboratory was attributed to methane gas interference. Based on this study, it was proposed to implement a

Investigation Report of CEMS Exceedances	
	correction factor in the CEMS to adjust for the methane gas interference. After review by MT and IEC, the correction factor was implemented on 17 May 2024. • The various exceedances from the ASP can be attributed to the frequent starting and stopping of the system which has been causing unstable process conditions during operation. • The exceedances at the Standby Gas Flaring Unit occurred due to unstable operation (low temperature).
Action Taken / Action to be Taken	The Contractor investigated the reason for the exceedances and arranged Remedial Works and Follow-up Actions (see below).
Remedial Works and Follow-up Actions	The Remedial Works and Follow-up Actions to be implemented by the Contractor to address the above exceedances (as well as updates on any exceedances from recent months) are detailed in the following table below.

Monitoring Location	Measures/ Actions to Address any Exceedances	Implementation Timeline & Status
Centralised Air Pollution Unit (CAPCS)	• To address the exceedances for Total Odour (ou/Nm^3) recorded in January 2024 – February 2024 and August 2024, the Contractor ordered a new H_2S / ORP sensor to replace the faulty one which was installed on 23 May 2024. • The cleaning of the ventilation pumps was conducted in April 2024.	• All measures have been implemented [(a)].
Cogeneration Unit 1 (CHP 1)	• To address the ongoing NO_x exceedances recorded from October 2023 – August 2024, the Contractor ordered 3 new cylinder heads from the supplier to replace the old ones and improve performance which were installed in May 2024. • To address the SO_2 exceedances recorded from October 2023 – June 2024 and August 2024, SO_2 sampling and testing was completed by a third-party laboratory that showed lower SO_2 values than those reported by the CEMS. The lower values measured by the laboratory was attributed to methane gas interference. Based on this study, it was proposed to implement a correction factor in the CEMS to adjust for the methane gas interference. After review by MT and IEC, the correction factor was implemented in May 2024. • To address the HCl exceedances recorded from October 2023 – April 2024 and July 2024, the Contractor implemented in May 2024 fine tuning measures such as reviewing the ignition temperature curve, spark plug condition check and adjusting the intake & exhaust valves on the cylinder to reduce the fluctuations in HCl emissions and keep within the permissible limit.	• The new cylinder heads were installed in May 2024, and further works are ongoing. • The updated SO_2 correction factor was implemented on 17 May 2024. • The fine-tuning measures were implemented during May 2024. • The CHP expert visited in from 20-24 May 2024 and report submitted in June 2024; Contractor began reviewing the report in July 2024. • A further tuning was carried out for the CHP on 12 August 2024. • The Contractor will receive additional training in December 2024.

Monitoring Location	Measures/ Actions to Address any Exceedances	Implementation Timeline & Status
	• A CHP expert from Europe visited the ORRC1 facility from 20-24 May to review the performance of the CHPs. • The Contractor will receive additional advanced training from the manufacturer for the operation and maintenance of the equipment. • The Contractor will continue additional maintenance works for the CHPs during the coming month.	
Cogeneration Unit 2 (CHP 2)	• To address the ongoing NO_x exceedances recorded from October 2023 – August 2024, fine tuning of CHP 2 such as reviewing the ignition temperature curve, spark plug condition check and adjusting the intake & exhaust valves on the cylinder was conducted to reduce the fluctuations in NO_x emissions and to keep within the permissible limit. • To address the SO_2 exceedances recorded from October 2023 – April 2024, SO_2 sampling and testing was completed by a third-party laboratory that showed lower SO_2 values than those reported by the CEMS. The lower values measured by the laboratory was attributed to methane gas interference. Based on this study, it was proposed to implement a correction factor in the CEMS to adjust for the methane gas interference. After review by MT and IEC, the correction factor was implemented in May 2024. • To address the HCl exceedances recorded from November 2023 and April 2024, the Contractor implemented fine tuning measures such as reviewing the ignition temperature curve, spark plug condition check and adjusting the intake & exhaust valves on the cylinder to reduce the fluctuations in HCl emissions and keep within the permissible limit. • A CHP expert from Europe visited the ORRC1 facility in May 2024 to review the performance of the CHPs. • The Contractor will receive additional advanced training from the manufacturer for the operation and maintenance of the equipment. • The Contractor will continue additional maintenance works for the CHPs during the coming month.	• The fine-tuning measures were implemented in May 2024, and further works are ongoing. • The updated SO_2 correction factor was implemented on 17 May 2024. • The CHP expert visited in from 20-24 May 2024 and report submitted in June 2024; Contractor began reviewing the report in July 2024. • A further tuning was carried out for the CHP on 12 August 2024. • The Contractor will receive additional training in December 2024.
Cogeneration Unit 3 (CHP 3)	• To address the ongoing NO_x exceedances, fine tuning measures of CHP 3 were implemented such as reviewing the ignition temperature curve, spark plug condition check and adjusting the intake & exhaust valves on the cylinder is being conducted to reduce the fluctuations in NO_x emissions and to keep within the permissible limit. • To address the SO_2 exceedances recorded from October 2023 – April 2024, SO_2 sampling and testing was completed by a third-party laboratory that showed lower SO_2 values than those reported by the CEMS. The lower values measured by the laboratory was attributed to	• The fine-tuning measures were implemented in May 2024, and further works are ongoing. • The updated SO_2 correction factor was implemented on 17 May 2024. • The CHP expert visited in from 20-24 May 2024 and report submitted in June 2024; Contractor

Monitoring Location	Measures/ Actions to Address any Exceedances	Implementation Timeline & Status
	methane gas interference. Based on this study, it was proposed to implement a correction factor in the CEMS to adjust for the methane gas interference. After review by MT and IEC, the correction factor was implemented in May 2024. • A CHP expert from Europe visited the ORRC1 facility in May 2024 to review the performance of the CHPs. • The Contractor will receive additional advanced training from the manufacturer for the operation and maintenance of the equipment. • CHP 3 was not operated during August 2024 and had no exceedances for the month. • The Contractor will continue additional maintenance works for the CHPs during the coming month.	began reviewing the report in July 2024. • A further tuning was carried out for the CHP on 12 August 2024. • The Contractor will receive additional training in December 2024.
Ammonia Stripping Plant (ASP)	• To address the ongoing NO_x exceedances recorded from October 2023 – August 2024, the Contractor conducted an overhaul of the ASP and arranged for a visit by the supplier to improve the reliability and performance of the system. • To address the ongoing SO_2 exceedances recorded from October 2023 – August 2024, SO_2 sampling and testing was completed by a third-party laboratory that showed lower SO_2 values than those reported by the CEMS. The lower values measured by the laboratory was attributed to methane gas interference. Based on this study, it was proposed to implement a correction factor in the CEMS to adjust for the methane gas interference. After review by MT and IEC, the correction factor was implemented in May 2024. • To address the ongoing NH_3 exceedances recorded from October 2023 – August 2024, the Contractor conducted an overhaul of the ASP and arranged for a visit by the supplier. • To address the HCl exceedances recorded from October 2023 – May 2024 and August 2024, the Contractor conducted an overhaul of the ASP and arranged for a visit by the supplier. • To address the ongoing exceedances and loss of control of the louvres for the Thermal Combustion Unit (TCU), the Contractor has approached the Supplier to remedy the situation and is exploring options in the interim to control the system until the automatic situation is rectified in September 2024.	• The overhaul of the ASP was completed 6 May 2024. • The supplier could not visit in June 2024 as planned and will be rescheduled. • The updated SO_2 correction factor was implemented on 17 May 2024. • The automatic situation of the TCU louvres will be rectified by September 2024.

Notes:

(a) Further measures to address the ongoing Total Odour exceedances are pending as at the date of submission of this EM&A report; updates will be provided in the subsequent monthly EM&A report once received.

Investigation Report of Action Level Exceedances for Odour Nuisance	
Date	9 August 2024 and 15 August 2024

Investigation Report of Action Level Exceedances for Odour Nuisance	
Time	9 August 2024: Independent Odour Patrol conducted 10:20 – 10:38 (exceedance during morning patrol only) 15 August 2024: Independent Odour Patrols conducted 10:37 – 10:58 (morning patrol) and 13:14 – 13:34 (afternoon patrol)
Monitoring Locations	Odour Patrol Location 1 (Tipping Hall), Location 2 (Tipping Hall), and Location 3 (Biogas Tank Valve Holder)
Parameter	Odour Intensity
Exceedance Description	Odour patrol was conducted by the independent odour patrol team of ALS Technichem (HK) Pty Ltd on 5 July 2024. According to the EM&A Manual, it is considered an Action Level exceedance if the odour intensity recorded by the panellists is Level 2 or above. During the reporting period, one (1) Action Level exceedance (detection of Odour Intensity Level 2) was recorded during the independent odour patrol at Location 3 (Biogas Tank Valve Holder) on 9 August 2024. In accordance with the Event and Action Plan for Odour Monitoring (see Table 3.8), an ad-hoc odour patrol was arranged on 15 August 2024 to confirm the findings, which identified a further three (3) Level 2 exceedances and one (1) Level 3 exceedance, constituting an exceedance of the Limit Level under the EM&A Manual. The Level 3 odour exceedance was identified at Location 2 (Tipping Hall, morning patrol), while the Level 2 odour exceedances were identified at Location 1 (Tipping Hall, morning patrol), Location 2 (Tipping Hall, afternoon patrol, and Location 3 (Biogas Tank Valve Holder, afternoon patrol). The source of these odour exceedances identified by the Contractor was the open doors of the Tipping Hall/ waste storage area, whose roller shutter doors had malfunctioned.
Action Taken / Action to be Taken	Ad-hoc odour patrol was arranged by the Contractor on 15 August 2024 and was conducted by the independent odour patrol team of ALS to confirm findings. The ad-hoc odour patrol identified a further three (3) Level 2 exceedances and one (1) Level 3 exceedance, constituting an exceedance of the Limit Level under the EM&A Manual.
Remedial Works and Follow-up Actions	As remedial actions, the Contractor installed 2 pieces of canvas to replace the broken shutter doors of Bay #2 and Bay #3 and also continued with maintenance of the broken shutter doors. Installation of the inner shutter doors of Bay #2 and Bay #3 commenced on 19 August 2024 and completed on 5 September 2024. The repaired shutter doors are expected to be fully completed in October 2024. Finally, the Contractor also added additional fans with artificial flavouring to help mitigate the odour. The Contractor will continue to monitor the odour intensity and arrange independent odour patrol in the next month.

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Date	11 September 2024