



ANNEX F

INVESTIGATION REPORT

Investigation Report of CEMS Exceedances	
Date	1 – 31 January 2024
Time	Continuous Monitoring throughout January 2024
Monitoring Location	Continuous Environmental Monitoring Systems (CEMS)
Parameter	Various emission parameters of the Centralised Air Pollution Control Unit (CAPCS), 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"> • Odour from CAPCS; • 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 Odour from CAPCS; NO_x, SO₂, and HCl from the CHPs; and the exceedances of NO_x, SO₂, NH₃, and HCl from ASP occurred due to system instability. • Regarding the NO_x exceedances from the CHPs, The CHP manufacturer engineer from Germany visited the ORRC1 facility in late 2023 and also began working on the study of a way to improve the emission performance of the engines. Improvement on NO_x emissions was obtained when the engines were running at optimum loading. Due to the CHPs running at lower than the suggested 85% to 90% under the current operational conditions, the NO_x values will exceed the emission limit from time to time. In addition, the exceedances also occur during the frequent starting and stopping of the equipment. During the initial startup period, the emissions tend to be higher until the engine stabilises. The Contractor will continue to communicate with the manufacturer to follow-up. • 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 no objections. This correction factor is planned to be implemented after finalising the arrangement with the environmental team and project proponent. • The various exceedances from the ASP can be attributed to several items: unstable operation of the system (due to various faults) that results in

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	<p>frequent starting and stopping of the system and unstable process conditions during operation. The Contractor would like to work with Organics to run a performance test to optimise the system both for treatment efficiency and emissions control. There has been frequent downtime, as well as solids issues on the ASP over the past year, making the operation of the system unstable.</p>
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	<p>The Contractor had arranged the CHP supplier to inspect, analyse and improve CAPCS, CHP, and ASP performance in February 2024 based on final reports of the quality assurance level 2 test (QAL2) for the CEMS calibration. This QAL2 evaluation is still ongoing, and improvement recommendation will be provided once the final report is received in order to address the various SO₂ exceedances from the CHPs and the ASP.</p> <p>Additionally, the Contractor is working with the Manufacturer to rectify the low temperature issue on some of the cylinder heads of the engines, which will allow the CHPs to run at higher loads and should lead to lower NO_x emissions.</p> <p>To address the various exceedances from the ASP, the Contractor will conduct an overhaul of the ASP at the end of March 2024 to increase reliability. In addition, a drum screen is targeted to be installed by the end of February/early March 2024 to decrease the solids entering the ASP in order to improve the efficiency and reliability of the system.</p>

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Date: 8 February 2024