PLAN

Title: Water Management Plan [DMSB]

DOCUMENT CONTROL			
Doc. Reference	PL-AUS-DAR-030	**Function**	HSSEQ
Revision Date	13/12/2021	**Group Owner**	Regional HSSEQ Manager
Rev. Number	5	**Group Approver**	Group Head of HSSEQ

APPROVED VARIANCE

There are currently no approved variances for this Plan and the Plan is to comply with Australian rules and regulations.

DOCUMENT REFERENCES

Internal References	• FRM-GOP-HSSEQ-058.02 - Business Risk Management Verification • GOP-HSEQ-024 - Personal Protective Equipment • GOP-HSSEQ-046 - Service Improvement Document • PL-AUS-HSSEQ-001 - Asset Management Plan [DMSB] • WA-GOP-QS-009.02 - Water Bunkering - DMSB • DMSBOPS011 - Water Stand TBRA • FRM-GOP-QS-009.01 - Potable Water System Verification • FRM-GOP-HSEQ-019.02 - DMSB Risk Register • DMSB Potable Water Management Logbook - 2021
External References	• Australian Drinking Water Guidelines 6, [2011] - Updated August 2018 • AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines • Technical Guidelines for the Prevention, Control and Investigation of Infections Caused by Legionella Species, 2017 • Work Health and Safety Act, Regulations & Code of Practice, 2011 • AS 2031 Water Quality – Sampling for Microbiological Analysis [ISO 19458:2006, MOD] • Plumbing Code Development Research Report Warm Water Systems, 2015

DOCUMENT SCOPE / PURPOSE

The purpose of this Plan is to is specify the requirements for maintenance of the Darwin Marine Supply Base [DMSB] potable water system and the procedure for delivery of water [vessel bunkering] for offshore use at the DMSB.

REVISION HISTORY

Rev	Date	Comment
1	17/06/2020	Creation of plan
2	23/03/2021	Full Review in line with water treatment Risk assessment
3	08/04/2021	Full Review
4	20/05/2021	Full Review Local and Regional
5	13/12/2021	Full Review Local

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Title: Water Management Plan [DMSB]

1.0 Purpose

The purpose of this Plan is to ensure that:

- Risks associated with the supply of drinking water at the DMSB are identified, assessed and controlled
- Water testing is defined and managed in accordance with Australian Drinking Water Guide [ADWG] and other relevant standards and guides
- All stakeholder interfaces are clearly described
- Information from this Plan is communicated to DMSB stakeholders as and when required in a prompt manner.

2.0 Responsibility Summary

This document is relevant to the following roles:

DMSB Manager

- Has overall responsibility and accountability for overseeing the delivery of safe and efficient operations at the DMSB
- Monitor the activities of DMSB Users to ensure compliance with this Plan
- Ensure chlorine monitoring and periodic sampling is carried out as laid out in this Plan, reports are checked, and corrective actions are taken when necessary
- Preventative maintenance tasks and repairs are undertaken to any equipment
- A risk assessment has been carried out on the system/for the task
- Complete monthly verifications on water system
- Ensure scheduled bunkering activities are discussed at Scheduling/Toolbox meetings.

DMSB Coordinator, Facility Coordinator and/or DMSB Security

- Ensure advice and support is provided to Facility Users in meeting the requirements of thisplan
- Monitor controls in relation to this plan ensuring all DMSB Users are compliant
- Promptly report all non-conformances to DMSB Manager and HSSEQ Department
- Follow the TBRA for task DMSBOPS011 - Water Stand
- Complete monthly verifications on water system
- Wear PPE free from contamination including clean gloves that are not used for other tasks that may introduce contaminants
- Ensure exclusion zones are set up/removed before and after bunkering
- Record water usage prior to and on completion of bunkering on FRM-PL-AUS-DAR-015.13 Vessel Log Sheet.

HSSEQ

- Review HSSEQ trends and analysis and develop risk mitigation strategies
- Support the DMSB Manager and Supervisors to conduct work in a safe and efficient manner
- Approve TBRAs within level of authority
- Provide HSSEQ support to the DMSB
- Complete monthly verifications on water system.

Agent/Client Responsibilities

- Communicate requirements of this Plan to all Vessel Masters.

Vessel Task Requirements

- Supply all connections and hoses for the supply of water from DMSB to vessel
- Ensure all equipment is fit for purpose and maintained, ensuring no contamination
- Connect/disconnect hoses from vessel/standpipe.

3.0 Abbreviations and Definitions

Terms	Meaning
ADWG	Australian Drinking Water Guidelines
Bunkering	The transfer between shore facilities and vessel
DMSB	Darwin Marine Supply Base
Microbials	A bacterium causing disease [legionella/E coli]
PPE	Personal Protective Equipment
SID	Service Improvement Document
SWMS	Safe Work Method Statement
TBRA	Task Base Risk Assessment
Water	Water that is safe to drink, use for food preparation or personal bathing

4.0 Introduction

The Darwin Marine Supply Base [DMSB], owned by Darwin Port and operated by ASCO, is a specific purpose intermodal freight facility servicing the offshore oil and gas industry with necessary supplies of equipment, water, drilling mud, fuel and other consumables required by offshore platforms.

Mains water is supplied at the DMSB via main water line and water is supplied to vessels via water bunker standpipes.

ASCO in line with this plan undertake the below water testing and flushing schedule, this schedule is aligned to best practice guidelines and legislation as per mentioned within document reference section of this Plan:

- Daily water flushing of water lines
- Twice weekly chlorine testing
- Weekly cleaning and sanitising of water outlets and water standpipes
- Routine maintenance and inspection to water outlets
- Monthly water system verifications
- Monthly third-party water testing by third party to ensure drinking water in line with ADWG

Note - If warranted and depending on the water results, the sampling regime may be varied. Variations will be recorded utilising FRM-GOP-QS-009.01 - Water System Verification.

5.0 Risk Management

The below table summarises the operational monitoring tasks that are completed with their required frequency. In the management of Microbial/bacteria. **Note*** - If warranted and depending on the water results, the sampling regime may be varied. Variations will be recorded utilising FRM-GOP-QS-009.01 - Water System Verification.

Frequency	Task	Document	Responsibility
Daily	Flush areas with low free Chlorine and suspected elevated turbidity, until levels improve. Note all results in a logbook.	*Best Practice*	ASCO

Weekly	Flush all little used outlets / fixtures and record in logbook. [it is understood that site flush all outlets weekly as part of their ongoing mitigation tasks, ensure all outlets attached to the distribution system are captured]	*Best Practice enHealth Guidelines HSE ACoP L8 [UK] European Technical Guidelines*	ASCO
	Test Chlorine, and temperature levels at the incoming mains and select outlets throughout the site, noting results in a logbook.	*Best Practice*	ASCO or suitable sub-contractor engaged by ASCO
	Where water heaters are present, ensure hot water is stored and distributed ≥60˚C and record in logbook	*AS 3500.3 enHealth Guidelines European Technical Guidelines*	ASCO
Monthly	Inspect all fixtures and equipment for cleanliness. This includes all standpipes, sample points, showers, tap aerators/tap heads, drinking water units etc. Clean as required. Record all inspections and actions in logbook. Test turbidity and pH at problematic areas, noting results in a logbook. Where levels improve [<1 NTU], Turbidity testing can become of the sites monthly testing. Where little/no change is noted on a monthly basis, inspection can revert to quarterly.	*Best Practice enHealth Guidelines*	ASCO and Sub-contactor
	Sample designated outlets/fixtures for Legionella [continuing current regime]	*Best Practice*	ASCO or suitable sub-contractor engaged by ASCO
Quarterly	Where fouling is still suspected in the distribution network, the systems should be treated with a bio- dispersant and disinfectant [bio-flush] This action can be bi-annual where more feasible	*Best Practice*	Suitable sub-contractor engaged by ASCO

Annual	Review Legionella Risk Management Plan	*enHealth Guidelines Section 5*	Suitable sub-contractor engaged by ASCO
Ongoing / Once Off / As Required	Maintain an up-to-date log book on site, containing: all servicing records, microbial test results, inspection logs and maintenance tasks.	*Best practice*	ASCO
	Where Legionella detections are returned and/or issues are not yielding, it is recommended that periodic Chlorination are conducted. Suitable methodology can be located in enHealth Guidelines, AS 3500.1 appendix I or Power Water 'Disinfection Procedures for Water Mains	*enHealth section 4.1 AS 3500.1 Appendix I Power Water* *[see Appendix 1 for methodology]*	Suitable contractor engaged by ASCO

***Note** - Refer also to Appendix 1 of this Plan for Risk Plan Management Plan Procedure.

5.1 Detected Levels of Bacteria - CFU/mL

The below table presents in line with current best practice guidelines detected level limits and control strategies to be applied if CFU/mL levels are above recommended levels. These levels are aligned with best practice guidelines and legislation available.

Test Results [CFU/mL] Detected:	Control Strategy	Traffic light
0 - 9	• Effective Maintenance Practice • System Under Control • Maintain Current Monitoring and Treatment Program	Provide water - no further actions
10 - 99	• Review Maintenance Strategies • Monitor and Perform Follow up Testing	Provide Water - Advise Vessel to Chlorinate Water within Vessel water tanks
100 - 999	• Potentially Hazardous Situation • Immediate Disinfection [alternatively higher dose biocide than usual] • Review Current Control Strategy • Re-test Water and Assess if Further Remedial Action is Necessary	Do not provide water
> 1000	• Serious Situation • Immediate Disinfection • Review Control Strategy • Re- test Water and Assess if Further Remedial Action is Necessary	Do not provide water

In line with best practice guidelines, ASCO will issue water when CFU/mL levels are within 0 - 100 CFU/mL. Where CFU/mL being above 100CFU/mL ASCO will increase maintenance strategies and monitoring and water from affected location points will not be supplied.

All test results will be issued to vessels as requested.

6.0 Water Bunkering Procedures

Water bunkering procedures are detailed in:

- Water Stand TBRA DMSBOPS011
- Water Sampling and Bunkering Work Aid WA-GOP-QS-009.02.

7.0 Chlorine Monitoring and Testing

The presence of free chlorine residual in the distribution system provides evidence of initial disinfection and protection against recontamination.

Free Chlorine Residual Testing shall be undertaken weekly on water and water delivery infrastructure by ASCO personnel, utilising the Hanna Free Chlorine Testing Kit. This testing is to check that the recommended chlorine levels are present and being maintained.

Recommended Chlorine Levels and Water Temperature

For normal domestic use, residual chlorine levels at the point where the consumer collects water should be between 0.2 and 0.5 mg/l. However, for water systems where drinking water reach temperatures greater than 25ºC, free chlorine or chloramine residual is required at 0.5 mg/L or higher.

The DMSB due to surface recording of water temperature being greater than 25ºC will ensure chlorine residual levels are greater than 0.5 mg/L to ensure suitable levels of bacterial protection are applied.

Recommended PH levels

The efficacy of Chlorine has a direct correlation with the pH of the water. As the pH increases the efficacy of the Chlorine dramatically decreases. The ADWG states full dissociation of Hypochlorous Acid [effective disinfectant] at >8.5, and no dissociation at <6.5, with the enHealth Legionella Guidelines and the European Technical Guidelines stating that the desired pH range for Chlorine to be effective in controlling microbial is ≤7.6.

DMSB will target a PH level of between 6.5 - 7.6 to ensure effectiveness of chlorine dousing - refer to Appendix 1 for guidance on PH controls.

8.0 Chlorine Testing Process

Twice Weekly free chlorine testing is conducted at various sample points using the instruction manual for the Chlorine Test Kit. The process is to:

1. Wash your hands thoroughly before sampling and wear disposable gloves
2. Do not allow the screw cap or mouth of the sample container to touch anything that may contaminate the sample
3. Remove any attachments, clean the sampling point, ensuring it is free from oily residue
4. Flush the system for 2 minutes with a HIGH rate of flow, then reduce to steady stream [approx. size of pencil]

5. Remove the cap from the sample bottle, taking care not to touch the inside of the cap or the neck of the bottle Do not allow the screw cap or mouth of the sample container to touch anything that may contaminate the sample
6. Fill the bottle to level line and then replace the cap tightly till ready to add reagent
7. Zero the checker as per the Instruction Manual
8. Add the reagent to the water sample
9. Place vial into the checker
10. Press button to analyse and read the results
11. Record results in DMSB water sampling spreadsheet - distribute results
12. During sampling check for material, discolouration or discernible odours and report any observations on the sampling record sheet
13. Where chlorine levels fall below 0.5 mg/L Darwin port to be contacted to increase chlorine levels in chlorination dosing plant, timelines, and new chlorine levels to be recorded in water sampling spreadsheet. Refer also to section 5 of this plan Risk management for further actions.

9.0 Water Temperature

In order to suppress and mitigate Microbial growth, temperature of the water is an important control factor.
The ADWG and Legionella Guidelines [AUS] state that the recommended temperature of cold water <20.0°C.

The DMSB cold-water temperature range is primarily ≥30°C. Given the ambient temperature throughout the year in Northern Territory, it is unlikely to drop to the target level of <20.0°C.

Current risk management strategies mentioned within this Plan takes into account this level of water temperature.

10.0 Communication Plan - Bacterial Infections

The following procedure and communication are conducted in the event of a bacterial infection event within the DMSB:

- All DMSB Users are made aware of positive Microbial\bacterial detections on the day of laboratory notification
- Remedial action, in the form of a clean and disinfection, is implemented as soon as possible
- Re-samples are taken 3-7 days after the disinfection, and further remedial action is undertaken if required
- Site Users are informed in order to determine requirement for limiting exposure and implement symptom monitoring
- Follow up actions are undertaken to ensure operational parameters are reviewed to prevent recurrence.

11.0 Maintenance

DMSB water storage and delivery infrastructure is maintained in accordance with the DMSB Asset Management Plan. The maintenance regime includes:

- Regular water flushing
- Above ground pipe and valve inspections
- Bunker standpipe inspections and cleaning
- Any recommended intervention if water sampling figures are above recommended requirements

Note* - If warranted and depending on the water results, the sampling regime may be varied. Variations will be recorded utilising FRM-GOP-HSEQ-009.01 - Water System Verification.

12.0 Audits Inspections and Risk Assessments

Below details the monthly and annual on-site inspection and risk assessment process on site to ensure Water management process is continually tested and assessed. Findings are recorded and actioned utilising the ASCO Service Improvement Process GOP-HSSEQ-046.

Monthly Potable Water System Verification

- The purpose of the Potable water system verification is to ensure that all the requirements of Darwin Marine Supply Base PL-AUS-DAR-030 Water Management Plan is fully implemented, and water quality is to ADWG standards. Verifications are conducted by DMSB Facilities Coordinator and or Darwin HSSEQ department.

Monthly Potable Water Testing

- ASCO Australasia (ASCO) engages EcOz Environmental Consultants (EcOz) to undertake monthly potable water testing at 11 locations along the potable water network supplying the Marine Supply Base (MSB) facility at East Arm Wharf. The purpose of this testing is to ensure the physical, chemical and microbial quality of the water meets the Australian Drinking Water Guidelines (ADWG 2021).

Annual Assessment of Risk Management Plan Potable Water Distribution

- ASCO Engages Hydro Chem to undertake the annual Risk Management Plan assessment. This assessment addresses the critical risks associated with the operation of the water distribution system and identifies any concerns and subsequent recommendations to the water management programme.

13.0 Sampling for Bacterial Analysis of Water

Monthly field sampling for bacterial analysis, laboratory assessment and reporting is undertaken at various sample points across the DMSB.

ASCO will use a qualified, independent 3rd Party service provider to conduct field sampling. The sub-contracted provider details are available from the DMSB Manager.

Microbiological analysis for the following contaminants is tested:

Contaminant	Type	Limits / Acceptable results
E.coli	Present in animal faeces, E.coli is the most common thermotolerant coliform in the group and is regarded as the most specific indicator of recent faecal contamination	Detection of E.coli indicates recent faecal contamination and the possible presence of other disease-causing micro-organisms, should not be detected in 100 mL of drinking water. Levels should be maintained to <1 CFU/mL
Total Coliforms	Total coliforms refer to a large group of bacteria that can be of faecal or non-faecal origin. Total coliforms do not present a direct health risk but can provide information on the efficiency of drinking water disinfection.	Recommends establishing numbers on a system-specific basis and investigation of any increase from <1 CFU/mL
Heterotrophic Plate Count [HPC]	Heterotrophic Plate Count is a test used to detect a number of micro-organisms present in water; general microbiological content of the water and hence a measure of the effectiveness of disinfection.	System-specific basis and investigate any marked increase in numbers following disinfection. Minimum Free chlorine levels 0.5mg/l. will eliminate any traces of HPC

Naegleria	Free-living amoebae, generally results from contact during bathing, or domestic uses of water other than drinking	A detection of Amoeba, will then be further tested for Naegleria in the treated water system, Chlorine levels will be increased to 1mg/l. to eliminate any traces of Naegleria
Total and free chlorine	Comes from chlorination of water supplies or is the result of pollution	Chlorine is best tested on-the-spot because samples lose chlorine quickly Minimum level 0.5 mg/l.
Legionella	Legionella bacteria comes from when it gains entry to the respiratory system through, a fine misted caused by showers or air conditioning systems. It can cause Pontic Fever which has flu like symptoms or Legionnaire's disease which is a serious type of lung infection which can be fatal	Legionella level above 10 CFU/mL or HPC count of more than 100,000 CFU/mL, Remedial action plan should be formed.

14.0 Testing Results

Testing Results are retained by DMSB and will be communicated to DMSB clients on request.

15.0 Non-Conformances/Improvement planning

All non-conformances or improvements identified in regards to this plan shall be investigated and recorded utilising GOP-HSSEQ-046 - Service Improvement Process [SID].

Actions include:

- Investigate the source of contamination
- If water has been discharged advise the Vessel/the Client
- Retest

16.0 Remediation

Any results of water sampling that is out of specification for microbiological or free chlorine readings shall be remediated in consultation with Darwin Port Management.

17.0 Monitor and Review

This Plan will be reviewed to ensure full compliance, as a minimum, a full review will be conducted annually. Water System Verification FRM-GOP-QS-009.01 shall be utilised to verify adherence to this Plan.

Appendix 1 - Risk Management Plan Procedure

Operational Control	Procedure
Sampling	Follow procedures as per AS 2031 or similar guidance documentation. Obtain and verify suitable sample procedure is being used by contractor.
pH Control	Ensure pH is being tested regularly [minimum monthly], using appropriate digital device [e.g. pH meter]. The device must be calibrated as required using a buffer solution. pH can be tested offsite at a lab, however, holding times as cited by the lab must not be exceeded [holding times are the time from the point the sample is taken until it needs to be tested] 1. Water should be allowed to flush through the test point until all stagnant water is removed. Water should be run for a minimum of 2 minutes 2. Collect a sample of water in a clean receptacle and follow the pH devices manufacturers guidance for correct operation and testing method 3. Record results in logbook.
Free Chlorine Testing	Ensure free Chlorine levels are being tested regularly [twice weekly], using appropriate digital device [e.g. colorimeter]. 1. Water should be allowed to flush through the test point until all stagnant water is removed. Water should be run for a minimum of 2 minutes. Testing of free Chlorine should always be done onsite, testing off site will not give an accurate result due to Chlorine depletion 2. Follow the Chlorine reader's manufacturers guidance for correct operation and testing method 3. Record results in logbook.
Turbidity	Can be tested onsite but it should be noted that turbidity testing can be difficult to get reproducible results. 1. Water should be allowed to flush through the test point until all stagnant water is removed. Water should be run for a minimum of 2 minutes. Samples can be analysed on- site or at a NATA accredited lab 2. Follow the manufacturers guidance for correct operation and testing method for turbidity, when testing onsite. Where a sample is being collected to send to a lab, ensure the correct bottle is being used, where no preservatives are present 3. Records results in the Potable Water Management Logbook - 2021.
Flush little used outlets / pipe	1. Open the isolation valves fully to allow water to flow, avoiding spray/aerosol creation 2. run the outlet for a period of 30 minutes as a minimum 3. Longer running time may be required from problematic areas 4. Records results in logbook.
Chlorination - Legionella	The following procedure and communication model will be enacted: 1. All relevant responsible persons are made aware of positive Legionella detections on

Detected in system	the day of laboratory notification 2. Remedial action, in the form of a clean and disinfection, is implemented as soon as possible 3. Re-samples are taken 3-7 days after the disinfection, and further remedial action is undertaken if required 4. Relevant staff are informed in order to determine requirement for limiting exposure and implement symptom monitoring 5. Follow up actions are undertaken to ensure operational parameters are reviewed to prevent recurrence 6. Issues are escalated appropriately.
Material Safety data sheets [MSDS]	Material Safety data sheets [MSDS] for the chemicals used in cleaning or disinfection: 1. Must be read and understood by staff responsible for and undertaking procedures using these materials 2. Be readily available on site 3. Staff should wear appropriate Personal Protective Equipment [PPE] when carrying out maintenance or cleaning 4. A Safe Work Method Statement [SWMS] must be read, understood and signed by those carrying out the procedure.