Annex I

Investigation Report

Investigation Report of CEMS Exceedances

Date	1 - 31 December 2019
Time	Continuous monitoring throughout December 2019
Monitoring Location	Continuous Environmental Monitoring System (CEMS)
Parameter	Various emission parameters of the Cogeneration Unit (CHP) Ammonia Stripping Plan (ASP)
Exceedance Description	1. Continuous monitoring was carried out at the CHP and ASP throughout the reporting period using the CEMS. According to the EM&A Manual, 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 CAPCS, CHP and ASP respectively. The concentration of the concerned air pollutants were monitored on-line by the CEMS. Exceedances of various emission parameters were recorded on the CEMS including: • NO_x and SO_2 in the CHP • NO_x and SO_2 in the ASP. 2. According to the Contractor, the plant was receiving around 100 tonnes of SSOW daily and was operated normally. 3. Further optimisation of the chemical dosing system of the The Contractor explained that the exceedances recorded in the ASP was because the thermal combustion unit of the ASP still require tuning to optimise the combustion efficiency.
Action Taken / Action to be Taken	• It was arranged with the supplier of CHPs to check the performance of CHPs onsite during the reporting period. The supplier will conduct a detailed investigation of the remaining exceedance recorded on the CHPs. After the investigation, the Contractor will perform the maintenance work according to suggestions raised by the supplier. The maintenance work is expected to complete in the next reporting period. • Parts of the modification works on the ASP has been completed, with more components waiting to be delivered to Hong Kong. The Contractor has scheduled the remaining modification work for the next few reporting periods with schedule shutdown of the ASP to facilitate the installation of equipment for performance optimisation.
Remedial Works and Follow-up Actions	The Contractor is recommended to closely monitor the processes, including the modification work and follow-up emission monitoring of the ASP to avoid exceedance. MT will carry out follow-up audit regarding the progress next month.

Prepared by:	Bonia Leung, MT Representative
Date	11 January 2020

Investigation Report of Intermediate Digestate Tank Leakage

Date	28 December 2019
Time	10:00 am
Monitoring Location	Intermediate Digestate Tank (IDT)
Parameter	IDT level
Exceedance Description	Suspension liquid overflow from the intermediate digestate tank (IDT) to the surface channel inside AD tanks farm was observed on 28 December 2019. The digestate spilled into the storm water discharge channel, and subsequently into the nullah.
Action Taken / Action to be Taken	The Contractor arranged clean-up of the spillage in the nullah immediately and stopped the suspension liquid of the IDT from overflowing. The Contractor found that the programme that controls the IDT was not functioning properly resulting in the overflow of digestate at the IDT. In addition, the 3-way valve near the IDT was open which did not stop the spillage from entering the storm drain system.
Remedial Works and Follow-up Actions	The Contractor monitors the IDT level closely using CCTV, enhanced the routine patrol on the IDT and closed the 3-way valve to prevent possible leakage to the nullah.

Prepared by: Bonia Leung, MT Representative
Date 11 January 2020

Extract of the Incident Notification Form on Suspension Overflow at IDT Prepared by the Contractor

Description of the Process

Intermediate Digestate Tank (IDT) is a 30m^3 buffer tank to transfer digestate to the duty centrifuge use. The IDT is provided with liquid level measurements to detect the hydrostatic pressure at the bottom. The second level sensor detects the fill level by radar at the roof area. The digester recirculating / transfer pumps are inhibited by high level in the IDT.

IDT automatic operation is controlled through SCADA. When dewatering operation finishes (the required volume of digestate is processed) the digestate feed pump stops and the duty centrifuge stops after going through a ramp down sequence according to its programmed procedures. Afterwards, a back-flushing cycle of digestate feed pipe can be carried out automatically or manually to clear digestate off the pipeline to avoid release and accumulation of biogas gas within pipelines.

Description of the Incident

On 28 December 2019 morning at around 10:00 am, some black water was found discharging slowly to the nullah from the storm water discharge outlet. Investigation was carried out immediately and found that suspension was passing from the 3-way gate valve near AD3.

There was an incident happened in the early morning (around 08:30am). Suspension was overflowed from the IDT to the surface channel inside AD tanks farm (Figure 1). OSCAR was carrying out cleaning work inside the tank farm. OSCAR had checked the discharge outlet at around 9:30 and did not find any leakage at that moment. OSCAR also kept monitor the outlet by using CCTV. The 3-way gate valve was believed fully closed and the team did not aware suspension would pass through the 3-way gate valve.

Immediate Corrective Actions

The team immediate put sandbags at the stormwater discharge outlet to block the leakage. OSCAR also arranged a vacuum tanker truck immediately to clean up the suspension at the nullah (Figure 2&3). Cleaning work for the spillage inside the tank farm, nearby surface channel and around the IDT was also completed at around 4:00 pm (Figure 4).

Photo.1 Overflow of Suspension from IDT

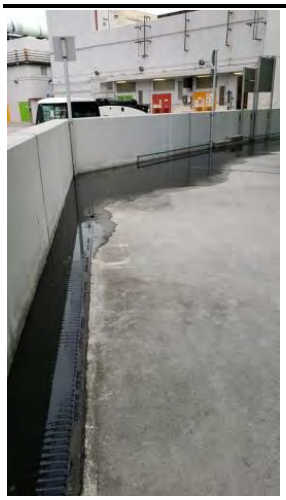


Figure.2&3 Sandbags was put at the discharge outlet and Vacuum tanker truck was arranged to cleanup

Figure.4 Completed cleanup of tank farm and nearby surface channels

Figure.5 Dye test carried out on 30 December to ensure the gate valve is fully closed

Root Cause Analysis

1. The centrifuge was running in the early morning and theoretically only suspension from AD3 would transfer to the IDT during the process.

2. Process water was found inject to IDT during the centrifuge process

3. Likely a hold in the control sequence logic causes the flushing water keep injecting to IDT even the flushing process finished.

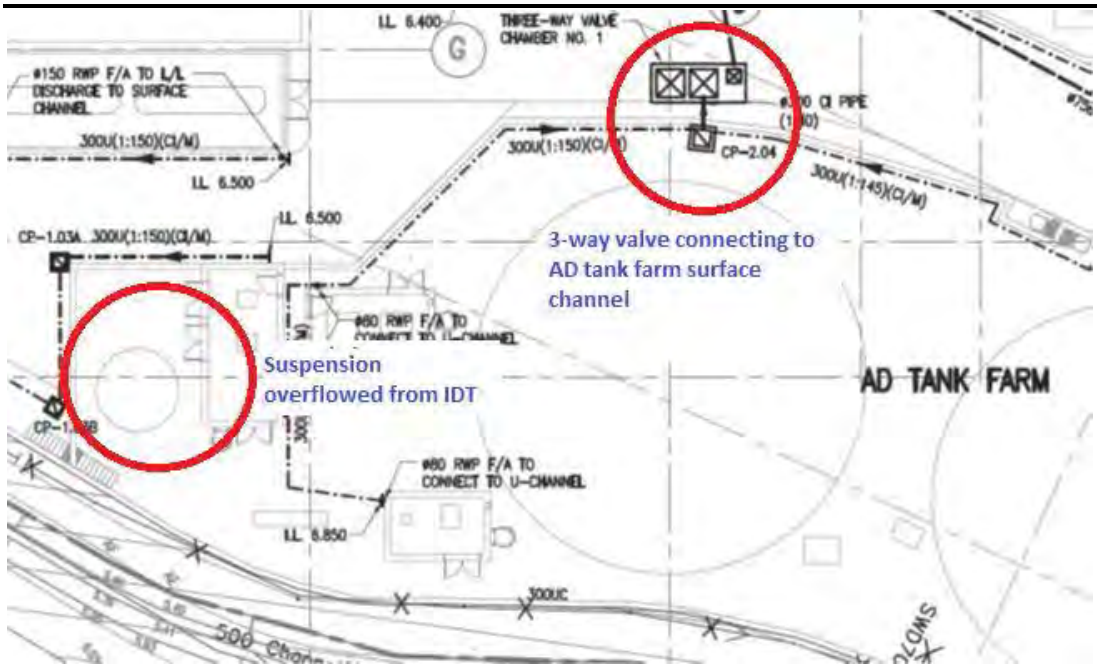
4. The team did aware the IDT tank was reaching high level however cannot immediately stop the flushing water injected to the IDT.

5. Process water with residual suspension overflowed from IDT to the overflow tank.

6. Process water with residual suspension overflowed to the surface channel at AD tank farm and discharged to the surface channel inside the AD tank farm.

7. The 3-way valve was closed at the time of the outbreak. Unfortunately the 3-way valve was not able to tight seal and some of the suspension passed through the valve and leaked to the nullah slowly.

Figure.6 Location map of the incident



Description of Corrective Actions (1)

1. Put sandbags at the discharge outlet to stop the leakage.
2. Arranged to clean up the suspension leaked to the nullah by a vacuum tanker truck.
3. Arranged to clean up the suspension at the surface channel near the IDT and inside AD tank farm.
4. Trouble shoot the centrifuge flushing control logic.

Description of Preventive Actions (2)

1. To check and fully close the 3-way gate valve to prevent possible leakage to nullah.
2. To carry out dye test to check the 3-way valve is fully closed.
3. To keep close monitoring the IDT level for each process (centrifuge and flushing).
4. To carry out programme enhancement to avoid injection of flushing water to IDT that may due to any interruption of programme sequence/logic.

(1) The corrective actions have been closed on 28 December 2019.
(2) The preventive actions have been closed on 31 December 2019.

Investigation Report of Treated Effluent Leakage

Date	25 August 2019
Time	12:35 am
Monitoring Location	Biogas system
Parameter	Biogas pressure
Exceedance Description	Biogas release as a result of unstable power supply by CLP on 25 August 2019.
Action Taken / Action to be Taken	The Contractor closed the biogas holder inlet valve to safeguard the biogas system as per emergency response procedures. The biogas pressure began to build up in the biogas system (before the biogas holder) resulting in the biogas being released through one of the pressure relief valves as per designed scenario to safeguard the biogas tanks.
Remedial Works and Follow-up Actions	The Contractor resumed the power supply from CLP and the biogas booster set. A thorough check was conducted to confirm the situation was under control with stable performance at around 5am.

Prepared by: Bonia Leung, MT Representative
Date 11 January 2020

Extract of the Incident Notification Form on Release of Biogas to the Environment Prepared by the Contractor

Description of the Process

The purpose of Organic Resources Recovery Centre Phase 1 (ORRC1 or the facility) is to convert source-separated organic waste into compost and biogas through proven biological treatment technologies. The biogas generated, after post-treatment including sulphur and water removal, would be in the on-site Combined Heat and Power (CHP) generators to generate hot water and electricity to be used on site and exported to the China Light and Power (CLP) power grid network.

The major equipment involving biogas includes:

- Anaerobic Digesters (AD)
- Suspension Buffer Tank (SBT)
- Desulphurisation Column
- Gasholder (GH)
- Dehumidifier
- Biogas booster system

The biogas consumers include:

- Emergency Flare
- Combined Heat and Power (CHP) Unit
- Ammonia Stripping Plant (ASP)

Description of the Incident

Time (Roughly)	Event
00:35	The electrical connections Q1 and Q2 opened because of the unstable power supply by CLP (Confirmed by CLP that there was a problem with their overhead lines). CHP2 & 3 were supply by CLP (Confirmed by CLP that there was a problem with their overhead lines). CHP2 & 3 were
00:40	CHP3 tripped off.
00:52	CHP2 tripped off and the plant blackout
01:58	Biogas holder inlet valve was arranged to close to safeguard the biogas system as per the emergency response procedures. This arrangement discontinued the pressure and level build up inside the biogas holder.
02:01	Q1 & Q2 closed, CLP power resumed.
02:01	Biogas holder level reached over 90%, booster set was unable to start due to lack of compress air supply.
02:01	Emergency flare was unable to start due to booster set was unable to start and therefore also no biogas supply to the flare
02:08	Anaerobic Digester (AD) Tank 1 Pressure relief Valve (PRV) triggered, biogas released from AD1 PRV intermittently. The biogas pressure was built up in the biogas system (before biogas holder) resulting in the biogas being released through one of the pressure relief valves as per designed scenario to safeguard the biogas tanks.

04:22	Biogas booster set resumed and thus biogas supply resumed
04:24	CHP2 resumed to consume biogas
04:52	Flare system tested and restarted to rapidly reduce the pressure and biogas holder level
05:00	Plant resumed normal operation

Immediate Corrective Actions

The Contractor immediate arranged onsite personnel to prepare for emergency (Biogas release). The Contractor immediate arranged maintenance team to carry urgent maintenance. The Contractor arranged to conduct a thorough check to confirm the situation was under control with stable performance at around 5:00am.

Root Cause Analysis

1. CHP's were able to enter "Island Mode". CHP 2 for approximately 15 minutes and CHP 3 for approximately 4 minutes after Q1 and Q2 opened. Primary cause for CHPs tripped is that the power demand exceeded the load generation step of the CHPs therefore as explained in "Electrical Operation philosophy" CHPs shutdown.
2. There were 2 sources of compressed air supply to the booster set (plant air and a standby portable air compressor). The plant air supply was resumed after CLP power resumed. However, a valve (0014-AV-001) was closed resulted in no plant air supply to a Sub-loop which provided plant air supply to the booster set and flare. The valve's operation philosophy is to maintain the pressure in the Biogas Area Compressed Air Sub-loop if the main loop loses pressure. Therefore, the valve was operating properly at the time of the incident and should have been placed into manual to open once the pressure in the main system reaches approximately 7 bar to return normal plant air to the Biogas Compressed Air Sub-loop.
3. The booster set resumed normal operation once the plant air was manually isolated from booster set to allow the air to activate the pneumatic valves on the booster set. A check valve (non-return valve) was found malfunction and caused the standby portable air compressor continues running and finally overheated. For normal weekly testing, the plant air isolated from the booster set therefore the effectiveness of the check valve between the plant air and the booster was unable to check. The check valve was not included in the normal testing protocol. The testing protocol and a detailed review of the biogas safety system will be conducted to mitigate the risk of future biogas incidents.
4. The flare could not start primarily due to the booster set being inoperative. Without adequate pressure and flow provided by the booster set, no fuel (biogas) reached the flare to allow for consumption of biogas. Flare was in automatic mode during blackout and power was supplied through the UPS system. The testing protocol and a detailed review of the biogas safety system will be conducted to mitigate the risk of future biogas incidents.

Description of Corrective Actions (1)

1. To immediate arranged maintenance team to carry urgent maintenance

(1) The corrective actions have been closed on 30 September 2019

2. To replace the malfunction check valve
3. To train up staff for emergency response during the planned Loss of Main test
4. To conduct review of the biogas safety system to mitigate the risk of future biogas incidents.

Description of Preventive Actions (2)

1. To review the system and the testing protocol revised to allow testing of the check valve to the plant air system.
2. To add extra compressed air source (3rd Source) in case of emergency and prepare the emergency operation procedure of the diesel compressor
3. To provide refreshment training for staff about the updated response
4. To update the plant resume and checking procedures during blackout
5. To manage the plant loading while CHPs in island mode a detailed operation procedure will need to be developed. OSCAR has invited the CHP supplier (MWM) engineer to review the capability of the CHPs to understand how island mode conditions and expecting engineer visit in November 2019 afterword we can provide more a detailed road map for the island mode situation for the CHPs.

(2) Items 1 to 4 have been closed on 4 October 2019. Items 5 is an on-going action.