The Demonstration, Manufacture and In-service support of the Combat Water Supply System (CWSS) Prime Contract for Provision and Support of Expeditionary Water Services

Safety and Environmental Case Report (SECR)

Annex E to

DEFFORM 47

OPERATIONAL SUPPORT PROGRAMMES

OPERATIONAL INFRASTRUCTURE PROGRAMME

Combat Water Supply System (CWSS)

Assessment Phase

CWSS Part 1 (Requirements) Safety and Environmental Case Report

CWSS PT1 SECR
November 2015
Version 6

CWSS Part 1 (Requirements) Safety and Environmental Case Report

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AMENDMENT RECORD

No.	Issue	Author	Date	Changes
1	0.1	Water PM –Martyn Ellis	Aug 11	Draft for review
2	0.2	M Whittington (PgMO-SnrEngr)	Aug 14	Complete review
3	2	M Whittington (PgMO-SnrEngr)	Sept 14	All comments from CWSS PM & OIP safety incorporated
4	3	P MacGregor (PgMO-Safety)	Nov 14	Incorporation of comments after further distribution from Assurance and OIP Safety Team
5	4	N Bennett (OIP Safety)	Apr 15	OIP Safety Acceptance Review
6	5	N Hand (OIP Safety-SnrMgr)	June 15	Revised in readiness for ITT. New Appendix 1, hazard log incorporated
7	6	D Lambert/N Bennett (OIP Safety)	Nov 15	Review and Update of Tolerability Levels
8				
9				
10				

CONTENTS

REFERENCES

Ref.	Document Title	Document Version and Date
1	CWSS Initial Gate Business Case	Version 2.2,19th December 2014
2	CWSS Safety & Environmental Management Plan	Version 1, 4th August 2014
3	JSP 454: Land Systems Safety and Environmental Protection	Version 6.1, September 2014
4	OSP Safety & Environmental Management System	Version 3.1, Issue 4, March 2015
5	CWSS Concept of Employment	Version 2, September 2013
6	CWSS System Requirements Document	Version 1.0, September 2015
7	CWSS Master Data Assumptions List	Version 0.2, 14th September 2015
8	Water Equipment Through-life Safety and Environmental Case Report	Issue 1, June 2015
9	Def Stan 00-56: Safety Management Requirements for Defence Systems	Issue 6, 2nd April 2015
10	POEMS EMP03: Environmental Impact Priority Evaluation	Issue 2.3e, September 2010
11	POEMS EMP04: Environmental Impact Assessment Plan	Issue 2.3e, September 2010
12	QinetiQ Operational Analysis: Water Management Framework 4 Sep 13	Version 1.1 15th October 2014
13	HSE Statistics on fatal injuries in the workplace in Great Britain 2015	July 2015
14	Guidelines for Drinking-water Quality	3rd Edition, Volume 1: Recommendations, 2008

Table 1 – References

ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
BPEO	Best Practicable Environmental Option
CADMID	Concept, Assessment, Demonstration, Manufacture, In-service, Disposal
CONEMP	Concept of Employment
COSHH	Control of Substances Hazardous to Health
COTS	Commercial Off The Shelf
CST(W)	Close Support Tanker (Water)
CWSS	Combat Water Supply System
DE&S	Defence Equipment and Support
DEFSTAN	Defence Standard
DSD13	Defence Strategic Direction 2013
EFM	Environmental Features Matrix
EWPE	Expeditionary Water Pipeline Equipment
GBA	Generic Base Architecture
HSE	Health and Safety Executive
IGBC	Initial Gate Business Case
JSP	Joint Services Publication
LFR	Lifetime Failure Rate
MDAL	Master Data Assumptions List
MHE	Manual Handling Equipment
MOTS	Military Off The Shelf
NBC	Nuclear, Biological and Chemical
OIP	Operational Infrastructure Programme
OSP	Operational Support Programmes
PECOC	Personal Equipment & Common Operational Clothing
PgMO	Programme Management Office
PHI	Preliminary Hazard Identification
PHI&A	Preliminary Hazard Identification & Analysis

POEMS	Project Oriented Environmental Management System
POSMS	Project Oriented Safety Management System
RCM	Risk Classification Matrix
REACH	Registration Evaluation Assessment and Restriction of Chemicals
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
SECR	Safety and Environmental Case Report
SEMP	Safety and Environmental Management Plan
SEMS	Safety and Environmental Management System
SEP	Safety and Environmental Panel
SQEP	Suitably Qualified and Experienced Persons
SRD	Systems Requirements Document
STANAG	Standardised NATO Agreement
WCP	Water Carriage Pack
WCP(R)	Water Carriage Pack (Racked)
WDR	Water Distribution Rack
WET	Water Equipment Through-life
WPU	Water Purification Unit

Table 2 – Abbreviations

EXECUTIVE SUMMARY

The Part 1 Safety Case (V4) for the Combat Water Supply System (CWSS) was supportive of the Initial Gate Business Case (IGBC) submission and demonstrated that the Safety and Environmental risks associated with CWSS could be satisfactorily managed. This Safety Case (V6) will now be used to support the CWSS Invitation to Tender (ITT) and passed to the tenderers to incorporate the safety assessments of their design.

This Safety and Environmental Case Report (SECR) has been produced following the Project Safety Initiation and a preliminary, top-down Safety Assessment. It is evident that a robust Safety and Environmental Management System (SEMS) has been implemented as defined through the CWSS Safety and Environmental Management Plan (SEMP) and overarching Operational Support Programmes (OSP) SEMS.

Through assessment and analysis of the appropriate assumptions, existing in-service experience and the System Requirements Document (SRD) (Ref. 6), a set of safety requirements and targets have been derived and are considered valid at this stage of the project. Furthermore, all applicable legislation, regulations, standards and MOD policy have been identified and system assumptions and boundaries recorded.

1 INTRODUCTION

1.1 Purpose

This document is the Part 1 SECR for the CWSS. The purpose of the report is to identify and set the safety objectives and requirements for CWSS and providing a baseline for all other safety documentation. The Part 1 Safety Case provides evidence to the IGBC (Ref. 1) that safety for the CWSS project can be effectively managed and safety requirements for the system have been established and will support the CWSS ITT.

1.2 Scope

This SECR has been developed specifically to support the procurement of CWSS. It will summarise safety evidence that safety for the CWSS project can be effectively managed and safety requirements for the system have been established.

1.2.1 The Scope of risk assessment will include the following;

1. General Equipment safety
2. User and System Requirements
3. Occupational safety i.e Manual handling, packaging, transport and storage, control of substances hazardous to health etc…
4. Safety of operation
5. Infrastructure interfaces
6. Maintenance
7. Training
8. Disposal
9. Areas of operation
10. Air emissions
11. Use of resources
12. Waste management

1.2.2 Usage Scope considers the platform and systems during:

1. Operation,
2. Training
3. Maintenance
4. Transportation
5. Storage
6. Disposal
7. Trials and Testing

1.2.3 Accident scope – Safety assessments should consider accidents relating to:

1. First Parties (maintainers, contractors(includes In Operational Theatre))
2. Second Parties
3. Third Parties (gen public or service personnel not involved with the CWSS).
4. Environmental damage and nuisance (as part of environmental analysis)

1.2.4 Hazard Scope – Safety analysis should consider hazards arising from but not limited to:

1. Inherent: These are hazards that arise from the physical implementation of the system. E.g. toxic materials, stored energy, sharp edges, high temperatures etc…
2. Functional: Functional hazards are associated with functions provided by the system and are role dependent. Functional hazards are mapped at boundary of the system and arise spontaneously from design error, component failures and operator error or may be a consequence of an environmental or inherent hazards
3. Environmental: These hazards exist in the environment in which the system is placed. Enviromental hazards may originate from natural environment (e.g weather), the local environment (e.g radiation hazard) or personnel (e.g operators or maintenance personnel)

1.3 Safety Overview

As per JSP 454 (Ref. 3), the Safety Case Structure for Land Systems is developed in three parts as the system progresses through its life cycle. The three parts of the Safety Case are as follows:

a. **Part 1 – Requirements:** Identifying the safety requirements for the system. Completed by OSP and OIP (The MOD Authority).

b. **Part 2 – Design:** Evidencing and arguing that the system can meet the safety requirements established as part of the System Requirement Document (SRD) and the Part 1 Safety Case. To be started on CWSS contract acceptance by the Prime Contractor using CWSS stakeholders.

c. **Part 3 – Operation & Support:** Supporting system acceptance demonstrating the residual risk is As Low As Reasonably Practicable (ALARP). To be completed by the Prime contractor and accepted by the Authority before In-service date.

CWSS Safety and Environmental management will comply with the OSP SEMS (Ref. 4) and the project SEMP (Ref.2). This SECR should be read in conjunction with these documents as the information contained in them has not been duplicated in this SECR.

1.4 Objectives

This document is not intended to be a full safety analysis; the document will identify safety requirements for the system and should be initiated and maintained throughout the life of the system, if and when further information becomes available, although the main effort should be applied during the initial stages of the CWSS system.

This document will examine the User Requirement Document (URD) in order to refine and establish the safety requirements for the CWSS system, the likely risks that meeting the User requirements may present and the criteria against which safety performance will be measured. This document will support the development of the System Requirement Document (SRD). And will address the following:

a. The system operating context and its environment;

b. Legislative and regulatory requirements;

c. MOD Policy and Certification requirements;

d. Civil or MOD Standards to be complied with;

e. Risk targets, tolerability criteria and the application of the ALARP principle;

f. Safety Integrity requirements;

g. Derived safety requirements.

2 SYSTEM OVERVIEW

2.1 Background

CWSS is a tri-service programme that seeks to provide potable, palatable and packaged water to all components deployed on operations. CWSS will sit at the heart of water provision within the land environment. It will include the capability to cover the full spectrum of operations in diverse climatic conditions for extended periods. In order to reduce the logistic supply chain CWSS will source water as close to the point of need as possible and will have an optimised logistic footprint, minimising the resources required to operate and support it at the availability levels required.

2.2 System Purpose

The CWSS project aims to:

a. Provide the water capability to support Defence Strategic Direction 2013 (DSD13) covering eight discrete areas (source, treat, test, package, store, issue, manage and dispose).

b. Support UK forces deployed within the land environment, configured and equipped to conduct high tempo, expeditionary operations, ensuring a level of self-sufficiency for the deployed force commensurate with the desire to achieve a full expeditionary capability.

c. Take water from its source and provide doctrinally mandated levels of potable, palatable and packaged water to the point of issue.

d. Address integration issues with the current in-service equipment as required.

e. Deliver water capability that can be deployed in line with concepts of use specified within the endorsed Concept of Employment (ref 5).

2.3 Equipment Scope

The CWSS project is in the Assessment phase of the CADMID procurement lifecycle and the exact technical solution has yet to be defined, as such the CWSS system is described in terms of its desired functional capabilities and its interaction with other systems.

CWSS will replace the existing Water Purification Unit (WPU) (Standard), WPU (Nuclear, Biological, Chemical (NBC)), WPU (Small Groups) and Water Carriage Pack (WCP) . Where possible CWSS will re-use and maintain existing water equipment which could include: Water Distribution Rack (WDR), Seawater Transfer System and possibly existing Pillow Tanks, Test Kits etc. The winning contractor may need to modify the remaining equipment to enable incorporation, interoperability into the CWSS system and Generic Base Architecture (GBA).

2.4 System Boundary

The CWSS project must seek to provide a solution to fill the boundaries depicted in Figure 1. CWSS should deliver an end-to-end solution spanning the provision of water from its source to the point of issue.

Source water will be abstracted and treated to meet the potable and palatable water standards. Treated water will be either placed into bulk storage for onward bulk distribution or sealed in packages and then transported forward to users. Users will break the seals on these packages when the water is required, and the water will be decanted into personal water containers (i.e. camelbacks and water bottles).

It must also provide the ability to receive, hold and issue water within the deployed unit but will not include distribution by specialised logistic units using the in-service Close Support Tanker (Water) (CST(W)) and WDR. Distribution of packaged water places a continuous and excessive burden on the supply chain. CWSS should aim to break this dependence, and reduce the logistic burden.

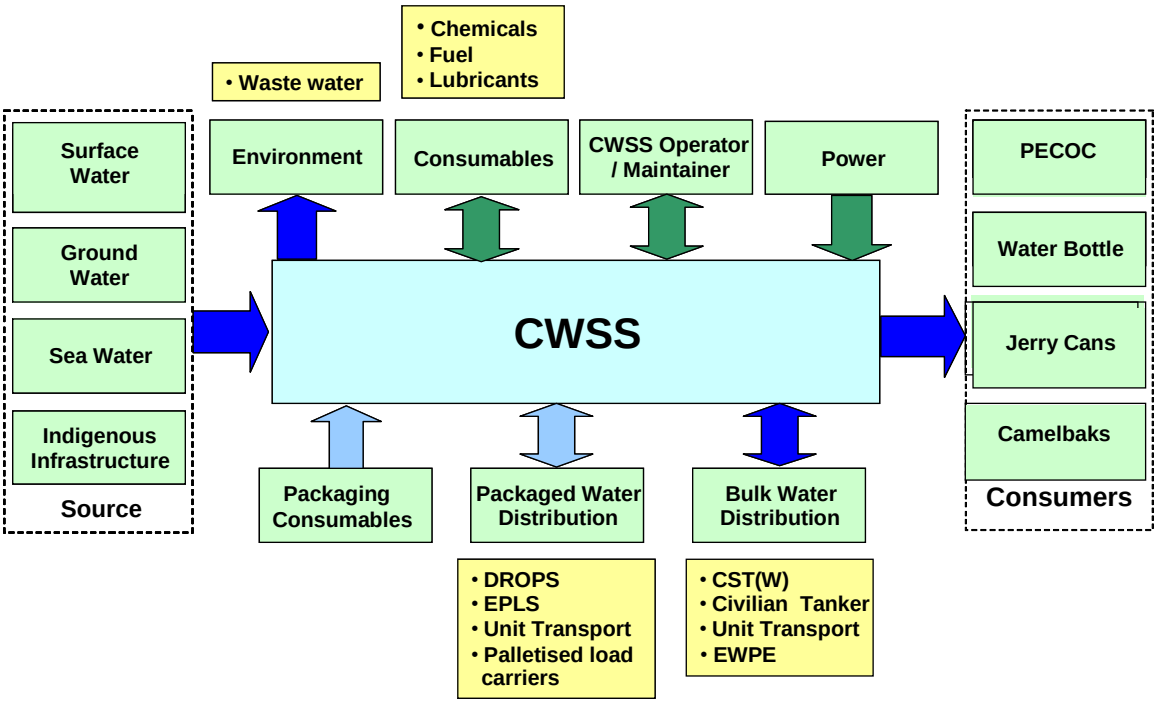

Figure 1 - CWSS System Boundary

The following table expands on the boundaries/interfaces and states what is/is not to be included in the CWSS safety assessment.

Boundary	Comment
Source	• The source will be selected by a suitably qualified experienced person (SQEP). • CWSS will interface with the existing borehole equipment and must be capable for interfacing with indigenous infrastructure. The boundary of each will be the connecting interface to the CWSS.
Waste Water	• All waste water from CWSS is included in the CWSS risk to life analysis. Once the water has been issued to another system / user it is then outside the CWSS boundary.
Bulk water storage	• Treated water will be placed into bulk storage and packaged into packages that will be sealed and then transported forward to users. The safety of both are to be considered as part of the CWSS Safety and Environmental Case.

Consumables	• Any dosing chemicals used for CWSS are included. • Lubricants / cleaners used in the use and in maintaining CWSS items are to be in included in the CWSS safety and environmental assessment.
Power	• Where CWSS equipment is supplied power from existing in-service power generation / distribution equipment the boundary is to be the point at which CWSS plugs into the current system e.g. the distribution socket. • If any CWSS system has a dedicated power generation capability this is to be included as part of the CWSS safety and environmental assessment.
Safety Integrity	Safety Integrity**:** The following section provides the strategy for demonstrating conformance with Safety Integrity Requirements with respect to Commercial Off-The-Shelf (COTS), Military Off-The-Shelf (MOTS), Modified COTS and bespoke software. COTS / MOTS Software • Where software functionality requires a modification to a COTS/MOTS product, this product will be treated as Modified COTS/MOTS. The safety assessment strategy for safety related modified COTS/MOTS Software will comprise the tasks outlined below: Develop an in-service history for the unmodified COTS/MOTS element of the product; Review the tools and processes used in producing the modifications, and their interfaces to safety related components, to verify compliance with target Safety Integrity Requirements; Perform inspections of the product development tools, processes and outputs. Bespoke software • The assessment strategy for safety related bespoke software will comprise the tasks outlined below. Review the tools and processes used in developing the product to verify compliance with target safety integrity requirements; Perform inspections of the product development tools, processes and outputs. Deriving Safety Integrity Requirements • Any software can form part of a hazard chain. In this case, assessments will be based on guidance given in Defence Standard (DEFSTAN) 00-56. Software used within the system will only be classified with respect to safety when it is part of a hazard chain and a safety assessment has been completed i.e. the software performs a function that can affect the potability of the water produced and forms part of the assurance process and not software that monitors power output or forms part of the engine management system.

Consumer receptacles / vehicles	• Apart from the interface any receptacles or vehicles receiving water which are not provided as part of CWSS are outside of the CWSS Safety and Environment Case.
Transportation	• If transportation via trailer or in-service vehicle is required existing in-service trailers or vehicles will be used. The trailer/vehicle is outside of the CWSS safety case but the securing of the equipment onto the trailer or vehicle is to be included in the CWSS safety case. If supplied with an ISO Container for transportation the use of that container is to be included in the CWSS assessment. • The scope of the risk assessment shall also include the interface for tactical and strategic deployability by military aircraft. • The interfaces between any Manual Handling Equipment (MHE) and CWSS equipment, will be part of the CWSS safety and environmental case.
Operator / maintainer	• The safety case is to consider the requirements for the operation and safe maintenance of CWSS
Consumers of Treated Water	• Military personnel and Deployed Civilians.
Legacy water Systems	• It is plausible that the CWSS supplier will encompass some existing in-service water capability e.g. WDR. In this case the existing safety case for that equipment will remain extant but any interfaces with the new CWSS equipment need to be considered. However if the contractor is to modify any in service equipment, this will be in scope for the CWSS safety and environmental case.

Table 3 – CWSS boundaries/interfaces

3 OPERATIONAL CONTEXT

3.1 Operating Environment

CWSS will provide a capability able to support the force operating in the land environment, configured and equipped to conduct high tempo, expeditionary operations wherever it may be deployed worldwide, by providing the capabilities to ensure self-sufficiency for water. It should enable the provision of mandated quantities of potable and palatable water for the user at the point of need.

CWSS will operate in the land domain to provide bulk water meeting potable water standards[1] and will provide packaged water to potable and palatable standards. Packaged water will be issued to personnel for personal consumption and bulk water will be issued for all other purposes.

The full operational context for CWSS can be found in the CONEMP (Ref. 5).

3.2 Operating Timescales

CWSS will operate in the land domain to provide water purification for simple interventions, complex interventions and enduring operations of up to 18 months at a time at which point commercial infrastructure solutions should replace CWSS. However this is dependent on the tactical situation and thus CWSS needs to be able to remain deployed for extended periods of time. CWSS will abstract source water from all viable sources (including sea water) and produce water at potable standards for bulk storage, packaging, onward distribution and issue as required.

All elements of CWSS will be compatible with each other so that it forms a flexible, scalable and modular system that can be configured to meet any need that arises.

4 KEY ASSUMPTIONS

4.1 Assumptions

In considering the safety assessment for CWSS the following assumptions regarding Safety and Environmental factors have been take from the CWSS Master Data Assumptions List (MDAL) (Ref. 7) :

MDAL Reference	*Assumption*	*DLOD*	*Safety Comments*
Master Data	*CWSS will be in-service for at least 15 years.*	*All*	

[1] Potable water standards specified in the SRD (Ref. 6).

MD 0059	*The Land Fleet requirement is not yet accurately defined. Total Fleet Requirement will be determined following OA work and during the Assessment Phase.* *For safety purpose CWSS fleet is assumed to be formed by 220 main equipment (65 WDR, 40 WPU(S), 39 WPU(SG), 66 WPU(NBC), 7 WPU(Saline)) used at 50% utilisation rate, supported by approximately 2000 storage equipment (WCP, STS, pillow tanks, etc.) based on the out-going fleet.*	*Equipment*	
MD 0015	*CWSS will utilise in-service vehicles and trailers for tactical deployment.*	*Equipment*	*System interfaces/boundaries will need to be reviewed as part of the Assessment Phase to ensure that the overall system is safe for operational use.*
MD 0022	CWSS will interface with existing water distribution equipment, including Combat Support Tanker(Water).		
MD 0016	Any residual in service water equipment that remains will be subsumed in a CFA Contract / Arrangement. CWSS will re-use existing water equipment where appropriate, including: Seawater Transfer System and possible existing Pillow Tanks, Test Kits etc. Some equipment may be modified by the prime contractor to achieve CWSS measures of effectiveness.	*Equipment*	
MD 0018	CWSS is to operate from the point of early entry into a theatre to enable self-sufficient provision for water, up until the establishment of an enduring infrastructure solution; this should be a maximum period of 18 months.	*Equipment*	

5 SAFETY CRITERIA

5.1 Tolerability Criteria

The CWSS SEMP (Ref. 2) outlines the risk classification tolerability level for risk classes A, B, C and D for the CWSS project which are duplicated here for clarity;

a. Risk Class A = Intolerable

b. Risk Class B = Undesirable

c. Risk Class C = Tolerable

d. Risk Class D = Broadly Acceptable

Historically, the treatment of water is a relatively low risk activity. Nevertheless, the following considerations have been made when assessing the Accident Severity and Probability definitions as part of the Part 1 Safety Case:

- The user population, number of equipment, time usage and service life: As yet the Land Fleet Requirement (LFR) for CWSS is undefined but it has been assumed that the likely numbers will be representative of the existing in-service fleet. Therefore for CWSS the probability definition as described in the in-service Water Equipment Through-life (WET) SECR (Ref. 8) and table below (Table 4), should be used as a starting point and modified to reflect any changes in the expected operation of CWSS.

Probability Category	Probability Ranges – Qualitative Definition
Frequent	Likely to be continually experienced
Probable	Likely to occur often
Occasional	Likely to occur several times
Remote	Likely to occur some time
Improbable	Unlikely, but may exceptionally occur
Incredible	Extremely unlikely that the event will occur at all, given the assumptions recorded about the domain and the system

Table 4 – CWSS Probability Definitions

- Due to the potential number of people reliant on the output of CWSS there is potential to inflict harm to a large number of people if the process is not conducted correctly.

Table 5, CWSS Accident Severity Definitions, documents the severity classification. These definitions have been adjusted to take into consideration the general public and those persons that consume the treated water but not directly involved with CWSS equipment. This category of persons should not expect to be harmed by the deployment and operation of CWSS and therefore this category is raise a severity group i.e. a risk that may be accepted for an operator or maintainer may not be tolerable for the general public.

Severity Category	Description applied to directly involved users: operators and maintainers	Description applied to consumers of product water and general public
Catastrophic	Multiple deaths	A single death and/or multiple severe injuries or equivalent occupational illness
Critical	Single death and/or multiple major injuries or equivalent occupational illness as defined in RIDDOR 2013 Regulation 4.	A single severe injury or occupational illness and/or multiple minor injuries or minor occupational illness
Marginal	Single severe injury or occupational illness and/or multiple minor injuries or minor occupational illness, as defined in RIDDOR 2013 Regulation 4.	At most a single minor injury or minor occupational illness
Negligible	At most a single, minor injury or minor occupational illness	Any injury or occupational illness however minor

Table 5 – CWSS Accident Severity Definitions

Following assessment at the Safety and Environmental Panel (SEP) on 13th May 2014 the definitions of risk classification, accident severity and probabilities were agreed to be consistent with the existing in-service equipment. As such, the standard definitions outlined in tables 0.1, 0.2 and 0.3 of the OSP SEMS (Ref. 4) have been used. The qualitative tolerability criterion is to be reviewed as the project continues throughout the assessment phase and agreed between the Authority and the Contractor at the start of a contract.

Exposure rates for personnel operating and maintaining the CWSS are yet to be formalised. As such, justifiable quantitative tolerability criterion is to be agreed between the Authority and the Contractor at the start of a contract when probable exposure rates are better understood. Quantitative tolerability criterion used to assess hazards associated with the consumption of water processed by CWSS shall be different to those used when assessing hazards associated with the CWSS operation and maintenance.

5.2 Safety Targets

The CWSS safety target is to reduce all associated risks to personnel to a level that are tolerable and ALARP. The UK Health and Safety Executive (HSE) advocate the application of this principle and the MOD require that this principle is applied to its operations.

The CWSS safety justification is based on the fundamental principle that safety risk should be reduced to ALARP. This means that, not only must the risk always be reduced to a tolerable level, it has to be demonstrated that further risk reduction is impracticable or where the cost of further risk reduction is grossly disproportionate to the benefits gained. To meet this objective a requirement is to ensure that effort and resource applied to the resolution and justification of ALARP for accidents, hence hazards are proportional to the safety detriment that they pose (i.e. the level of risk being managed or the complexity of the equipment).

The most suitable data source against which to compare the risk associated with MOD use of CWSS equipment is considered to be the HSE collated statistics on health and safety in the construction industry [Ref. 13]. These statistics show that, averaged over 5 years (2009/10 to 2013/14), there were 2.07 fatal injuries per 100,000 workers across the construction industry. It is considered reasonable to use this figure as a safety target for operators and maintainers of the CWSS. CWSS operators and maintainers are thereby exposed to risk which is no higher than the average risk for all UK construction workers, representing a level of risk routinely accepted by individuals in their day-to-day lives.

Personnel consuming water processed by CWSS should be considered at less risk of injury than the operators and maintainers of CWSS. Therefore this group of persons are incorporated in the general public severity category within the tolerability criterion (see Table 5). The initial safety target for personnel consuming water processed by CWSS is aligned with the lifetime excess cancer risk[2] of 1 fatal injuries in a population of 100,000 ingesting drinking water. This has been taken from paragraph 3.3.2 of the World Health Organisation (WHO) Guidelines for Drinking-water Quality (Ref. 14).

The safety targets for CWSS operation and maintenance and the consumption of water processed by CWSS shall be reviewed and agreed between the Authority and the Contractor at the start of the contract.

5.3 Risk Classification Criteria

The severity and probability of each potential accident are related to the Accident Risk Classification, Table 6 details the Risk Classification Matrix (RCM) used for this Part 1 and should be reassessed during the Part 2 Demonstration phase.

[2] Considered to be the worst case scenario, ‘reference level of risk’, in the diverse adverse health outcomes from the consumption of water.

	SEVERITY			
PROBABILITY	Catastrophic	Critical	Marginal	Negligible
Frequent	A	A	A	B
Probable	A	A	B	C
Occasional	A	B	B	C
Remote	B	B	C	D
Improbable	B	C	D	D
Incredible	C	D	D	D

Table 6 – Risk Classification Matrix

6 SAFETY REQUIREMENTS

6.1 Safety Legislative and Regulatory Requirements

The contractor will be required to demonstrate compliance with the following UK Safety Legislation and EU Directives, derived from the SRD (Ref. 6) and any further legislation identified during the assessment.

- Health and Safety at Work Act 1974
- Water Supply (Water Quality) Regulations 2000
- Regulatory Reform (Fire Safety) Order 2005
- Environmental Protection Act 1990
- CE Marking Directive (93/68/EEC)
- Machinery Directive (89/392/EEC)
- The Low Voltage Directive (73/23/EEC) EMC Directive 89/336/EEC
- Management of Health and Safety at Work Regulations 1999
- Fire Precautions (Workplace) Regulations (1997)
- Supply of Machinery (Safety) Regulations (Amendment) (1994)
- The Provision and Use of Work Equipment Regulations 1998 (PUWER)
- Workplace (Health, Safety and Welfare) Regulations 1992
- Manual Handling Operations Regulations 1992
- Electricity at Work Regulations 1989
- Electrical Equipment (Safety) Regulations 1994
- Electromagnetic Compatibility Regulations 2006
- Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)
- Control Of Substances Hazardous to Health (COSHH) 2002

6.2 MOD Policy and Certification Requirements

The following MoD Policy and Certification Requirements are applicable to the CWSS project:

- JSP 454(6) Procedures for Land Systems Equipment Safety Assurance
- JSP 418 MOD Corporate Environmental Protection Manual
- JSP 375 MOD Health and Safety Handbook

- JSP 815 Defence Health and Safety and Environmental Protection
- Project Orientated Safety Management System (POSMS) and Project Orientated Environmental management System (POEMS)

6.3 Civil and MOD Safety Standards

To comply with the Secretary of State for Defence policy, the MOD needs to ensure that the management and technical standards that are adopted are consistent with the best civil and international standards. To achieve maximum harmonization it is therefore MOD policy to utilise international standards where appropriate and an agreed hierarchy is as follows:

- European Union civil standards.
- International civil standards.
- UK civil standards (including BS 8551 and BS EN 1508).
- Standardised NATO Agreements (STANAGs).
- UK Defence Standards (DEFSTANs).

The applicable Civil and MOD standards to CWSS are as follows:

- Def Stan 00-56 Issue6 Safety Management Requirements for Defence Systems
- STANAG 2136: 6th Edition - Requirements For Water Potability During Field Operations And In Emergency Situations
- STANAG 2885: 5th Edition – Emergency Supply of Water in Operations
- Joint Warfare Publication 4-01.1 (Water)

6.4 System Requirements

The SRD (Ref. 6) contains the prevailing safety requirements and details of the deliverables required from the contractor. The CWSS capability shall be configured so that all identified residual risks are found to tolerable and ALARP or broadly acceptable in accordance with JSP 454 (Ref. 3) and Def Stan 00-56 (Ref. 9). The relevant System Requirements relating to safety have been listed below in Table 5.

It should be noted that the water quality standard is identical to the current in-service equipment and thus OSP have a very high degree of confidence that this standard can be met by the CWSS. Routine sampling and testing, as per the existing in-service equipment is also a requirement which will monitor the standard.

ID	System Requirement	Threshold MOP	Objective MOP	Priority	*Justification*	Validation	Status	Remarks
280	CWSS shall comply with pressure equipment regulations if any	In accordance with: a. [EU 97 23 EC]; b. Pressure systems safety		M		IC	Candidate	

	pressure vessels are used.	regulations [PSSR2000] (only applicable over 250 bar*litres).						
282	CWSS shall identify any Specialist Personal Protective Equipment.	For: a. Construction; b. Commissioning; c. Operation; d. Maintenance; e. Decommissioning; f. Dismantling; g Disposal; of the equipment. In accordance with: a. [JSP 375] PPE; b. [JSP 317] H&S; c. Associated [Safety Rules and Procedures].		1	To comply with Health & Safety and environmental control requirements.	IC FT	Candidate	This is exclusive of any issued PPE. Ideally there shall be no Specialist Personal Protective Equipment needed.
284	CWSS shall be intrinsically safe (safe by design NOT training) and have a safe system of	System is intrinsically safe during all operations: - a. Storage and handling; b. Deployment;		M	To comply with Health & Safety and environmental control requirements. The user has a duty of care to provide equipment that is	DI IC	Candidate	

	work.	c. Construction; d. Commissioning; e. Operation; f. Maintenance; g. Decommissioning; h. Dismantling; i. Redeployment; j. Disposal. In accordance with: a. [JSP 375] PPE; b. [JSP 317] H&S; c. Associated [Safety Rules and Procedures].			safe to operate.			
285	CWSS shall shut down in a fail-safe manner in the event of a failure.	Does not become a health or safety hazard. Prevents any further damage or degradation to CWSS including automated back-wash if required.		M	The user has a duty of care to provide equipment that is safe to operate.	DI IC FT	Candidate	
286	CWSS design shall be	Compliant with: a. [Def Stan		M		DI IC	Candidate	

	compliant with safety policies and guidance.	00-56]; b. Guidance from [JSP 454] (Land Systems safety Management Policy and Guidance).						
768	CWSS design must be managed in accordance with MOD policy	CWSS is managed in accordance with POSMs and POEMS policy and all supporting documentation is produced in a format consistent with MOD management tools (e.g. E-Cassandra)		M	MOD policy requires that all equipment risks are managed and maintained in order to ensure that risk is held at ALARP.	IS	Candidate	

Table 7 – CWSS System Requirements relevant to Safety

7 INITIAL SAFETY ASSESSMENT

7.1 Preliminary Hazard Identification

In accordance with POSMS SMP04 it is highly desirable to identify the top level hazards and accidents associated with the system as early in the project lifecycle as possible. By identifying the hazards and accidents the project will maximise the opportunity to remove risk and ensure the safety of the system. At this stage of the programme a specific design solution has yet to be identified or developed so the Preliminary Hazard Identification and Analysis (PHI&A) focuses instead on the CWSS functionality and envisaged capability.

OSP has conducted a Preliminary Hazard Identification (PHI) based on the knowledge and expertise gleaned on the existing systems within OIP. It should be noted that depending on the chosen solution some of these hazards will be discarded. In the case of the Water packaging plant hazards have been listed consistent with those expected for an industrial processing machine. This PHI is at Appendix 1 to this report. This is a generic PHI and provides for guidance and direction only. It is neither exhaustive nor prescriptive and a live document which is subject to changes at all stages of the project lifecycle.

7.2 Safety panel

The preliminary CWSS Hazard Log was presented to the in-service WET SEP on 13th May 2014. It was agreed at the SEP that the preliminary studies indicated that CWSS, excluding the packaging capability, will not present any more risk than the current in-service equipment. However the packaging capability risks will form part of the CWSS risk analysis.

8 ENVIRONMENTAL CRITERIA

8.1 Environmental Targets

There is a requirement that environmental aspects arising from the CWSS programme of work shall be identified and environmental impacts are known, recorded, evaluated and mitigated, where appropriate, to facilitate the effective management of the system through life.

Decisions made on environmental and Sustainable Development grounds must be balanced with other requirements such as operational capabilities and cost-effectiveness over the whole lifetime of the project. However, the approach utilised by the project sets the target that all environmental aspects are reduced to the Best Practicable Environmental Option (BPEO).

8.2 Objectives

The objective of the environmental criteria is to identify and define the environmental requirements and risk classification process applicable to CWSS. The environmental criteria provide a baseline against which the environmental impacts presented by the system are to be assessed. The environmental criteria taken from POEMS are provided in the following sections as guidance at this juncture. The final environmental criteria will be agreed by the SEP.

8.3 Environmental Frequency Definitions

The environmental frequency designations and definitions to be used for the CWSS appraisal are based upon those contained in POEMS EMP03. The frequency definitions quantify the number of times that an environmental impact occurs or is likely to occur, e.g. daily, weekly, monthly etc.

Frequency Designation	Definition
1	Occurs once in the life of the fleet
2	Occurs once in five years
3	Occurs once in a year (12 month period)
4	Occurs once a month (30 day period)
5	Occurs once a week (7 day period)
6	Occurs at least once in a 24 hour period

Table 8 – Environmental Frequency Designations and Definitions

Table 6 provides exemplar frequency definitions to be used for the CWSS environmental assessment. These definitions are to be agreed between the Authority and external stakeholders.

8.4 Environmental Severity Definitions

The environmental severity designations and definitions to be used in the CWSS environmental section of the appraisal are those laid down in POEMS EMP03 (Ref.10) and their use must be agreed by the SEP.

8.5 Environmental Issues

The likely environmental aspects of CWSS are:

- Fossil fuel consumption for pumping equipment
- Water Consumption
- Land Contamination in the event of spillage
- Use of chemical in treatment of water
- Flushing, maintenance and wash-down bi products.
- Disposal of treatment bi products and residual chemicals.

An Environmental Features Matrix (EFM) is to be progressed during the project Assessment Phase by the tenderer in conjunction with MOD stakeholders.

8.6 Impact Priority Matrix

The Impact Priority Matrix, Table 8, has been formed by the agreement of the initial SEP, attended by the Authority, stakeholders and OIP Safety and is used to determine the level of priority action to be assigned to the environmental aspects and their corresponding environmental impacts. This is provided as an exemplar and its use is to be agreed between the Authority and the Contractor.

		Frequency Designation					
Severity Designation		1	2	3	4	5	6
	A (=1)	1	2	3	4	5	6
	B (=2)	2	4	6	8	10	12
	C (=3)	3	6	9	12	15	18
	D (=4)	4	8	12	16	20	24
	E (=5)	5	10	15	20	25	30
	F (=6)	6	12	18	24	30	36

Table 9 – Priority Evaluation Matrix

8.7 Priority Thresholds

The Priority Threshold values have been extracted from POEMS EMP04 (Ref. 11) and are detailed in Table 9. The default threshold scores of 1 to 10, 12 to 20 and 24 to 36, as defined in POEMS, are to be used to identify low, medium and high priority impacts respectively.

Value	Impact classification
1 to 10	Low Priority
12 to 20	Medium Priority
24 to 36	High Priority

Table 10 – Environmental Impact Priority Thresholds

9 ENVIRONMENTAL REQUIREMENTS

9.1 UK and EU Environmental Legislation

The contractor will demonstrate compliance against all relevant UK and EU Environmental Legislation. Existing equipment shows the following legislation and regulations to be relevant:

- Environmental Protection (Duty of Care) Regulations 1991
- The Fluorinated Greenhouse Gases Regulations 2009 (Revoke and remake S.I 2008 no 41)
- The Environmental Permitting (England and Wales) Regulations 2010
- The Hazardous Waste (England and Wales) (Amendment) Regulations 2009
- The List of Wastes (England) Regulations 2005
- The Groundwater (England and Wales) Regulations 2009
- Surface Waters (Dangerous Substances) (Classification) Regulations 1989
- Surface Waters (Dangerous Substances) (Classification) Regulations 1997
- Surface Waters (Dangerous Substances) (Classification) Regulations 1998
- The Conservation of Habitats and Species Regulations 2010
- Environmental Protection (Controls on Ozone-Depleting Substances) Regulations 2002 and EU directive 2037/2000
- The Waste (England and Wales) Regulations 2011
- Noise Emissions in the Environment by Equipment for Use Outdoors Regulations 2001
- The Waste Electrical and Electronic Equipment Regulations 2006
- The Dangerous Substances and Explosive Atmospheres Regulations 2002
- Control of Pollution Act 1974. & Control of Pollution (Amendment) Act 1989
- Restriction of the use of Certain Hazardous Substances in Electrical Equipment Regulations 2008
- Waste Batteries and Accumulators Regulations 2009
- The Registration Evaluation Assessment and Restriction of Chemicals (REACH) Regulations 2006

9.2 Civil and MoD Environmental Standards

The following Civil and MoD environmental standards apply to the CWSS project:

- ISO 14001:2004 Environmental management systems -- Requirements with guidance for use

9.3 Environmental Feature Matrix

An Environmental Features Matrix is to be progressed during the ITT by the tenderers.

9.4 Sustainability Assessment

As part of the environmental assessment the contractor will be required to develop a bill of materials of major consumables and line replacement items with appropriate evidence supporting their ease of availability and ease of disposal.

10 CONCLUSIONS AND RECOMMENDATIONS

This Safety and Environmental Case has predominantly been based on the experience obtained from managing the in-service water treatment equipment. There are a number of assumptions in place considering the in-service equipment currently used by the Armed Forces. Following the initial safety assessment it is considered that, if the Safety and Environmental Requirements identified within this report are adhered to, the CWSS will meet the overall Safety Target of all risks being ALARP. The water treatment standards for CWSS are as per the in-service equipment and so OIP has a high degree of confidence that the standards are realistic and achievable.

The CWSS project will address capability gaps identified within the Operational Analysis work carried out by QinetiQ (Ref. 12). The new capability to be introduced by CWSS will address the principal gaps that include limited capacity storage at 1st line, the reliance on Urgent Operational Requirements, no capability to distribute by air and obsolescence and training issues involving existing equipment. It is thought that the capacity storage capability will be met with a water packaging plant that is likely to be a Modified COTS/MOTS equipment. This is not seen as a major concern which cannot be managed by training or the use of contractors.

This CWSS SECR Part 1 demonstrates that the safety risks associated with CWSS are such that they can be satisfactorily managed and therefore the project can progress through the assessment phase.

APPENDIX 1 – PRELIMINARY HAZARD IDENTIFICATION

Ser	System level hazard	Local hazard (Cause)	Hazard Type	Applicable Mission Phase	Risk to Life
01	Contaminated water product	Back flow of waste into treated water	F[1]	Operational	H
02	Contaminated water product	Damaged distribution equipment, hoses, pumps and holding tank	F	Operational	H
03	Contaminated water product	Equipment failure due to manufacturing defect	F	Operational	H
04	Contaminated water product	Inadequate training	F	Operational	H
05	Contaminated water product	Incorrect spares supplied to CWSS	F	Operational	H
06	Contaminated water product	Insufficient practical (hands on) experience	F	Operational	H
07	Contaminated water product	Procedural error (Failure of HFI)	F	Operational	H
08	Contaminated water product	Use of incorrect chemicals	F	Operational	H
09	Contaminated water product	Water product is under sterilised (e.g. insufficient steriliser used)	F	Operational	H
10	Contaminated water product	CWSS purification operation not monitored, mechanical/human interface	F	Operational	H
11	Contaminated water product	AESPs not available/ inadequate	F	Operational	H
12	Contaminated water product	Degraded function at extremes of temperature	F	Operational	H
13	Contaminated water product	Contaminants allowed to access treated water during inspection / test process	F	Operational	H
14	Degraded Water Product	Water product is over sterilised	F	Operational	H
15	Over purified water.	Excessive use of Reverse Osmosis device	F	Operational	L
16	Personnel Hazard	Inadequate ease of maintenance infrastructure not adequate	I[2]	Deployment, Maintenance	M
17	Personnel Hazard	Public stray onto CWSS site while deploying system	I	Deployment, Operational	M
18	Personnel Hazard	Servicing contaminated equipment Exposure to waste during maintenance / repair of	I	Operational	M

Ser	System level hazard	Local hazard (Cause)	Hazard Type	Applicable Mission Phase	Risk to Life
		CWSS			
19	Personnel Hazard	Transportation of contaminated equipment	I	Maintenance	H
20	Personnel Hazard	Waste concentrate Includes exposure when disposing of waste concentrate and used filters or filter media	I	Maintenance / disposal	M
21	Personnel Hazard	Hazardous substance – chemical spillage during transportation	I	Deployment	M
22	Personnel Hazard	High working pressure	I	Operational	M
23	Personnel Hazard	Lifting hazard – excessive weight	I	Deployment	H
24	Personnel Hazard	Local populous extract water close to reject / treatment by-product	I	Operational	M
25	Loss of transport vehicle stability	CWSS overloads transport vehicle, residual water	I	Movement	H
26	Personnel hazard	Operating near source water or water storage containers	I	Operations	M
27	Uncontrolled release of stored water	Water tank suffers structural failure	I	Operation	L
28	Personnel hazard	Working in confined spaces	I	Operations	H
29	Unexpected movement of water distribution point	High winds	I	Operations	M
30	Personnel hazard	Personnel touch hot / cold bare metal surfaces	I	Operations	L
31	Misuse, negligence or deliberate intervention	User or 3rd party interferes with correct operation of system	F	Operations	H
32	Personnel hazard	Operation of CWSS power supply in confined space	I	Operations	H
33	Personnel hazard	Spillage of fuel from power supply	I	Operations	L
34	Personnel hazard	Exposure to excessive noise	I	Operations	M
35	Personnel hazard	Exposure to hazardous voltages	I	Operations Maintenance	H
36	Personnel hazard - RTI	Excessive weight of the CWSS-total load exceeds the maximum safe load of service transport	I	Operation Transport	H
37	Personnel hazard - RTI	Equipment instability while trailer mounted, loss of control	I	Operation Transport	H

Ser	System level hazard	Local hazard (Cause)	Hazard Type	Applicable Mission Phase	Risk to Life
38	Personnel hazard	Interface of CWSS causes degradation to in-service transport /equipment.	I	Operation Transport	H
39	Personnel hazard	Inappropriate CWSS lifting points	I	Operation Transport	H
40	Personnel hazard	Working at Height	I	Operation	H
41	Personnel hazard	Movement of CWSS by MHE	F	Operation Movement	M
42	Personnel hazard	Unintentional Pillow Tank movement	I	Operations	M

Notes:

1. F = Functional; CWSS equipment depends on the system operating correctly in response to an input.
2. I = Inherent; A permanent (built in), essential or characteristic of CWSS.

Risk to Life scoring criteria

H - There is a potential for a fatality or fatalities
M – Potential for a serious injury
L – Reportable incidence under the Reportable Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)