AJC JOINT VENTURE

By Hand

The EIA Ordinance Register Office,
Environmental Protection Department,
27th floor, Southorn Centre,
130 Hennessy Road,
Wanchai, Hong Kong

Ref.: AJC/EPD/240014

Date: 7 August 2024

Attn.: Mr. Henry LEUNG

Dear Sir,

RE: CONTRACT NO.: 13/WSD/17
DESIGN, BUILD AND OPERATE FIRST STAGE OF TSEUNG KWAN O DESALINATION PLANT
Submission of Audit Report of Measures for Mitigating Hazard to Life

As per Condition 2.20 of both Environmental Permit No. EP-503/2015/B and Further Environmental Permit No. FEP-01/503/2015/B, we would like to submit herewith 4 hard copies and 1 electronic copy of final submission of Audit Report of Measures for Mitigating Hazard to Life to the Director for record. The respective table of responses to comments is also attached for your easy reference.

Should you have any enquiry, please do not hesitate to contact our Environmental Monitoring Manager, Brian Kam at 9456 9541.

Thank you for your attention.

Yours faithfully
For and on behalf of AJC Joint Venture

Stephen Yeung
Project Manager

SY/VA/LWWK/BK/pcm

Encl.

c.c.: Water Service Department – Mr. W.F. CHEUNG (By Email)
Binnies Hong Kong Limited – Mr. Roger Wu (By Email)
Lam Environmental Services – Miss Serena Shek (IEC) (By Email)
Acuity Sustainability Consulting Limited – Mr. Toby Wan (ETL) (By Email)

Response to Comments on Audit Report on Measures for Mitigating Hazard to Life (Issue 2)

1. Comments from Environemtnal Protection Department dated 6 October 2023 via Fax

No.	Comments	Response
1.	General – Please state explicitly (e.g. S.1.2, cover letter, etc.) if the scope of the Project covers Stage 1 of the Tsueng Kwan O Desalination Plant (DP1) only.	The relevant text has been amended accordingly.
2.	Report Cover – Please clarify whether the Report is intended for Stage 2 of the Tseung Kwan O Desalination Plant.	The report is intended for the first stage of the desalination plant. Report cover has been amended accordingly.
3.	Table 2-1 and 2-2 – (a) "Audit Results" – According to Condition 2.20 of the EP, the audit report should certify the implementation of design requirements / measures recommended in the Detailed Design Plan (DDP). However, it is noted from the audit results that the implementation status of some measures are stated as "will be installed"/ "will be provided" / "being installed"/ "construction in progress" / etc., which suggests that the requirements / measures are yet to be implemented. Please review and clarify.	The audit results have been updated to clarify that the measures have been implemented.
	(b) "Audit Results" (last column) – It appears that some of the audit results does not confirm the implementation of the requirements / measures as required by Condition 2.20 of the EP, but indicates that there is no change to the recommendation presented in DDP and provide supplementary information only. Please provide the audit results with explicit confirmation of the implementation of requirements / measures if applicable.	The audit results have been updated to clarify that the measures have been implemented.
4.	Table 2-2 – (a) Item 1.3 (last column) – It is noted from the audit result that the provided on-site chlorine generation (OSCG) building volume is 5450.38 m3, which exceeds the design requirements stated in the 2017 ERR (i.e. 4000 m3) and the recommendation in the 2021 DDP (i.e. 3800 m3). In view that the OSCG building volume of 4000 m3 was a design assumption for computation of the chlorine release rate in the 2017 ERR as stated in the 4th column, please clarify whether such increase of OSCG building volume was reviewed / approved in any of the EIAO documents of the Project (e.g. those listed in Condition 1.7 of the EP). If not, another ERR should be submitted	Please be clarified that the volume of 4,000 m^3 is not a design requirement. It is not an upper limit nor a lower limit but is a design assumption used in the 2017 ERR. Text has been added in Table 2.2 (Item 1.3) to adequately address the environmental implications of such change and explain to the public that the change will not cause any adverse hazard to life impact. Implications of the changes have also been reviewed in S13.2.11 of a separate ERR (Issue 1) for "*Agreement No. CE 92/2022 (WS) Second Stage of Desalination Plant at Tseung Kwan O - Investigation, Design and Construction*" (2023 ERR) submitted to EPD. Based on the technical comments

No.	Comments	Response
	separately to review the implication of the revised design (e.g. whether the chlorine release rate would be changed due to the increase in volume of the OSCG building) before implementation.	received from the EPD on 18 Oct, 1 Nov and 8 Nov 2023, EPD has no comment on S13.2.11 of the 2023 ERR , which states that such change of building volume would not cause additional adverse hazard to life impact.
	(b) Item 4.1 (last column) – Please confirm whether hoses and couplers for transfer of the concerned chemicals are different in size as required.	Confirmation has been added in the revised report.
	(c) Item 4.2 (4th column) – It seems that the design value in the approved DDP is "about 300m". Please review.	Amended accordingly.
	(d) Item 5.7 (4th column) – It seems illogical that recommendations in 2021 DDP was based on the explosive delivery route provided by CEDD in 2023. Please review.	The typo "in 2023" has been deleted.
5.	S.3.1.1.1 – We have reservation to the conclusion at this stage as some of the design requirements / measures are not "being implemented" yet.	Updated information has been provided in the revised report for your review.

ISSUE 3

AUDIT REPORT ON MEASURES FOR MITIGATING HAZARD TO LIFE

First Stage of Desalination Plant at Tseung Kwan O

BINNIES PROJECT NO. 4110400/40.0000.11A

Report Authorized For Issue By:	For and on Behalf of Binnies Hong Kong Limited

PREPARED FOR

Water Supplies Department

DOCUMENT CONTROL AMENDMENT RECORD	Contract No. 13/WSD/17 First Stage of Desalination Plant at Tseung Kwan O	No: 4110400/40.0000.11A Prepared By: Binnies
Audit Report on Measures for Mitigating Hazard to Life	Client: Water Supplies Department	Initials: AC Date: 29 April 2024

Pages	Date	Issue No.	Description	Initials
All	August 2023	1	Issue 1	AC
All	September 2023	2	Issue 2	AC
All	April 2024	3	Issue 3	AC

First Stage of Desalination Plant at Tseng Kwan O

Environmental Certification Sheet for
Further Environmental Permit (FEP) No. FEP-01/503/2015/B and
Environmental Permit (EP) No. EP-503/2015/B

Name of this Document:	Audit Report on Measures for Mitigating Hazard to Life
Prepared by:	Binnies Hong Kong Limited
Date of Report:	29 April 2024

Reference FEP and EP Condition: Condition 2.20

No later than 3 months before the commencement of operation of the Project, 4 hard copies and 1 electronic copy of an audit report shall be submitted to the Director for record to certifying the implementation of design requirements / measures recommended in the Detailed Design Plan approved under Condition 2.12 of this Permit. Before submission to the Director, the audit report shall be certified by the ET Leader and verified by the IEC as conforming to the recommendations contained in the Detailed Design Plan approved under Condition 2.12.

Environmental Team (ET) Certification:

I hereby certify the above reference document in accordance with Condition 2.20 of FEP No. FEP-01/503/2015/B and EP No. EP-503/2015/B.

Jacky LEUNG
ET Leader
Acuity Sustainability Consulting Limited

Refer to the separate certification letter
Signature

Date: 30 April 2024

Independent Environmental Checker (IEC) Verification:

I hereby verify the above reference document in accordance with Condition 2.20 of FEP No. FEP-01/503/2015/B and EP No. EP-503/2015/B.

Serena SHEK
IEC
Lam Environmental Services Limited

Refer to the separate verification letter
Signature

Date: 30 April 2024

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List of Appendices

1 Introduction

1.1 Background

1.1.1 The desalination plant at Tseung Kwan O (TKO) Area 137 (**the Project**) involves 2 stages. Stage 1 of the Project (DP1) involves a water production capacity of 135,000 cubic meters (m^3) per day. Stage 2 of the Project (DP2) involves an additional water production capacity of 135,000 m^3 per day. The overall capacity of the Project would be 270,000 m^3 per day at the ultimate stage.

1.1.2 An Environmental Impact Assessment (EIA) study for the Project was completed in accordance with the EIA Ordinance (EIAO) during the Feasibility Study (FS) stage of the Project. The EIA Report for the Project (Register No.: AEIAR-192/2015) was approved on 4 November 2015 under the EIAO (**the 2015 EIA**). The Environmental Permit (EP) (No: EP-503/2015), covering the construction and operation of Project, was granted on 4 December 2015.

1.1.3 Following the approval of the 2015 EIA, the Project design was further reviewed, and several design changes were identified. An environmental review was then carried out to address the environmental impacts arising from the design changes and to support the necessary Variation of Environmental Permit (VEP) application for the Project. The findings of the environmental review are presented in the report "*Agreement No. CE 8/2015 (WS) First Stage of Desalination Plant at Tseung Kwan O – Investigation, Design, Construction. Environmental Review Report - Variations for Design Changes (Issue 2)*" issued on 3 November 2017" (**the 2017 ERR**). Amendment of the EP was applied under the EIAO on 5 January 2018. The amended EP (No: EP-503/2015/A) was subsequently granted on 26 January 2018.

1.1.4 On 29 November 2019, the Contractor of DP1 submitted the application for Further Environmental Permit (FEP) to the Environmental Protection Department (EPD) under Section 12 of the EIAO. The FEP (No. FEP-01/503/2015/A) was granted to the Contractor on 20 December 2019.

1.1.5 Further amendment of the EP and FEP was applied on 12 March 2024. The latest amended EP (No. EP-503/2015/B) and FEP (No. FEP-01/503/2015/B) were granted on 3 April 2024.

1.1.6 In accordance with Condition 2.12 of the latest EP and FEP, a Detailed Design Plan (DDP) for Storage of Chlorine and Carbon Dioxide was prepared for the Project and submitted to EPD on 17 March 2020. With incorporation of all comments received from the EPD, the DDP was approved by EPD on 17 August 2021. The 2021 DDP provides the design details of DP1 and assumes that the design of DP2 would remain the same as the reference design adopted in the 2017 ERR. The 2021 DDP also compares the design details of the Project against the design requirements / measures specified in Table 1 of the EP / FEP and in the 2017 ERR.

1.2 Scope and Purpose of this Audit Report

1.2.1 This Audit Report is prepared for the first stage of the Tseung Kwan O Desalination Plant (DP1) in accordance with Condition 2.20 of the FEP and EP for certifying the implementation of design requirements / measures recommended in the 2021 DDP approved under Condition 2.12 of the FEP and EP, and for submission to the EPD for record. This Audit Report has been certified by the Environmental Team Leader and verified by the Independent Environmental Checker (IEC) as conforming to the recommendations contained in the 2021 DDP approved under Condition 2.12 of the FEP and EP.

1.3 Report Structure

1.3.1 The Report Structure is as follows:

Section 1	Introduction
Section 2	Audit Results
Section 3	Conclusion

2 Audit Results

2.1.1 DP1 is under construction stage and is scheduled for completion and commissioning by late December 2023. DP2 is currently under the investigation and design stage. DP2 is scheduled for construction in 2024 and commissioning in 2027. The audit results for certifying the implementation of design requirements / measures in DP1 as recommended in the 2021 DDP are presented in **Table 2-1** and **Table 2-2**.

Table 2-1 Audit Results for Implementation of Design Requirements / Measures for Chlorine and Carbon Dioxide Storage Recommended in the FEP and 2021 DDP

No.	Types of Storage	Design Requirements/Measures in FEP	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
1.	**Chlorine Store**			
1.1	Chlorine storage quantity in the chlorine store	No more than 37 tonnes in 1-tonne drums	The Project will adopt the On-site Chlorine Generation (OSCG) system for use in disinfecting the process water. The use of OSCG system avoids the importation of liquid chlorine and the need for stocking/ on-site storage of chlorine (i.e., Potential Hazardous Installation) whereby intrinsically eliminating the hazard due to transport (on-site and off-site), use, and storage of liquid chlorine, and thus reducing the risk to human life and the development constraints in the vicinity.	OSCG has been implemented in DP1 in accordance with the recommendation of the DDP to replace the importation, storage and use of liquid chlorine. The OSCG main skids (2 trains) are currently positioned in the OSCG building for DP1. Drawing and photo records are provided in **Appendix A-1** and **Appendix A-2**.
1.2	Volume of chlorine store	Larger than 4200 m^3		
1.3	Design and layout of chlorine store	The chlorine store shall be designed in a way such that the average number of drums ruptured in the worst-case scenario during earthquake should be no more than 6.		
1.4	Separation distance between, the chlorine store and explosive trucks / TKO Area 137 Pier	The setback distance between the chlorine building and explosive trucks / TKO Area 137 Pier shall provide sufficient clearance **(see remarks below) so that the overpressure resulting from explosion of explosive trucks or the explosives offloading operation that reaches the chlorine building is less than 2 psi.		
1.5	Separation distance between the chlorine store and any one of the site boundaries (except for the site boundary adjacent to the Clear Water Bay Country Park)	More than 100m		
2	**Carbon Dioxide Store**			
2.1	Maximum number of carbon dioxide storage tank	16 units	5 units in DP1	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Only 5 units are installed in DP1. Layout drawing and photo records are provided in **Appendix B-1** and **Appendix B-2.**
2.2	Type of storage tank	Vacuum insulated, double containment	Vacuum insulated, double containment	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Storage tanks are vacuum insulated with double containment. Specifications of CO_2 tanks installed in DP1 are given in **Appendix B-3**.
2.3	Storage tank capacity	No more than 100 tonnes per tank	Capacity 100 tonnes per tank	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Capacity of each tank is 100 tonnes as indicated in **Appendix B-1**.
2.4	Pressure relief system of carbon dioxide storage tank	Pressure protection for the inner vessel shall be provided by 2 sets (1 duty and 1 stand-by) of pressure protection devices. Each set of pressure protection device will be composed of 2 independent pressure relief valves. The pressure relief valves system will be designed to avoid the common mode failure such that the risk of common mode failure is negligible.	Two sets of pressure protection devices will be provided at inner vessel. Each will compose of two independent pressure relief valves and will be designed to avoid common mode failure.	The CO_2 tanks have been implemented following the recommendations in 2021 DDP and in accordance with the Detailed Process and Instrumentation Diagrams (P&IDs) of Remineralization CO_2 storage tanks and related systems and details of the pressure relief system as presented in the 2021 DDP. Relevant information from the 2021 DDP is reproduced in **Appendix B-4** and **Appendix B-6** for record. Photo record of pressure relief valve is included in **Appendix B-7**.
		The pressure protection device on the outer vessel shall be a plate relief device. The plate relief device will be a standard installation in accordance with industrial standards (EN 13458 Part 2 Annex 1).	Pressure relief valves will be provided on the outer vessel, which will be plate relief valves and will be of EN 13458 Part 2 standard compliant.	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Details and photo record of the pressure relief system implemented for the CO_2 storage tanks in DP1 are given in **Appendix B-6** and **Appendix B-7**.
2.5	Pressure relief system of carbon dioxide road tanker	Pressure protection for the inner vessel shall be provided by 2 sets (1 duty and 1 stand-by) of pressure protection devices. Each set of pressure protection device shall be composed of 2 independent pressure relief valves. The pressure relief valves system shall be designed to avoid the common mode failure such that the risk of common mode failure is negligible.	Two sets of pressure protection devices will be provided on the inner vessel. Each will compose of two independent pressure relief valves and will be designed to avoid common mode failure.	Pressure protection devices have been implemented for the CO_2 tanker following the recommendations in 2021 DDP and in accordance with the P&ID of CO_2 Road Tanker and details of the pressure relief system as presented in the 2021 DDP. The relevant information from the 2021 DDP is reproduced in **Appendix B-5** and **Appendix B-6** for ease of reference.
2.6	Separation distance between the carbon dioxide storage area and explosive trucks / TKO Area 137 Pier	The setback distance between the carbon dioxide storage area and explosive trucks / TKO Area 137 Pier shall provide sufficient clearance so that the overpressure resulting from explosion of explosive trucks or the explosives offloading operation that reaches the carbon dioxide storage area is less than 2 psi.	The maximum offloading capacity to the explosive offloading pier at TKO Area 137 is 5,000 kg TNT equivalent explosives. The maximum capacity per explosive truck from the explosive offloading pier at TKO Area 137 is 1,750 kg TNT equivalent explosives. According to 2017 ERR and based on the formula given in the Queensland Explosives Information Bulletin 50 Version 4 (current) Section 12 (the Bulletin 50) and referring	The as-built location of the CO_2 storage area in DP1 (as indicated in **Appendix C**) follows the recommendations in the 2021 DDP, and hence also met the relevant separation requirement of the EP and FEP.

No.	Types of Storage	Design Requirements/Measures in FEP	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
			to Kingery-Bulmash Blast Parameter Calculator on the website of International Ammunition Technical Guidelines, United Nation, the 2-psi overpressure zone for 5,000 kg and 1,750 kg TNT equivalent explosives is within 178 m and 125m from the explosion source respectively. The liquid carbon dioxide (CO_2) storage area in DP1 is over 300m from the explosive offloading pier, which is greater than the maximum hazard distance or the 2psi overpressure zone of 178m from the explosive source. The CO_2 storage area in DP1 would have sufficient clearance from the explosive offloading pier. The CO_2 storage area in DP1 would not be impacted by the explosive explosion at the pier. Based on the explosive delivery route provided by CEDD at the time of preparing the 2021 DDP, the CO_2 storage area in DP1 is located outside the 2psi overpressure zone of the explosion of the explosive delivery truck. The CO_2 storage area in DP1 would not be impacted by the road transport of explosives.	
2.7	Separation distance between the carbon dioxide storage area and any one of the site boundaries (except for the site boundary adjacent to the Clear Water Bay Country Park)	More than 100m	The CO_2 storage in DP1 is situated at more than 100 m away from both northern and western boundaries of the desalination plant.	The as-built CO_2 storage area in DP1 follows the recommendations of 2021 DDP. It is situated at more than 100 m away from both northern and western boundaries of the desalination plant as shown in **Appendix C**.
2.8	Other safety features of carbon dioxide storage tanks and the facilities	Trycock for overfilling alarm and warning shall be provided on carbon dioxide storage tanks.	Trycock valves will be provided for overfilling alarm and warning on CO2 storage tanks.	Trycock valves have been provided on the CO_2 storage tanks. Details and photo records of the trycock valves are given in **Appendix B-8** and **Appendix B-9**.
		High level alarm shall be provided to operating staff at control room for liquid level monitoring and warning.	High level alarm will be provided and connected to main control room.	High level alarm has been provided and connected to the control room. High level alarm is indicated in the P&ID in **Appendix B-4**.
		Fencing shall be provided surrounding the carbon dioxide facilities.	Security fence will be provided around CO_2 storage area.	Security fence has been installed around the CO_2 Storage area as shown in **Appendix B-10**.

Table 2-2 Audit Results for Implementation of Design Requirements / Measures for Chlorine and Carbon Dioxide Storage Recommended in the 2017 ERR and 2021 DDP

No.	Parameters	Design Requirements / Measures in 2017 ERR	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
1	**On-site Chlorine Generation**			
1.1	Chlorine generation rate	The ultimate chlorine generation rate (including both Stage 1 and Stage 2 works) is 2250 kg per day. Two OSCG systems, each with capacity of 1125 kg per day, will be installed in 2 stages in 2 separate buildings.	No changes to these assumptions are proposed.	The current OSCG design ultimate production for DP1 is 426 kg/d (213 kg/d per train x 2 trains) for DP1. Supporting information including data sheet extracted from the material submission is given in **Appendix A-3**. The reduced production rate would not induce additional hazard to life impact.
1.2	Ventilation rate	6 air change per hour (ACPH)	No change to the ventilation rate is proposed.	Forced ventilation of minimum 6 ACPH is provided for 7 nos. of rooms within the OSCG building for DP1 as follows.

<table>
<tr><th>No.</th><th>Parameters</th><th>Design Requirements / Measures in 2017 ERR</th><th>Recommendations in 2021 DDP</th><th>Audit Results - Actual Provisions for DP1 and Records</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><th rowspan="2">Room Name</th><th rowspan="2">Provision</th><th colspan="3">Ventilation</th></tr>
<tr><th>ACH</th><th>Max. Room Design Temperature, °C</th><th>Relative Humidity, %</th></tr>
<tr><td>Scrubber Room</td><td>MV</td><td>6</td><td>40</td><td>Uncontrolled</td></tr>
<tr><td>Big Bag Salt Store Room</td><td>MV</td><td>6</td><td>-</td><td>Less than 50%</td></tr>
<tr><td>Electrolyser Skid Stream Room</td><td>MV</td><td>6</td><td>40</td><td>Uncontrolled</td></tr>
<tr><td>Equalisation Tank and Neutralisation Tank Room</td><td>MV</td><td>6</td><td>40</td><td>Uncontrolled</td></tr>
<tr><td>Filtered Brine Tank Room</td><td>MV</td><td>6</td><td>-</td><td>Uncontrolled</td></tr>
<tr><td>Chlorinators Room</td><td>MV</td><td>6</td><td>40</td><td>Uncontrolled</td></tr>
<tr><td>DG Store 4 Class 8 (Sodium Hypochlorite Store)</td><td>MV</td><td>6</td><td>-</td><td>Uncontrolled</td></tr>
</table>
Air Conditioning is provided for Electrical room of OSCG building.

Natural ventilation is provided for the Sodium Bisulphite room, Hydrochloric Acid room and Sodium Hydroxide room of OSCG building.

Supporting documents including data sheet and drawing are provided in Appendix A4 and Appendix A5.
</td></tr>
<tr><td>1.3</td><td>Volume of each OSCG building</td><td>4000 m^3</td><td>Proposed Design Value: 3800 m^3
Hazard Implications: In the 2017 ERR, the 10-minute average chlorine release rates to atmosphere (due to accidental indoor chlorine release) were computed by the PHAST model with reference to the building volume of 4000 m^3 and the 6 ACPH ventilation rate. In view that the ventilation rate and chlorine generation rate in each OSCG building and the associated indoor chlorine release rate at source as assumed in the 2017 ERR would remain unchanged, the chlorine release rates to atmosphere would not be significantly affected by the slight reduction of the building volume. In addition, the chlorine risks as predicted in the 2017 ERR are well within the acceptable levels with great safety margins from the assessment criteria. The slight reduction of the building volume would not cause any significant implication on the overall conclusion of the 2017 ERR on the chlorine hazards.</td><td>As-built Building Volume:
Electrolyser skid stream room = 4323.10 m^3
Entire OSCG Building = 5450.38 m^3
Supporting information is given in Appendix A-6.
Hazard Implications: The OSCG skids are stored in the electrolyser skid stream room. Its ventilation rate would remain to be 6 ACPH) and the daily chlorine production rate and the associated indoor chlorine release rate at source would be reduced by more than 50% from 1,125 kg per day as assumed in the 2017 ERR to 426 kg per day. The chlorine release rates to atmosphere would not be increased due to the increase in the skid room volume. In addition, the predicted chlorine risks in the 2017 ERR are well within the acceptable levels with great margins from the assessment criteria. The change of the building volume would not cause any adverse implication on the chlorine risk presented in the 2017 ERR and would not lead to any unacceptable chlorine hazard.</td></tr>
<tr><td>2</td><td colspan="4">Chlorine Gas</td></tr>
<tr><td>2.1</td><td>Discharge of chlorine gas to the atmosphere</td><td>No vent pipe will be provided for direct discharge to the atmosphere</td><td>No change to this design requirement is proposed.</td><td>This design requirement has been properly implemented. There is no vent pipe for direct discharge of chlorine gas to atmosphere.
There are three types of vents discharging to atmosphere in the OSCG building, which are hydrogen vent, tank air vent and treated air vent from scrubber as shown in Appendix A-7.</td></tr>
<tr><td>2.2</td><td>Safety measures</td><td>- Chlorine detectors
- Chlorine scrubber system
- Activation of recycle damper when chlorine scrubber is in operation</td><td>All these safety measures will be adopted in the proposed design.</td><td>Safety measures have been implemented following the recommendations of 2021 DDP. Please refer to supporting information and EPD's "no objection" reply to the proposed scrubber in Appendix A-8 to Appendix A-11.</td></tr>
<tr><td>2.3</td><td>Separation distance between the centre of OSCG building and the nearest site boundary</td><td>Greater than 30 m</td><td>- Over 100 m for OSCG in DP1
- > 30 m for OSCG in DP2</td><td>The OSCG building in DP1 has been implemented following the recommendations of 2021 DDP. Please refer to the supporting document including the BIM screen shot in Appendix A-12 and photo record in Appendix C.</td></tr>
</table>

No.	Parameters	Design Requirements / Measures in 2017 ERR	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
2.4	Separation distance between the exhaust point / louvers of OSCG buildings and the nearest site boundary	Greater than 30 m	- Over 100 m for OSCG in DP1 - > 30 m for OSCG in DP2	The OSCG building and the associated exhaust point / louvers in DP1 have been implemented following the recommendations of 2021 DDP. Please refer to the supporting document including the BIM screen shot in **Appendix A-12** and photo record in **Appendix C.**
3	**Hydrogen Release**			
3.1	Discharge of hydrogen gas to the atmosphere	Individual vent pipe will be provided for each generator	No change to this design requirement is proposed.	Individual hydrogen vent has been provided for each generator as indicated in **Appendix A-7**.
3.2	Concentration of hydrogen gas for discharge to the atmosphere	1% of Lower Flammability Limit (LFL) for hydrogen	No change to this design requirement is proposed.	Dilution blower has been provided to dilute the hydrogen with air to less than 1% by volume, below LFL. Alarm has been installed and will be raised when the in-duct hydrogen monitoring sensor detect the hydrogen concentration higher than 1%. Emergency shutdown (ESD) has been implemented. The ESD panel will be activated and shut off OSCG skids 1 & 2. Please refer to the supporting drawings and document in **Appendix A-8, Appendix A-13** and **Appendix A-14**.
3.3	Hydrogen explosion due to failure of OSCG units	The hazard distance of hydrogen explosion from the OSCG skid was estimated to be 11m for overpressure of 2 psi. Under the reference design, sufficient separation was provided between the chemical tanks and OSCG units to avoid simultaneous failure of tanks containing incompatible chemicals.	Sufficient separation will be provided between the chemical tanks and OSCG units in DP1 to avoid simultaneous failure of tanks containing incompatible chemicals,	The chemical tanks and OSCG units have been installed in the OSCG building of DP1 in accordance with the recommendation in 2021 DDP. BIM model separation distance as supporting information is shown in **Appendix A-15**. OSCG facilities have been installed in accordance with the BIM model.
4	**Sodium Bisulphite ($NaHSO_3$) Assessment**			
4.1	Safety measures to avoid right product delivered into the wrong tank.	Hoses and couplers for transferring of $NaHSO_3$, hydrochloric acid (HCl), ferric chloride ($FeCl_3$), sulphuric acid (H_2SO_4) and citric acid ($C_6H_8O_7$) are different in size to avoid connecting road tankers of incompatible chemicals to corresponding storage tanks.	No change to the safety measure is proposed.	According to Contractor's current design, there is no citric acid ($C_6H_8O_7$) storage in DP1. Hoses and couplers for transferring of $NaHSO_3$, HCl, $FeCl_3$ and H_2SO_4 are in different sizes and have been implemented following the recommendations in the 2017 ERR and 2021 DDP (see **Appendix A-42**).
		Warning signs will be displayed at the inlet of each storage tank to show chemical name and to warn the potential hazards of mixing incompatible chemicals	No change to the safety measure is proposed.	Warning signs have been installed in accordance with the recommendations in 2017 ERR and 2021 DDP (see **Appendix A-43**).
		$NaHSO_3$, sodium hypochlorite (NaOCl), HCl, $FeCl_3$, H_2SO_4 and $C_6H_8O_7$ will be delivered by road tankers.	No change to the safety measure is proposed.	The safety measure has been implemented in accordance with the recommendations of 2021 DDP. Please refer to the supporting information in **Appendix A-16** to **Appendix A-22** showing the provision of filling points for road tankers at Chemical Building and OSCG Building. As advised by the potential chemical supplier(s), the following chemicals will be delivered by road tanker • $NaHSO_3$ (OSCG Building) (Note: Powder form of sodium metabisulphite will be used for preparing $NaHSO_3$ in Chemical Building) • NaOCl (both Chemical Building and OSCG Building) (photo for Chemical Building is attached in **Appendix A-22**) • HCl (OSCG Building) • $FeCl_3$ (Chemical Building) (photo attached in **Appendix A-22**) • H2SO4 (Chemical Building)
		HCl, $FeCl_3$, H_2SO_4 and $C_6H_8O_7$ at chemical building will be stored in double containment tanks.	No change to the safety measure is proposed.	Double containment has been provided for the chemicals in accordance with the recommendations in the 2017 ERR and 2021 DDP. FSD approved DG drawings showing the bund arrangement are provided in

No.	Parameters	Design Requirements / Measures in 2017 ERR	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
				Appendix A-23 to **Appendix A-32**. Chemical storage tanks of HCl, $FeCl_3$ and H_2SO_4 are located within bund with capacity equal to 100% of all tanks in a compartment which is capable to contain any spillages within the bund. The bund works are regarded as double containment for HCl, $FeCl_3$ and H_2SO_4 at Chemical Building and OSCG Building. Photo records are given in **Appendix A-33**.
		HCl, $FeCl_3$, H_2SO_4 and $C_6H_8O_7$ flowing outside of the chemical building will be collected by roadside drains	Floor surface gradient will be used for directing any spillage of HCl, $FeCl_3$, H_2SO_4 and $C_6H_8O_7$ towards the sump within the storage compartment and contained inside the chemical building for further clean-up and proper disposal. Design of the floor gradient shall take account of the viscosity of the chemicals.	Floor surface gradient has been provided for HCl, $FeCl_3$, $H2^SO_4$, $NaHSO_3$, NaOCl rooms, within the bund in accordance with the recommendations of 2021 DDP. Please refer to the architectural drawings as supporting information in **Appendix A-34** and **Appendix A-35** and photo record of sump pits in **Appendix A-36**.
		Perimeter drain will be installed surrounding $NaHSO_3$, HCl and NaOCl storage compartments at OSCG buildings.	Floor surface gradient will be used for directing any spillage of $NaHSO_3$, HCl and NaOCl towards the sump within the storage compartments and contained inside the OSCG buildings for further clean-up and proper disposal. The floor gradient design of the buildings shall take account of the viscosity of the chemicals.	
		Bunds will be provided for all storage compartments	No change to this design measure is proposed.	Bunds have been provided for the chemical storage compartments. Supporting information is provided in **Appendix A-23** to **Appendix A-33**.
		Double containment will be provided for HCl pipelines in OSCG buildings.	No change to this design measure is proposed.	This design measure has been implemented accordingly. Double containment has been provided for HCl pipeline to contain the spillages outside HCl store room. Inside HCl store room, the HCl acid storage tanks and pipeline are located within the bund with capacity equal to 100% of all tanks in a compartment. The bund is regarded as double containment and will contain the spillages inside HCl store room. Supporting information is provided in **Appendix A-37** to **Appendix A-40**.
		Alignment of HCl pipeline is away from pipelines for other incompatible chemicals in OSCG building.	No change to this safety measure is proposed.	This design measure has been implemented accordingly. As-built alignment of HCl pipeline is away from pipelines for other incompatible chemicals in OSCG building as shown in **Appendix A-38**.
		Floor surface gradient will be used for directing spillage of incompatible chemicals to different locations such that HCl will be collected to a separate drain system.	No change to this safety measure is proposed in the latest design.	This design measure has been implemented accordingly. Floor surface gradient has been provided and will be used for directing spillage of incompatible chemicals to different locations such that HCl will be collected to a separate drain system. Please refer to the architectural drawings as supporting information in **Appendix A-35**.
		Only one storage tank will be connected to delivery pipeline at any one time to minimize the amount of spillage.	No change to this design measure is proposed.	This design measure has been implemented accordingly. Separate control valves (open/close) are provided at each tank outlet. The control logic of the valves has been developed in a way such that only one storage tank will be connected to delivery pipeline at any one time to minimize the amount of spillage. Please refer to the supporting information in **Appendix A-16** to **Appendix A-22**
		Pipe pressure will be continuously monitored. Pumps will be immediately shut down if irregular pressure drops occur.	No change to these design measures is proposed.	This design measure has been implemented accordingly. Pressure monitoring system has been installed at the discharge of the sodium bisulphite dosing pumps. The pumps will be tripped to stop running by the control system when irregular pressure drops are detected at pump discharge. Please refer to the process and instrumentation diagram in **Appendix A-41**.
		Vibration sensing system will be installed alone pipelines. Pumps will be immediately shut down if excessive vibration is detected to minimize the amount of leakage through damaged pipelines.	No change to these design measures is proposed.	This design measure has been implemented accordingly. Vibration sensing system has been installed at the dosing line of the sodium bisulphite dosing pumps. The pumps will be tripped to stop running by the control system when irregular vibration are detected at dosing line. Please refer to the process and instrumentation diagram in **Appendix A-41**.
4.2	Separation distance between OSCG buildings and chemical building.	380m	**Design Value:** about300 m **Hazard Implications**: The separation distance of 380 m in the 2017 ERR is mainly to show that it is one of the safety measures for eliminating the operation error namely "right product delivered into the wrong tank". There is no significant risk implication due to the change in the separation distance from 380 m to 280 m.	Actual Value: 340 m (which met the requirement of 2021 DDP) Please refer to BIM screen shot in **Appendix A-12** and photo record in **Appendix C**.

No.	Parameters	Design Requirements / Measures in 2017 ERR	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
5	**Liquid Carbon Dioxide (CO_2)**			
5.1	Number of CO_2 storage tank	16 units	5 tanks in DP1	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Only 5 units are installed in DP1. Layout drawing and photo records are provided in **Appendix B-1** and **Appendix B-2.**
5.2	Type of storage tank	Vacuum insulated	Vacuum insulated	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Storage tanks installed in DP2 are vacuum insulated with double containment. Specifications of CO2 tanks installed in DP1 are given in **Appendix B-3**.
5.3	Storage tank capacity	100 tonnes per tank	100 tonnes per tank	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Capacity of each tank is 100 tonnes as indicated in **Appendix B-1**.
5.4	Type of vaporizer	Ambient	Ambient	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. The type of vaporizer is ambient. Inspection report is provided in **Appendix B-11**.
5.5	Transport mode	By road tanker	By road tanker	The transport mode by road tanker has been implemented. Plan view of road tanker filling point is shown in the CO2 system layout in **Appendix B-1**. CO_2 road tanker license is attached in **Appendix B-12**.
5.6	Safety measures	CO_2 storage in double containment	CO_2 storage in double containment	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP. Storage tanks are vacuum insulated with double containment. Specifications of CO_2 tanks installed in DP1 are given in **Appendix B-3**.
		2. set of pressure relief valves (PRVs) on inner containment. The 2 sets of PRVs are connected by a switchover valve. Each set consists of 2 PRVs.	No changes to the design measures are proposed.	The CO_2 storage tanks have been implemented following the recommendations in 2021 DDP and in accordance with the Detailed P&IDs of Remineralization CO_2 storage tanks and related systems and details of the pressure relief system as presented in the 2021 DDP. Relevant information from the 2021 DDP is reproduced in **Appendix B-4** and **Appendix B-6** for record. Photo record of pressure relief valve is included in **Appendix B-7**.
		Plate pressure relief device on outer containment (considered on storage tanks only).	No changes to the design measures are proposed.	Plate pressure relief devices have been provided on outer containment in accordance with the recommendations in 2021 DDP. Details and photo record of the pressure relief system are given in **Appendix B-6** and **Appendix B-7**.
		Trycock for overfilling alarm and warning	No changes to the design measures are proposed.	Trycock for overfilling alarm and warning has been implemented in accordance with the recommendation in 2021 DDP. Details and photo records of the trycock valves are given in **Appendix B-8** and **Appendix B-9**.
		High level alarm to operating staff at control room for liquid level monitoring and warning	No changes to the design measures are proposed.	High level alarm has been provided in accordance with the recommendation in 2021 DDP. High level alarm is indicated in the P&ID in **Appendix B-4**.
5.7	Separation distance between CO_2 storage area and the explosive truck during off-site transport	Set back the CO_2 storage with sufficient clearance so that the overpressure resulting from explosion of explosive vehicle during off-site transport that reaches the storage is less than 2 psi.	Based on the explosive delivery route provided by CEDD, the setback distance of the CO_2 storage area in DP1 is located outside the 2psi overpressure zone from the explosive delivery truck. The CO_2 storage area in DP1 would not be impacted by the road transport of explosives.	The as-built location of the CO_2 storage area in DP1 (as indicated in **Appendix C**) follows the design assumption in 2021 DDP, and hence also met the relevant separation requirement of the 2017 ERR.
5.8	Separation distance between CO_2 storage area and the explosive offloading pier	Set back the CO_2 storage with sufficient clearance so that the overpressure resulting from explosion of explosives at the offloading pier that reaches the storage is less than 2 psi.	The liquid CO_2 storage areas in DP1 is over 300m from the explosive offloading pier, which is greater than the maximum hazard distance or the 2psi overpressure zone from the explosive source. The CO_2 storage area in DP1 would have sufficient clearance from the explosive offloading pier.	
5.9	Separation distance between CO_2 storage area and site boundary	Approximately 100 m	The CO_2 storage in DP1 is situated at more than 100 m away from both northern and western boundaries of the desalination plant.	The as-built CO_2 storage area in DP1 follows the recommendations of 2021 DDP. It is situated at more than 100 m away from both northern and western boundaries of the desalination plant as shown in **Appendix C**.

No.	Parameters	Design Requirements / Measures in 2017 ERR	Recommendations in 2021 DDP	Audit Results - Actual Provisions for DP1 and Records
5.10	Separation distance between CO_2 storage area and toe of natural slope behind	Approximately 30m	Approximately 30m for CO_2 storage in DP1	The as-built CO_2 storage area in DP1 follows the recommendations in 2021 DDP. It is situated at more than 30 m away from the slope toe in indicated in **Appendix B-13** and **Appendix C**.
5.11	Safety measure to protect the CO_2 storage area from soil debris.	A 1.5m high baffle barrier will be constructed at the roadside of the internal access road.	No change to the safety measure is proposed.	A 1.5 m high barrier has been provided as indicated in the photo record in **Appendix B-14**.

3 Conclusion

3.1.1 An audit has been carried out in accordance with Condition 2.20 of FEP No. FEP-01/503/2015/A and EP No. EP-01/503/2015/A for certifying the implementation of design requirements / measures recommended in the 2021 DDP approved under Condition 2.12 of the FEP and EP. The audit results showed that the design requirements and measures for mitigating hazard to life as recommended in the 2021 DDP have been implemented at DP1. With the provision of these design requirements and measures, operation of the DP1 would not induce additional hazard to life impact as compared to the predictions in the 2017 ERR and 2021 DDP.

End of Text

Member of the Aurecon Group

Our Ref: PL-202405006

Date: 3 May 2024

AJC Joint Venture
5/F, Tower A, Manulife Financial Centre,
223-231 Wai Yip Street,
Kwun Tong,
Kowloon,
Hong Kong

Attn: Mr. Brian Kam

Dear Sir,

Contract No. 13/WSD/17
Design, Build and Operate First Stage of Tseung Kwan O Desalination Plant
Certification of Audit Report on Measures for Mitigating Hazard to Life (Issue 3)

We refer to the revised Audit Report on Measures for Mitigating Hazard to Life (Issue 3) issued on 30th April 2024 for the captioned project.

We have no further comment and hereby certify the captioned submission in accordance with Condition 2.20 of Environmental Permit EP-503/2015/B and Further Environmental Permit FEP-01/503/2015/B.

Yours Faithfully,
For and on behalf of
Acuity Sustainability Consulting Limited

Jacky C. H. Leung
Environmental Team Leader

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Our ref.: LES/J2024-01/CS/L011
Date : 3 May 2024

By Post and Email

Water Supplies Department
New Works Branch
Consultants Management Division
6/F, Sha Tin Government Offices,
1 Sheung Wo Che Road, Sha Tin,
New Territories

Attn: Mr. Sam Hui/ Mr H L Lai

Dear Sirs,

Independent Environmental Checker (IEC) for Construction and Operation of the First Stage Desalination Plant at Tseung Kwan O (Quotation Ref. No. TKO1/IEC/003)

Verification of Audit Report on Measures for Mitigating Hazard to Life

We refer to the revised Audit Report on Measures for Mitigating Hazard to Life (Issue 3) for the captioned project prepared by Binnies Hong Kong Limited.

We have no further comment and hereby verify the captioned report in accordance with Condition 2.20 of Environmental Permit EP-503/2015/B and Further Environmental Permit FEP-01/503/2015/B.

Yours sincerely,
For and On Behalf Of
Lam Environmental Services Limited

Serena Shek
Independent Environmental Checker

Encl.

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