



ANNEX F

INVESTIGATION REPORT

Investigation Report of CEMS Exceedances	
Date	1 – 31 March 2024
Time	Continuous Monitoring throughout March 2024
Monitoring Location	Continuous Environmental Monitoring Systems (CEMS)
Parameter	Various emission parameters of the Cogeneration Units (CHPs) and Ammonia Stripping Plant (ASP)
Exceedance Description	<p>1. 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 and 2.5 of the EM&A Manual (Version F) for the CAPCS, CHPs, 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:</p> <ul style="list-style-type: none"> • NO_x, SO₂, and HCl from CHP1; • NO_x and SO₂ from CHP2; • NO_x and SO₂ from CHP3; and • NO_x, SO₂, NH₃, and HCl from ASP. <p>2. The Contractor has investigated the cause of the exceedances and identified that:</p> <ul style="list-style-type: none"> • The exceedances of NO_x, SO₂, and HCl from the CHPs; and the exceedances of NO_x, SO₂, and NH₃ from ASP occurred due to system instability. • Regarding the NO_x exceedances from CHP1, the Contractor has identified that the Co-gen unit may have been burning lubrication oil, which caused many of the exceedances. • 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 NO_x exceedances from CHP3, the Contractor has identified that the exceedances may be reduced by overhauling CHP3. • Regarding the SO₂ exceedances from the CHPs, a quality assurance level 2 test (QAL2) was completed by a third-party laboratory that showed lower SO₂ 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. The MT and IEC have reviewed the proposal and have

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	<p>no objections. This correction factor is planned to be implemented by April 2024.</p> <ul style="list-style-type: none"> 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.
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.

Remedial Works and Follow-up Actions

Monitoring Location	Measures/ Actions to Address any Exceedances	Implementation Timeline & Status
Centralised Air Pollution Unit (CAPCS)	<ul style="list-style-type: none"> To address the exceedances for Total Odour (ou/Nm³) recorded in January 2024 and February 2024, the Contractor has ordered a new H₂S / ORP sensor to replace the faulty one and will be installed as soon as practicable. The ventilation pipes in wet sieve drums and reject skips will be cleaned in order to remove clogs and increase the air flow rate. 	<ul style="list-style-type: none"> The installation of the new H₂S /ORP sensor will be completed as soon as practicable ^(b). The cleaning of ventilation pumps will be conducted in April 2024.
Cogeneration Unit 1 (CHP 1)	<ul style="list-style-type: none"> To address the ongoing NO_x exceedances recorded from October 2023 – March 2024, the Contractor has ordered 3 new cylinder heads from the supplier to replace the old ones and improve performance. To address the SO₂ exceedances recorded from October 2023 – March 2024, a quality assurance level 2 test (QAL2) was completed by a third-party laboratory that showed lower SO₂ 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. To address the HCl exceedances recorded from October 2023 – March 2024, the Contractor shall implement 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 will visit the ORRC1 facility 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. 	<ul style="list-style-type: none"> The new cylinder heads will arrive and be installed by May 2024. The updated QAL2 correction factor for SO₂ will be implemented as soon as practicable ^(b); the MT and IEC have no objections, and the Contractor has informed EPD of this scheduled implementation. The fine-tuning measures will be implemented by May 2024. The CHP expert will visit in May 2024. The Contractor will receive additional training in December 2024.

Remedial Works and Follow-up Actions		
Cogeneration Unit 2 (CHP 2)	<ul style="list-style-type: none"> To address the NO_x exceedances recorded from October 2023 – March 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 is being conducted to reduce the fluctuations in NO_x emissions and to keep within the permissible limit. To address the SO₂ exceedances recorded from October 2023 – March 2024, a quality assurance level 2 test (QAL2) was completed by a third-party laboratory that showed lower SO₂ 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. To address the HCl exceedances recorded from November 2023, the Contractor shall implement 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 will visit the ORRC1 facility 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. 	<ul style="list-style-type: none"> The fine-tuning measures will be implemented by May 2024. The updated QAL2 correction factor for SO₂ will be implemented as soon as practicable ^(b); the MT and IEC have no objections, and the Contractor has informed EPD of this scheduled implementation. The CHP expert will visit in May 2024. The Contractor will receive additional training in December 2024.
Cogeneration Unit 3 (CHP 3)	<ul style="list-style-type: none"> To address the NO_x exceedances recorded from October 2023 – March 2024, the Contractor shall implement relevant measures/ actions beyond the overhaul completed in December 2023 ^(a). To address the SO₂ exceedances recorded from October 2023 – March 2024, a quality assurance level 2 test (QAL2) was completed by a third-party laboratory that showed lower SO₂ 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. A CHP expert from Europe will visit the ORRC1 facility 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. 	<ul style="list-style-type: none"> The Contractor’s implementation timeline to address the continued NO_x exceedances is pending ^(b). The updated QAL2 correction factor for SO₂ will be implemented as soon as practicable ^(b); the MT and IEC have no objections, and the Contractor has informed EPD of this scheduled implementation. The CHP expert will visit in May 2024. The Contractor will receive additional training in December 2024.
Ammonia Stripping Plant (ASP)	<ul style="list-style-type: none"> To address the NO_x exceedances recorded from October 2023 – March 2024, the Contractor will conduct an overhaul of the ASP and arrange for a visit by the supplier to improve the reliability and performance of the system. To address the SO₂ exceedances recorded from October 2023 – March 2024, a quality assurance level 2 test (QAL2) was completed by a third-party laboratory that showed lower SO₂ values than those reported by the CEMS. The lower 	<ul style="list-style-type: none"> The overhaul of the ASP will be carried out in April 2024, and the supplier will visit in June 2024. The updated QAL2 correction factor for SO₂ will be implemented as soon as practicable ^(b); the MT and IEC have no

Remedial Works and Follow-up Actions

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.

- To address the NH₃ exceedances recorded from October 2023 – March 2024, the Contractor will conduct an overhaul of the ASP and arrange for a visit by the supplier.
- To address the HCl exceedances recorded from October 2023 – March 2024, the Contractor will conduct an overhaul of the ASP and arrange for a visit by the supplier.

objections, and the Contractor has informed EPD of this scheduled implementation.

Notes:

- (a) Response from the Contractor is still pending as of the date of submission, and these relevant measures shall be provided accordingly in the subsequent monthly report once the response is received.
- (b) The Contractor’s implementation timeline on this item is still pending as at the date of submission, and this timeline shall be provided accordingly in the subsequent monthly report once the response is received.

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Date: 11 April 2024