HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.4.93 ES Volume D - WNDA Development App D13-11 - Marine modelling of the operational discharge

PINS Reference Number: EN010007

Application Reference Number: 6.4.93

June 2018

Revision 1.0

Regulation Number: 5(2)(a)

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Horizon Internal DCRM Number: WN0902-JAC-PAC-APP-00172

[This page is intentionally blank]

HORIZON NUCLEAR POWER

ENERGY WORKING FOR BRITAIN

H1 screening of the Wylfa Newydd Cooling Water Discharge

DCRM Ref Number: WN034-JAC-PAC-REP-00154

Document Number: 60PO8058|AQE|REP|005

Revision: 1.0

Additional Requirements or Controls			
LISTED READERS ONLY		LEGALLY PRIVILEGED	

Comments:

Distribution		
Required for Listed Readers Only and Legally Privileged but can be used with other markings		

Approvals Table				
	Role	**Printed Name**	**Signed Name**	**Date**
Originated by	Document Author	Jacobs	See separate PDF	
Reviewed by	Document Reviewer	Jacobs	See separate PDF	
Checked by	Head of Section			
Approved by	EMT Representative			

Revision History				
Date	**Rev No.**	**Summary of Changes**	**Ref Section**	**Purpose of Issue**
2.6.17	0.1	Amendments following comments.	Throughout	Draft version
25.7.17	0.2	Amendments following comments.	Throughout	Draft version
29.08.17	0.3	Changes to address NRW suggestion of PNEC value for Dibromochloromethane	Throughout	Draft version
12.01. 18	1.0	Changes to address consultation comments	Throughout	Final version
15.03.18	1.0	Final iteration following Horizon governance		Final version

Contents

Tables

1 Introduction

1.1 Purpose and applicability

This document is an assessment of the aqueous discharges expected to arise via the cooling water discharge during operation of the Wylfa Newydd Nuclear Power Station (the Power Station). This document and associated H1 Appendix (Excel workbook of operational and maintenance continuous and batch discharge data, to be referred to in conjunction with this document) have been produced in support of an application for an Environmental Permit under schedule 21 of *The Environmental Permitting (England and Wales) Regulations 2016* (SI 2016 NO.1154) (EPR 2016), as amended.

1.2 Terms and definitions

Table 1-1 Terms and definitions

TERM	DEFINITION
AA	Annual average
ABWR	Advanced Boiling Water Reactor
CAD	Controlled area drain
COD	Chemical oxygen demand
CW	Circulating Water
EQS	Environmental Quality Standard
HCW	High chemical impurity waste
Horizon	Horizon Nuclear Power Ltd
HVAC	Heating ventilation and air conditioning system
MAC	Maximum allowable concentration
MUWTP	Make-up water treatment plant
NOEC	No observed effects concentration
NSD	Non-radioactive storm drain
PNEC	Predicted no-effect concentration
RCW	Reactor Building Cooling Water
RSW	Reactor Building Service Water
RUHS	Reserve Ultimate Heat Sink
SWSD	Service water storm drain
TCW	Turbine Building Cooling Water
TRO	Total residual oxidant
TSS	Total suspended solids
TSW	Turbine Building Service Water

1.3 Scope

This document is the report of an H1 screening of the conventional discharge to the marine environment from the Power Station during operation. Discharges during the commissioning period are assumed to be similar to or less than those under operational conditions. Discharges arising during Site Preparation and Clearance and construction are outside the scope of this assessment.

Discharges containing radioactive contaminants are also outside the scope of this document and will be considered in a separate assessment.

2 Summary

Horizon Nuclear Power Wylfa Ltd (Horizon) is proposing to develop a new Nuclear Power Station (the Power Station), next to the site of the Existing Power Station on Anglesey.

The cooling water will be abstracted from Porth-y-pistyll through the cooling water intake structure, passed through the Power Station's cooling water system (comprising the Circulating Water, Reactor Building Service Water (RSW) and Turbine Building Service Water (TSW) systems) and returned to the Irish Sea at the cooling water discharge structure. The conventional discharge from the Power Station is subject to H1 screening with respect to the marine environment. The H1 process enables calculation of the impact of substances likely to be released to various media. In this instance, the H1 screens out the need for detailed assessment of those discharges to liquid effluent streams described as insignificant in comparison to the relevant Environmental Quality Standard (EQS).

The impacts of all of the chemical discharges expected to arise from the Power Station have been screened out as insignificant with the exception of sodium nitrite which has been the subject of subsequent investigation.

3 Introduction to H1 screening

The conventional discharge from the Power Station is subject to H1 screening with respect to the marine environment. The H1 process enables calculation of the impact of proposed substances released to various media. The H1 assessment screens out the need for detailed assessment of those discharges to liquid effluent streams described as insignificant in comparison to the relevant EQS. There is a specific process for discharges into cooling water streams that are then discharged to estuaries or coastal waters.

The Environment Agency provides a methodology for the risk assessment of discharges to surface water. The risk assessments enable operators to demonstrate how their activities will be managed so that the impact on their local environment is acceptable to the Environment Agency. Natural Resources Wales has stated its intention to accept the H1 screening process for regulated activities in Wales.

4 Background information for H1 screening

4.1 Information sources

The following information source has been used in this H1 assessment to provide details of the expected discharges from Power Station:

- Horizon Nuclear Power Environmental Permit Application – Water Discharge Activity. Supporting information for Horizon Nuclear Power Wylfa Limited's application for a Water Discharge Activity Environmental Permit at the proposed Wylfa Newydd Power Station. DCRM Ref Number: WD03.03.02-S5-PDC-REP-00002. Revision: 0.1

Further details of the information sources used in this H1 assessment are listed in Section 8.

Horizon has undertaken water quality monitoring in the vicinity of the Existing Power Station since 2010, the results of which have been used to provide ambient water quality data for this assessment. These data are available in appendix D13-1 (Water quality and plankton surveys report) (Application Reference Number: 6.4.83).

The screening process compares the predicted concentrations of the discharge constituents to water quality standards [Reference RD1]. Where available, the EQS provided by the Environment Agency on the H1 screening website [RD2] have been used. For those constituents for which an EQS is not available, alternative standards have been used. The preference in selecting these screening criteria has been to use a predicted no-effects concentration (PNEC).

4.2 Discharge points

There will be four discharge points for liquid effluent from the Power Station. These will be to:

- sea (cooling water outfall), via the seal pit;
- sea (Porth-y-pistyll) – cooling water intake and discharge point for the fish recovery and return system;
- Welsh Water wastewater treatment works; and
- surface watercourse.

4.3 Operational scenarios

The expected chemical discharges from the Power Station during operation and outage have been considered separately as the chemical discharges will differ considerably between the two periods.

It is proposed to discharge a number of effluent streams into the cooling water before it is discharged to the sea. The volume of these effluent discharges will be minor in comparison to the cooling water flow.

During an outage period, one of the two Advanced Boiling Water Reactor (ABWR) Units will be operational while the other is on outage. The fuel cycles for the two Units at the Power Station will be scheduled so that the outages will not be undertaken on both reactors at the same time.

The cooling water discharge from the Power Station during outage will be the sum of the operational cooling water discharges for one Unit and the outage cooling water discharges for the other Unit.

4.4 Operational discharges

Under normal operational conditions, there will be a number of discharges arising from the Power Station, both continuous and non-continuous (i.e. batch discharges).

The expected operational discharges from the Power Station are summarised in Table 4.1.

4.4.1 Exclusions

Discharges of total residual oxidant (TRO) arising from the dosing of sodium hypochlorite in the Circulating Water, TSW, RSW, Service Water Storm Drain (SWSD) and Reserve Ultimate Heat Sink (RUHS) are being modelled and assessed separately from this H1 assessment and therefore will not be considered within this report. Similarly, sources of chlorine will also be treated as contributing to the overall TRO assessment, and are therefore assessed separately.

There will be a discharge (348m^3/y) from the high chemical impurity waste (HCW) stream which will contain radioactive contaminants and is therefore outside of the scope of this assessment. It should be noted that under normal operating conditions, the non-radioactive components of discharges to the HCW will be treated prior to being discharged to a holding tank for re-use within the ABWR. However, should the holding tank be at capacity, a discharge may be made to the seal pit, although this will have been treated by the HCW (evaporator and demineraliser treatment stages), and so is considered outside of the H1.

Corrosion of condenser material by the circulating water is expected to be insignificant compared to other effluent flows from the Power Station, as pipework materials with a low corrosion potential will be selected (e.g. the main condenser will be of titanium construction) and consequently levels of corrosion products are expected to be low. The use of corrosion inhibitors (e.g. sodium nitrite) in some of the systems will further reduce the levels of corrosion that may occur. Therefore, corrosion and erosion products have not been specifically considered in this assessment.

In addition to the chemical discharges listed in Table 4.1, a number of other discharges will be made from the Power Station. These discharges are not expected to contain chemical pollutants and therefore are not considered in this assessment, but for reference include:

- discharge from the fish recovery and return system. Biocide dosing occurs downstream of the return line for the fish recovery and return system. Therefore, this system will not contain biocide; and
- surface water: the runoff will essentially be free of contamination at the point it is discharged to the seal pit as measures such as oil interceptors and sediment traps will be utilised.

Discharges from blowdown of the house boilers, which will include phosphate and hydrazine, will be held on site and disposed of separately as only a small volume will be produced each day. Therefore, these chemicals will not be discharged via the seal pit and thus are not considered in this assessment.

4.4.2 Continuous discharges

Continuous discharges from the Power Station during normal operation are considered in the following sections.

4.4.2.1 Sea water (trade effluent – returned abstracted water)

The cooling water being returned to the sea will contain a number of chemicals arising from operation of the Power Station. Sodium hypochlorite will be dosed into the cooling water system at the intake (downstream of the screens) to manage biofouling. Thus it will be present with its degradation products in the discharge from the circulating water system, SWSD, RSW and the TSW systems. The dosing location means it will not be present in the fish recovery and return system.

The circulating water system contains metal components (pipework and condensers for example), the corrosion or erosion of which would result in an addition of metal to the cooling water flow. However, as outlined in Section 4.4.1, it is expected that these would be insignificant compared to other sources. Therefore, products of corrosion or erosion are not considered further in this assessment. Scale washings (i.e. the removal (washing out) of scale deposits) from the inside of the tubes of the steam condenser are not expected to be present in the discharge from the circulating water system as a consequence of the seawater flow, the biocide dosing and the physical cleaning measures (sponge balls).

4.4.3 Batch discharges

4.4.3.1 Potable water (trade effluent)

The seawater (swapped for potable water) side of the RSW heat exchanger will be drained down on a weekly basis, producing a weekly batch discharge of 79m^3 (per Unit) of trade effluent to the seal pit. The seawater side of the TSW heat exchanger will be drained down every three months, producing a batch discharge of 39m^3 (per Unit) of trade effluent to the seal pit.

The make-up water treatment plant (MUWTP) will convert potable water to demineralised water required by the Power Station. The maximum demand for demineralised water from the Power Station will be 900m^3/d. For each 100m^3, a volume of 10m^3 of effluent is assumed to be produced, as a result of the regeneration of the ion exchange columns. The discharge will contain the chemicals found in potable water at ten times the usual concentration as well as sodium hydroxide and sulphuric acid (used as the regeneration chemicals).

Table 4-1 Expected chemical discharges from the Power Station during operation.

CHEMICAL DISCHARGE	SYSTEM	DISCHARGE POINT	CONTINUOUS OR BATCH DISCHARGE	MAXIMUM DISCHARGE VOLUME PER ABWR UNIT	DISCHARGE VOLUME FOR BOTH ABWR UNITS*	CONCENTRATION	NOTES
Sodium hypochlorite (TRO)	CW	Sea (cooling water outfall) via seal pit	Continuous		369,600m^3/h	TRO 0.1mg/l	TRO is being modelled separately outside of the H1 assessment, therefore it is not considered further here. TRO generated from any chlorine dioxide dosing will be within the 0.1mg/l discharge of this chemical from the cooling water outfall, and will not affect this overall concentration.
	TSW		Continuous		14,800m^3/h	TRO 0.1mg/l	
	RSW		Continuous		18,000m^3/h	TRO 0.1mg/l	
	SWSD		Batch	240m^3/d	480m^3/d	TRO 0.1mg/l	
	RUHS		Batch	No data	No data	TRO 0.1mg/l	
Chemicals present in potable water	TSW	Sea (cooling water outfall) via seal pit	Batch	39m^3 every three months	78m^3 every three months	Various	See H1 Assessment spreadsheet. Chemicals present in potable water at 10x normal concentration
	RSW	Sea (cooling water outfall) via seal pit	Batch	79m^3 per week	158m^3 per week		
	MUWTP	Sea (cooling water outfall)	Batch	45m^3/d	90m^3/d		

CHEMICAL DISCHARGE	SYSTEM	DISCHARGE POINT	CONTINUOUS OR BATCH DISCHARGE	MAXIMUM DISCHARGE VOLUME PER ABWR UNIT	DISCHARGE VOLUME FOR BOTH ABWR UNITS*	CONCENTRATION	NOTES
		via seal pit					
Sodium hydroxide		Sea (cooling water outfall) via seal pit	Batch			1 te/d	Regeneration chemicals
Sulphuric acid		Sea (cooling water outfall) via seal pit	Batch			0.5 te/d	
Chlorine dioxide	RUHS	Sea (cooling water outfall) via seal pit	Batch	No data	No data	No data	Volume of discharge from the RUHS is not known
Chemicals present in demineralised water	Controlled area drain (CAD)	Sea (cooling water outfall) via seal pit	Batch	$2.7m^3/d$	$5.4m^3/d$		
	Non-radioactive storm drain (NSD)	Sea (cooling water outfall) via seal pit	Batch	$24m^3/d$	$48m^3/d$		

* Please note that the discharge volumes presented here for the Circulating Water, RSW and TSW systems are those occurring at low tide (LAT) and are therefore the minimum discharge volumes for these three discharges. These volumes are used in the H1 assessment as they present a worst case in terms of the lowest volume of cooling water in which dilution of the process effluents will occur. The other discharge volumes presented in this column are maximum volumes. The maximum volumes of the process effluents are used to assess the maximum concentrations of the individual chemicals present. The process effluent discharge volumes are not affected by the tide.

4.4.3.2 Demineralised water (trade effluent)

The trade effluent discharges from the NSD arise from the Heating Ventilation and Air Conditioning (HVAC) system, Reactor Building Cooling Water (RCW) and Turbine Building Cooling Water (TCW) systems, which are discharge supplied by the demineralised water supply. The water condensed from the HVAC system (3.1m^3/d per Unit) would have no corrosion inhibitor or chemical contaminants present.

During operation, the CAD will receive chemically-contaminated effluent from the non-radioactive washwater (sourced from potable water) from the active laboratories (0.2 m^3/d). For the RUHS system, trade effluent from regular cleaning of the open loop for the control of the *Legionella* microorganism will result in a use of chlorine dioxide. The TRO discharge from this use of chlorine dioxide will be managed within the proposed 0.1mg/l TRO discharge limit. A TRO discharge at 0.1mg/l has been modelled for the Environmental Impact Assessment and the biocide discharge from cleaning of the open loop of the RUHS has therefore been effectively included within that modelling study.

4.4.3.3 Sea water (trade effluent)

The discharge from the SWSD arises from the RSW and TSW systems as a batch discharge to the seal pit. The volume discharged from the SWSD is estimated as 24m^3/d with a maximum of 240m^3/d per Unit. As the discharge arises from the RSW and TSW systems, the discharge will contain sodium hypochlorite (TRO).

4.5 Maintenance discharges

The expected maintenance discharges from the Power Station are summarised in Table 4-2.

Table 4-2 Expected chemical discharges from the Power Station during outage.

CHEMICAL DISCHARGE	SYSTEM	DISCHARGE POINT	CONTINUOUS OR BATCH DISCHARGE	MAXIMUM DISCHARGE VOLUME PER ABWR UNIT	CONCENTRATION
Sodium nitrite	NSD	Sea (cooling water outfall) via seal pit	Batch	240m^3/d	500ppm
	CAD	Sea (cooling water outfall) via seal pit	Batch	30m^3/d	
Azole (benzotriazole)	NSD	Sea (cooling water outfall) via seal pit	Batch	240m^3/d	3ppm
	CAD	Sea (cooling water outfall) via seal pit	Batch	30m^3/d	3ppm
Sodium hypochlorite	RUHS	Sea (cooling water outfall)	Batch	50m^3/d	TRO being modelled

CHEMICAL DISCHARGE	SYSTEM	DISCHARGE POINT	CONTINUOUS OR BATCH DISCHARGE	MAXIMUM DISCHARGE VOLUME PER ABWR UNIT	CONCENTRATION
(TRO)		via seal pit			separately to the H1 assessment.
	SWSD	Sea (cooling water outfall) via seal pit	Batch	240m^3/d	
Chemicals present in potable water	MUWTP	Sea (cooling water outfall) via seal pit	Batch	90m^3/d	There are over 70 chemical constituents at varying concentrations – see H1 Assessment spreadsheet for assessment.
Sodium hydroxide	MUWTP	Sea (cooling water outfall) via seal pit	Batch	1 te/d	Concentrations of the separate constituents of sodium hydroxide are listed in subsequent tables
Chemicals present in demineralised water	Backup building	Sea (cooling water outfall) via seal pit	Batch	1000m^3 per outage	Demineralised water is sourced from potable water. The potential chemical pollutants in the potable water discharge from the MUWTP has been assessed therefore separate assessment of demineralised water from this system is not necessary.
Sulphuric acid	MUWTP	Sea (cooling water outfall) via seal pit	Batch	0.5 te/d	Concentrations of the separate constituents of sulphuric listed in subsequent

CHEMICAL DISCHARGE	SYSTEM	DISCHARGE POINT	CONTINUOUS OR BATCH DISCHARGE	MAXIMUM DISCHARGE VOLUME PER ABWR UNIT	CONCENTRATION
					tables
Sodium hypochlorite (TRO)	RSW	Sea (cooling water outfall) via seal pit	Continuous	4500m^3/h	TRO is being modelled separately to the H1 assessment.

4.5.1 Continuous discharges

The cooling water as trade effluent from the RSW will continue to be discharged during outage. The discharge will contain sodium hypochlorite (TRO).

There are no other continuous discharges during the outage period on each Unit apart from surface water runoff which is not considered in this assessment as it is not expected to contain any contaminants.

4.5.2 Batch discharges

4.5.2.1 Potable water (trade effluent)

The MUWTP will continue to operate during outage periods, and will produce a volume of 10m^3 of effluent for each 100m^3 of demineralised water produced. The discharge will contain the chemicals found in potable water at ten times the usual concentration, and will also contain sodium hydroxide and sulphuric acid which will be used as regeneration chemicals.

During outage, a trade effluent batch discharge will be made from the RUHS from the drain down of the open loop following operation or maintenance to the seal pit. The discharge will contain chlorine dioxide, and as a result will be accounted for within the wider TRO assessment.

4.5.2.2 Demineralised Water (trade effluent)

During outage, discharges will be made from the CAD These will include 3.1m^3/d of water condensed from the HVAC system, and 0.2m^3/d washwater from the active laboratories. During regular inspection of the closed loop cooling systems during outage (such as the RCW and TCW), 30m^3/d of water dosed with corrosion inhibitor (sodium nitrite and azole (benzotriazole)) will be released.

Discharge from the NSD (240m^3/d) will comprise demineralised water containing the corrosion inhibitors sodium nitrite and azole (benzotriazole).

A batch discharge from the HCW of 58m^3 will occur six times per year, giving a total of 348m^3/y. The discharge will contain radioactive contaminants and therefore is not considered further in this assessment.

During outage, a discharge of 1000m^3 will be made from the backup building, comprising demineralised water and its associated chemical components.

5 Assessment and modelling methodology

H1 is an assessment of whether the concentration of the expected chemical discharges from the Power Station is greater than the EQS (or equivalent value) for that chemical. If the expected concentration is less than the EQS, no further assessment is required. Section 5.1 describes the EQSs used in the assessment and where an EQS is not available, the alternative screening criteria that has been adopted.

5.1 Environmental Quality Standards

The predicted surface water discharge from the Power Station has been compared to EQSs issued by the Environment Agency [RD3, RD4], where available. However, there are a number of chemicals which are expected to be discharged from the Power Station for which a published EQS is not available.

For those chemicals for which an EQS published by the Environment agency is not available, it is not possible to assess the significance of these within the discharge in the same way as above. In these instances, a value has been taken from 'H1 Assessment of Chemical Discharges from Hinkley Point C on the Marine Environment' [RD5] where such a figure is available. Alternatively, the mean or maximum background level has been used (as applicable), or wider literature has been searched to identify screening criteria. Where possible, PNEC values for the marine environment have been adopted, or the lowest ecotoxicology data concentration for available aquatic organisms.

Table 5-1 shows the water quality standards (and sources) used to undertake the H1 assessment.

Table 5-1 Water quality standards used to assess the quality of chemical discharges from Wylfa Newydd Power Station.

CHEMICAL DISCHARGE	AA EQS (µg/l)	AA EQS SOURCE	MAXIMUM ALLOWABLE CONCENTRATION (MAC) EQS (µg/l)	MAC EQS SOURCE	MEAN BACKGROUND (WHERE USED IN PLACE OF AA EQS) (µg/l)	MAXIMUM BACKGROUND (WHERE USED IN PLACE OF MAC EQS) (µg/l)	EQS OR OTHER THRESHOLD, FROM OTHER SOURCE (µg/l)
Sulphate					2,590.76	2828	
Sodium					10,214,250	11,375,000	
Nitrite (mg/l NO_2)					3.94	14.8	
Nitrate (mg/l NO_3)					50	146	
Ammonium							21 [RD7]
Aluminium							24 [RD8]
Iron	1,000	[RD3]				271	
Manganese					10	10	
Copper	3.76	[RD3]				2.12	
Phosphorus							14 LC50 marine fish [RD27]
Fluoride	5,000	[RD3]	15,000	[RD3]			
Arsenic	25	[RD3]				1.81	
Cadmium	0.2	[RD3]				0.09	
Cyanide	1	[RD3]	5	[RD3]			
Chromium	0.6	[RD3]	32	[RD3]			
Mercury			0.07	[RD4]			PNEC 0.05 plus background concentration (=0.055) [RD38]
Nickel	8.6	[RD4]	34	[RD4]			
Lead	1.3	[RD4]	14	[RD4]			
Antimony							0.0113 [RD9]
Selenium					0.5	0.5	
Tritium	Tritium is a radioactive element and therefore is not considered in this assessment						
Chloride					18,980 Background typical [RD10]		
Boron	7,000	[RD3]				5015	
Benzo (a) Pyrene			0.027	[RD4]	0.005		
Tetrachloromethane					0.05	0.05	
Trichloroethene	100	[RD3]				0.05	
Tetrachloroethene	10	[RD4]					10 MAC [RD4]
Bromate							140 PNEC saltwater organisms [RD26]
Benzene	8	[RD4]	50	[RD4]			
1,2 Dichloroethene	10	[RD4]				0.05	
Pesticides							
Aldrin							0.003 [RD11]
Chlorfenvinphos	0.1	[RD4]	0.03	[RD4]			
Dieldrin							0.003 [RD11]

CHEMICAL DISCHARGE	AA EQS (µg/l)	AA EQS SOURCE	MAXIMUM ALLOWABLE CONCENTRATION (MAC) EQS (µg/l)	MAC EQS SOURCE	MEAN BACKGROUND (WHERE USED IN PLACE OF AA EQS) (µg/l)	MAXIMUM BACKGROUND (WHERE USED IN PLACE OF MAC EQS) (µg/l)	EQS OR OTHER THRESHOLD, FROM OTHER SOURCE (µg/l)
Heptachlor							0.00003 [RD28]
Heptachlor Epoxide							0.00003 [RD28]
Parathion							100 [RD29]
Diazinon	0.01	[RD3]	0.26	[RD3]			
Mecoprop	18	[RD3]	187	[RD3]			
2-4,D	0.3	[RD3]	1.3	(95^{th} percentile) [RD3]			
Dicamba							0.61 MAC [RD12]
Simazine	1	[RD4]	4	[RD4]			
Atrazine	0.6	[RD4]	2	[RD4]			
MCPA	80	[RD3]	800	[RD3]			
Trietazine							130 Acute LC50 algae [RD30]
Propetamphos	0.03	[RD3]	0.1	[RD3]			
Ioxynil	10	[RD3]	100	[RD3]			
Terbutryn							0.86 Acute LC50 Fish [RD13]
MCPB							1500 [RD14]
Pentachlorophenol	0.4	[RD4]	1	[RD4]			
2,4,5-T							1300 Acute LC50 Fish [RD31]
Asulam							190 [RD15]
Glyphosate	196	[RD3]	398	(95^{th} percentile) [RD3]			
Fenpropimorph							0.016 PNEC aqueous phase organisms. [RD16]
Fenpropidin							320 Chronic NOEC aquatic invertebrates [RD32]
2,4-DB							1100 acute EC50 algae growth [RD33]
Propachlor							1.3 [RD17]
Benazolin							1000 chronic NOEC algae growth [RD34]
Ethofumesate							800 chronic NOEC fish [RD35]
Bromoxynil	100	[RD3]	1000	[RD3]			
Dichlorprop							500 acute LC50 fish [RD36]
Propazine							180 acute EC50 algae growth [RD37]
Chlorpyrifos	0.03	[RD4]	0.1	[RD4]			
Polycyclic aromatic hydrocarbons							
Benzo 1,12 perylene			0.00082	[RD4]			
Benzo 3,4 fluoranthene			0.017	[RD4]			

CHEMICAL DISCHARGE	AA EQS (µg/l)	AA EQS SOURCE	MAXIMUM ALLOWABLE CONCENTRATION (MAC) EQS (µg/l)	MAC EQS SOURCE	MEAN BACKGROUND (WHERE USED IN PLACE OF AA EQS) (µg/l)	MAXIMUM BACKGROUND (WHERE USED IN PLACE OF MAC EQS) (µg/l)	EQS OR OTHER THRESHOLD, FROM OTHER SOURCE (µg/l)
Benzo 11,12 fluoranthene			0.017	[RD4]			
Indeno 1,2,3-cd pyrene	0.00017	(PAH) [RD4]					
Trihalomethanes							
Trichloromethane	2.5	[RD4]					34 MAC [RD18]
Dichlorobromomethane							24 [RD18]
Tribromomethane							5 AA [RD19] 6 MAC [RD19]
Dibromochloromethane							0.63 [RD25]
Total Organic Carbon					5130	11,500	
Chlorine Free (MGL)			10 (95th percentile)	[RD3]			0.04 [RD39]
Total chlorine			10 (95th percentile concentration of total residual oxidant)	[RD3]			0.04 [RD39]
Trihalomethanes							146 [RD20]
Sodium carbonate	See below for constituents of sodium carbonate						
Sodium chloride							5000 [RD21]
Sodium sulphate							1109 [RD22]
Ammonia	21	[RD3]					
Sodium nitrite							6 [RD23]
Azole (Benzotriazole (BTA))							19 [RD24]
Zinc	6.8	[RD3]				26.30	

[1] Chronic PNEC AA value from [RD5]

[2] Acute PNEC MAC value from [RD5]

6 Assessment and modelling results

The first stage of the H1 assessment is to screen out discharges which are deemed to be not liable to cause pollution (i.e. the expected concentration does not exceed than the published EQS). Where a published EQS is not available from the H1 screening resource the discharge concentration has been compared to a surrogate EQS, which is based on values such as the average or maximum background concentration (as applicable), PNEC value or lowest ecotoxicity concentration, and if the increase is less than 1% of this surrogate EQS, then it has been screened out. The sources of each EQS are presented in Table 5-1 and published EQSs and surrogate EQSs are differentiated by an asterisk, respectively in Table 6-2, Table 6-3, Table 6-6 and Table 6-7. This allows the reader to compare whether the concentration in the effluent has screened using the EQS value or the EQS plus 1% (for published and surrogate EQSs, respectively).

For substances that do not have a published EQS, many of the discharge concentrations appear to be greater than the mean or maximum background level, but the increase is less than 1% of the surrogate EQS. In these cases, ambient water quality is the dominant source of the chemical in question.

The following sections show the results of the assessment and the discharges which can be screened out of further assessment. Discharges which cannot be screened out and require further investigation are discussed in Section 7.

6.1 Operational discharges

6.1.1 Continuous discharges

The continuous discharges arising during the operational period are listed in Table 6-1, along with the reasons why they are not assessed as part of this report.

Table 6-1 Operational Phase Continuous Discharges

DISCHARGE	REASON FOR EXCLUSION FROM H1 ASSESSMENT
Hydrazine and phosphate	Hydrazine and phosphate will be present in the discharge from blowdown of the auxiliary boilers. However, due to the low volume (<20m^3/year) this discharge will be held on site and disposed of separately and therefore does not form part of the H1 assessment.
Sodium hypochlorite (as TRO)	TRO is being modelled and assessed separately from the H1 assessment.
Seawater	Seawater discharged from the fish recovery and return system will not contain any chemical contaminants.
Demineralised water (from potable water)	Demineralised water is sourced from potable water. The potential chemical pollutants in the potable water discharge from the MUWTP have been assessed; therefore, an assessment of the demineralised water discharge is not necessary.
Surface water	There are not expected to be any chemical

DISCHARGE	REASON FOR EXCLUSION FROM H1 ASSESSMENT
	contaminants in the surface water at the point of discharge.

6.1.2 Batch discharges

Table 6-2 shows that the average operational phase discharges for which there is an EQS or surrogate value available, can be screened out of the need for further assessment.

Table 6-2 Assessment results for average operational phase batch discharges. Substances without an asterisk have a published EQS and their concentration is compared to this value (2nd column). Substances with an asterisk have a surrogate EQS and the concentration is compared to this value plus 1% (4th column).

CHEMICAL DISCHARGE	AA EQS (OR SURROGATE EQS)	AVERAGE CONCENTRATION IN THE EFFLUENT (µG/L)	AA EQS +1%	IS DISCHARGE >EQS OR SURROGATE EQS*+1%?
Sulphate*	2,590.76	2,591.57	2,616.67	No
Nitrite (mg/l NO2)*	3.94	3.94	3.98	No
Sodium*	10,214,250	10,214,167	10,316,393	No
Nitrate (mg/l NO3)*	50.00	50.23	50.50	No
Ammonium*	21.00	0.001	21.21	No
Aluminium*	24.00	0.003	24.24	No
Iron	1,000	50	1,010	No
Manganese*	10.00	10.00	10.10	No
Copper	3.76	0.70	3.80	No
Phosphorus*	14.00	0.001	14.14	No
Fluoride	5,000.00	0.00	5,050.00	No
Arsenic	25.00	1.54	25.25	No
Cadmium	0.20	0.02	0.20	No
Cyanide	1.00	0.003	1.01	No
Chromium	0.60	0.41	0.61	No
Mercury*	0.055	0.005	0.056	No
Nickel	8.60	0.51	8.69	No

Chemical discharge	AA EQS (or surrogate EQS)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate
Lead	1.30	0.79	1.31	No
Antimony*	0.01	0.000004	0.01	No
Selenium*	0.50	0.50	0.51	No
Chloride*	18,980.00	18,982.72	19,169.80	No
Boron	7,000.00	4,746.29	7,070.00	No
Benzo (a) Pyrene*	0.01	0.005	0.01	No
Tetrachloromethane*	0.05	0.05	0.05	No
Trichloroethene	100.00	0.05	101.00	No
Tetrachloroethene	10.00	0.000040	10.10	No
Bromate*	140.00	0.0005	141.40	No
Benzene	8.00	0.000002	8.08	No
1,2 Dichloroethene	10.00	0.05	10.10	No
Pesticides				
Aldrin*	0.003	0.0000004	0.00	No
Chlorofenvinphos	0.10	0.0000006	0.10	No
Dieldrin*	0.0030	0.0000004	0.00	No
Heptachlor*	0.00003	0.0000005	0.00	No
Heptachlor Epoxide*	0.00003	0.0000008	0.00003	No
Parathion*	100.00	0.0000003	101.00	No
Diazinon	0.01	0.0000006	0.01	No
Mecoprop	18.00	0.0000004	18.18	No
2-4,D	0.30	0.0000005	0.30	No
Dicamba*	0.61	0.0000009	0.62	No
Simazine	1.00	0.0000005	1.01	No
Atrazine	0.60	0.0000006	0.61	No

Chemical discharge	AA EQS (or surrogate EQS)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate
MCPA	80.00	0.0000006	80.80	No
Trietazine*	130.00	0.0000006	131.30	No
Propetamphos	0.03	0.0000010	0.03	No
Ioxynil	10.00	0.0000005	10.10	No
Terbutryn*	0.86	0.0000006	0.87	No
MCPB*	1,500.00	0.0000005	1,515.00	No
Pentachlorophenol	0.40	0.01	0.40	No
2,4,5-T*	1,300.00	0.0000006	1,313.00	No
Asulam*	190.00	0.0000006	191.90	No
Glyphosate	196.00	0.0000005	197.96	No
Fenpropimorph*	0.02	0.0000012	0.02	No
Fenpropidin*	320.00	0.0000007	323.20	No
2,4-DB*	1,100.00	0.0000007	1,111.00	No
Propachlor*	1.30	0.0000007	1.31	No
Benazolin*	1,000.00	0.0000006	1,010.00	No
Ethofumesate*	800.00	0.0000008	808.00	No
Bromoxynil	100.00	0.0000005	101.00	No
Dichlorprop*	500.00	0.0000005	505.00	No
Propazine*	180.00	0.0000007	181.80	No
Chlorpyriphos	0.03	0.0000003	0.03	No
Polycyclic aromatic hydrocarbons				
Benzo 1,12 perylene*	0.00082000	0.0000002	0.00083	No
Benzo 3,4 fluoranthene*	0.0170	0.0000001	0.01717	No
Benzo 11,12 fluoranthene*	0.0170	0.0000001	0.01717	No

Chemical discharge	AA EQS (or surrogate EQS)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate
Indeno 1,2,3-CD pyrene	0.000170	0.0000003	0.00017	No
Trihalomethanes				
Trichloromethane	2.50	0.0514250	2.53	No
Dichlorobromo-methane*	24.00	0.0013161	24.24	No
Tribromomethane*	5.00	0.04	5.05	No
Dibromochloro-methane	0.63	0.001	0.64	No
Total Organic Carbon*	5,130.00	5,129.96	5,181.30	No
Chlorine Free *	0.04	0.00002	0.0404	n/a
Total chlorine*	0.04	0.00002	0.0404	No
Trihalomethanes*	146.00	0.004	147.46	No
Sodium hydroxide	See individual constituents of sodium hydroxide			
Sodium carbonate	See individual constituents of sodium carbonate			
Sodium chloride*	5,000.00	0.009	5,050.00	No
Sodium sulphate	1,109.00	0.009	1,120.09	No
Sulphuric acid	See individual constituents of sulphuric acid			
Ammonia	21.00	0.0002	21.21	No
Zinc	6.80	6.2125	6.87	No

The discharge from the controlled area drain is expected to have the chemical parameters stated in Table 6-3 of which COD and TSS screen out.

Table 6-3 Assessment results for maximum operational phase batch discharges. Substances without an asterisk have a published EQS and their concentration is compared to this value (2nd column). Substances with an asterisk have a surrogate EQS and the concentration is compared to this value plus 1% (4th column).

CHEMICAL DISCHARGE	MAC EQS (OR SURROGATE EQS)	MAXIMUM CONCENTRATION IN THE EFFLUENT (µG/L)	MAC EQS +1%	IS DISCHARGE >EQS OR SURROGATE EQS+1%?
Sulphate*	2828	2828.8971	2856.28	No
Nitrite (mg/l NO2)*	14.8	14.8013	14.948	No
Sodium*	11,375,000	11,374,896.42	11,488,750	No
Nitrate (mg/l NO3)*	146	146.2571	147.46	No
Ammonium*	21	0.0009	21.21	No
Aluminium*	24	0.0033	24.24	No
Iron*	271	271.0006	273.71	No
Manganese*	10	10.0001	10.1	No
Copper*	2.12	2.1235	2.1412	No
Phosphorus*	14	0.0011	14.14	No
Fluoride	15000	0.0032	15150	No
Arsenic*	1.81	1.8100	1.8281	No
Cadmium*	0.09	0.09	0.0909	No
Cyanide	5	0.0027	5.05	No
Chromium	32	6.8100	32.32	No
Mercury	0.07	0.0100	0.0707	No
Nickel	34	0.7800	34.34	No
Lead	14	2.7000	14.14	No
Antimony*	0.0113	0.0000050	0.011413	No
Selenium*	0.5	0.5000035	0.505	No
Chloride*	18980	3.2052894	19169.8	No
Boron*	5015	5014.9555775	5065.15	No
Benzo (a) Pyrene	0.027	0.0050000	0.02727	No

Chemical discharge	MAC EQS (or surrogate EQS)	Maximum concentration in the effluent (µg/L)	MAC EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Tetrachloromethane*	0.05	0.0500241	0.0505	No
Trichloroethene*	0.05	0.0500022	0.0505	No
Tetrachloroethene*	10	0.0000442	10.1	No
Bromate*	140	0.0005092	141.4	No
Benzene	50	0.0000026	50.5	No
1,2 Dichloroethene*	0.05	0.0500152	0.0505	No
Pesticides				
Aldrin*	0.003	0.0000005	0.00303	No
Chlorofenvinphos	0.03	0.0000007	0.0303	No
Dieldrin*	0.003	0.0000004	0.00303	No
Heptachlor*	0.00003	0.0000006	0.0000303	No
Heptachlor Epoxide*	0.00003	0.0000009	0.0000303	No
Parathion*	100	0.0000003	101	No
Diazinon	0.26	0.0000006	0.2626	No
Mecoprop	187	0.0000004	188.87	No
2-4,D	1.3	0.0000006	1.313	No
Dicamba*	0.61	0.0000010	0.6161	No
Simazine	4	0.0000005	4.04	No
Atrazine	2	0.0000007	2.02	No
MCPA	800	0.0000006	808	No
Trietazine*	130	0.0000006	131.3	No
Propetamphos	0.1	0.0000011	0.101	No
Ioxynil	100	0.0000005	101	No
Terbutryn*	0.86	0.0000007	0.8686	No
MCPB*	1500	0.0000006	1515	No
Pentachlorophenol	1	0.0100005	1.01	No

CHEMICAL DISCHARGE	MAC EQS (OR SURROGATE EQS)	MAXIMUM CONCENTRATION IN THE EFFLUENT (µG/L)	MAC EQS +1%	IS DISCHARGE >EQS OR SURROGATE EQS+1%?
2,4,5-T*	1300	0.0000006	1313	No
Asulam*	190	0.0000007	191.9	No
Glyphosate	398	0.0000006	401.98	No
Fenpropimorph*	0.016	0.0000014	0.01616	No
Fenpropidin*	320	0.0000008	323.2	No
2,4-DB*	1100	0.0000008	1111	No
Propachlor*	1.3	0.0000007	1.313	No
Benazolin*	1000	0.0000007	1010	No
Ethofumesate*	800	0.0000009	808	No
Bromoxynil	1000	0.0000005	1010	No
Dichlorprop*	500	0.0000006	505	No
Propazine*	180	0.0000008	181.8	No
Chlorpyrifos	0.1	0.0000003	0.101	No
Polycyclic aromatic hydrocarbons				
Benzo1,12 perylene	0.00082	0.0000002	0.0008	No
Benzo 3,4 fluoranthene	0.017	0.0000001	0.01717	No
Benzo 11,12 fluoranthene	0.017	0.0000001	0.01717	No
Indeno 1,2,3-CD pyrene*	0.00017	0.0000003	0.0001717	No
Trihalomethanes				
Trichloromethane*	34	0.052	34.34	No
Dichlorobromo-methane*	24	0.001	24.24	No
Tribromomethane*	6	0.180	6.06	No
Dibromochloro-methane*	0.63	0.002	0.6363	No
Total Organic Carbon*	11500	11500	11615	No
Chlorine Free (MGL)	10	0.00002	10.1	No
Total chlorine	10	0.00004	10.1	No
Trihalomethanes*	146	0.0048	147.46	No
Sodium hydroxide	See individual constituents of sodium hydroxide			

Chemical discharge	MAC EQS (or surrogate EQS)	Maximum concentration in the effluent (µg/L)	MAC EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Sodium carbonate	See individual constituents of sodium carbonate			
Sodium chloride*	5000	0.0102	5050	No
Sodium sulphate*	1109	0.0102	1120.09	No
Sulphuric acid	See individual constituents of sulphuric acid			
Ammonia*	21.00	0.00	21.21	No
Zinc*	26.3	26.30	26.563	No

6.2 Maintenance discharges

6.2.1 Continuous discharges

Table 6-4 Assessment results for average maintenance phase continuous discharges

Chemical discharge	AA EQS (or Surrogate EQS)	Maximum concentration in effluent (µg/l)	AA EQS + 1 %	Is discharge >1% increase on EQS?	Is discharge >EQS or surrogate EQS +1%
There are no continuous discharges during the maintenance phase (with the exception of surface water discharge which is not included in this assessment – see section 5.1 and TRO from the TSW and RSW which is also not included in this assessment)					

Table 6-5 Assessment results for maximum maintenance phase continuous discharges

Chemical discharge	MAC EQS (or Surrogate EQS)	Maximum concentration in effluent (µg/l)	MAC EQS + 1 %	Is discharge >1% increase on EQS?	Is discharge >EQS or surrogate EQS +1%
There are no continuous discharges during the maintenance phase (with the exception of surface water discharge which is not included in this assessment – see section 5.1 and TRO from the TSW and RSW which is also not included in this assessment)					

6.2.2 Batch discharges

Table 6-6 lists the batch discharges which will be released during the outage period. As only one Unit will be on outage at a time, and the other Unit will be operating, the total discharge to the seal pit will be made up of the operational discharges of one Unit, plus the outage discharges of the other Unit. The values listed in Table 6-6 are therefore the total values which will be discharged from the Power Station as a whole during outage. There will be one MUWTP serving both Units, and this will continue to operate throughout the outage period, to serve the operating Unit and the one in outage.

Sodium nitrite cannot be screened out as it exceeds the EQS equivalent for both AA and maximum discharges. During an outage, sodium nitrite will be present in the discharge from the NSD and CAD where it will be used as a corrosion inhibitor. There are no background data available for sodium nitrite so it is not possible to compare the expected discharge to the ambient concentration. Therefore, the potential impact on sodium nitrite in the discharge from the Power Station has been assessed further.

Table 6-6 Assessment results for average maintenance phase batch discharges

CHEMICAL DISCHARGE	AA EQS (OR EQUIVALENT)	AVERAGE CONCENTRATION IN THE EFFLUENT (µG/L)	AA EQS +1%	IS DISCHARGE >EQS OR SURROGATE EQS+1%?
Sodium nitrite*	6.00	24.801	6.06	Yes
Azole (Benzotriazole (BTA))*	19.00	0.149	19.19	No
Sulphate*	2591	2592	2617	No
Nitrite (mg/l NO2)*	3.94	3.94	3.98	No
Sodium*	10214250	10214083	10316393	No
Nitrate (mg/l NO3)*	50.00	50.46	50.50	No
Ammonium*	21.00	0.0016	21.21	No
Aluminium*	24.00	0.01	24.24	No
Iron	1000.00	50.00	1010.00	No
Manganese*	10.00	10.00	10.10	No
Copper	3.76	0.71	3.80	No
Phosphorus*	14.00	0.002	14.14	No

Chemical discharge	AA EQS (or equivalent)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Fluoride	5000.00	0.01	5050.00	No
Arsenic	25.00	1.54	25.25	No
Cadmium	0.20	0.02	0.20	No
Cyanide	1.00	0.003	1.01	No
Chromium	0.60	0.41	0.61	No
Mercury*	0.06	0.01	0.06	No
Nickel	8.60	0.51	8.69	No
Lead	1.30	0.79	1.31	No
Antimony*	0.01	0.00001	0.01	No
Selenium*	0.50	0.50	0.51	No
Chloride*	18980.00	18985.44	19169.80	No
Boron	7000.00	4746.25	7070.00	No
Benzo (a) Pyrene*	0.01	0.005	0.01	No
Tetrachloromethane*	0.05	0.05	0.05	No
Trichloroethene	100.00	0.05	101.00	No
Tetrachloroethene	10.00	0.00008	10.10	No
Bromate*	140.00	0.00052	141.40	No
Benzene	8.00	0.000005	8.08	No
1,2 Dichloroethene	10.00	0.05	10.10	No
Pesticides				
Aldrin*	0.003	0.0000009	0.003	No
Chlorofenvinphos	0.100	0.0000012	0.101	No

Chemical discharge	AA EQS (or equivalent)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Dieldrin*	0.003	0.000001	0.003	No
Heptachlor*	0.00003	0.000001	0.00003	No
Heptachlor Epoxide*	0.00003	0.000002	0.00003	No
Parathion*	100.00	0.000001	101.00	No
Diazinon	0.01	0.000001	0.01	No
Mecoprop	18.00	0.000001	18.18	No
2-4,D	0.30	0.000001	0.30	No
Dicamba*	0.61	0.000002	0.62	No
Simazine	1.00	0.000001	1.01	No
Atrazine	0.60	0.000001	0.61	No
MCPA	80.00	0.000001	80.80	No
Trietazine*	130.00	0.000001	131.30	No
Propetamphos	0.03	0.000002	0.03	No
Ioxynil	10.00	0.000001	10.10	No
Terbutryn*	0.86	0.000001	0.87	No
MCPB*	1500.00	0.000001	1515.00	No
Pentachlorophenol	0.40	0.01	0.40	No
2,4,5-T*	1300.00	0.000001	1313.00	No
Asulam*	190.00	0.000001	191.90	No
Glyphosate	196.00	0.000001	197.96	No
Fenpropimorph*	0.02	0.000002	0.02	No
Fenpropidin*	320.00	0.000001	323.20	No

Chemical discharge	AA EQS (or equivalent)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate EQS+1%?
2,4-DB*	1100.00	0.000001	1111.00	No
Propachlor*	1.30	0.000001	1.31	No
Benazolin*	1000.00	0.000001	1010.00	No
Ethofumesate*	800.00	0.000002	808.00	No
Bromoxynil	100.00	0.000001	101.00	No
Dichlorprop*	500.00	0.000001	505.00	No
Propazine*	180.00	0.000001	181.80	No
Chlorpyriphos	0.03	0.000001	0.03	No
Polycyclic aromatic hydrocarbons				
Benzo 1,12 perylene*	0.0008200	0.0000004	0.0008282	No
Benzo 3,4 fluoranthene*	0.0170000	0.0000002	0.0171700	No
Benzo 11,12 fluoranthene*	0.0170000	0.0000003	0.0171700	No
Indeno 1,2,3-CD pyrene	0.0001700	0.0000006	0.0001717	No
Trihalomethanes				
Trichloromethane	2.50	0.05	2.53	No
Dichlorobromo-methane*	24.00	0.0026	24.24	No
Tribromomethane*	5.00	0.04	5.05	No
Dibromochloro-methane	0.63	0.0027	0.64	No
Total Organic Carbon*	5130.00	5129.92	5181.30	No
Chlorine Free *	0.04	0.000043	0.04	No

Chemical discharge	AA EQS (or equivalent)	Average concentration in the effluent (µg/L)	AA EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Total chlorine*	0.04	0.000069	0.04	No
Trihalomethanes*	146.00	0.00866	147.46	No
Sodium hydroxide	See individual constituents of sodium hydroxide			
Sodium carbonate	See individual constituents of sodium carbonate			
Sodium chloride*	5000.00	0.02	5050.00	No
Sodium sulphate	1109.00	0.02	1120.09	No
Sulphuric acid	See individual constituents of sulphuric acid			
Ammonia	21.00	0.0005	21.21	No
Zinc	6.80	6.21	6.87	No

Table 6-7 details the maximum discharge flows for maintenance phase batch discharges. The maximum maintenance phase discharge of sodium nitrite arising from the CAD and NSW is expected to exceed the EQS equivalent value and therefore has required further assessment.

Table 6-7 Assessment results for maximum maintenance phase batch discharges

Chemical discharge	MAC EQS (or equivalent)	Maximum concentration in the effluent (µg/L)	MAC EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Sodium nitrite*	6.00	27.654	6.06	Yes
Azole (Benzotriazole (BTA))*	19.00	0.166	19.19	No
Sulphate*	2591	2592	2617	No
Nitrite (mg/l NO2)*	3.94	3.94	3.98	No

Chemical discharge	MAC EQS (or equivalent)	Maximum concentration in the effluent (µg/L)	MAC EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Sodium*	10214250	10214083	10316393	No
Nitrate (mg/l NO3)*	50.00	50.46	50.50	No
Ammonium*	21.00	0.0016	21.21	No
Aluminium*	24.00	0.01	24.24	No
Iron	1000.00	50.00	1010.00	No
Manganese*	10.00	10.00	10.10	No
Copper	3.76	0.71	3.80	No
Phosphorus*	14.00	0.002	14.14	No
Fluoride	5000.00	0.01	5050.00	No
Arsenic	25.00	1.54	25.25	No
Cadmium	0.20	0.02	0.20	No
Cyanide	1.00	0.003	1.01	No
Chromium	0.60	0.41	0.61	No
Mercury*	0.06	0.01	0.06	No
Nickel	8.60	0.51	8.69	No
Lead	1.30	0.79	1.31	No
Antimony*	0.01	0.00001	0.01	No
Selenium*	0.50	0.50	0.51	No
Chloride*	18980.00	18985.44	19169.80	No
Boron	7000.00	4746.25	7070.00	No
Benzo (a) Pyrene*	0.01	0.005	0.01	No
Tetrachloromethane*	0.05	0.05	0.05	No

Chemical discharge	MAC EQS (or equivalent)	Maximum concentration in the effluent (µg/L)	MAC EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Trichloroethene	100.00	0.05	101.00	No
Tetrachloroethene	10.00	0.00008	10.10	No
Bromate*	140.00	0.00052	141.40	No
Benzene	8.00	0.000005	8.08	No
1,2 Dichloroethene	10.00	0.05	10.10	No
Pesticides				
Aldrin*	0.003	0.0000009	0.003	No
Chlorofenvinphos	0.100	0.0000012	0.101	No
Dieldrin*	0.003	0.000001	0.003	No
Heptachlor*	0.00003	0.000001	0.00003	No
Heptachlor Epoxide*	0.00003	0.000002	0.00003	No
Parathion*	100.00	0.000001	101.00	No
Diazinon	0.01	0.000001	0.01	No
Mecoprop	18.00	0.000001	18.18	No
2-4,D	0.30	0.000001	0.30	No
Dicamba*	0.61	0.000002	0.62	No
Simazine	1.00	0.000001	1.01	No
Atrazine	0.60	0.000001	0.61	No
MCPA	80.00	0.000001	80.80	No
Trietazine*	130.00	0.000001	131.30	No
Propetamphos	0.03	0.000002	0.03	No
Ioxynil	10.00	0.000001	10.10	No

Chemical discharge	MAC EQS (or equivalent)	Maximum concentration in the effluent (µg/L)	MAC EQS +1%	Is discharge >EQS or surrogate EQS+1%?
Terbutryn*	0.86	0.000001	0.87	No
MCPB*	1500.00	0.000001	1515.00	No
Pentachlorophenol	0.40	0.01	0.40	No
2,4,5-T*	1300.00	0.000001	1313.00	No
Asulam*	190.00	0.000001	191.90	No
Glyphosate	196.00	0.000001	197.96	No
Fenpropimorph*	0.02	0.000002	0.02	No
Fenpropidin*	320.00	0.000001	323.20	No
2,4-DB*	1100.00	0.000001	1111.00	No
Propachlor*	1.30	0.000001	1.31	No
Benazolin*	1000.00	0.000001	1010.00	No
Ethofumesate*	800.00	0.000002	808.00	No
Bromoxynil	100.00	0.000001	101.00	No
Dichlorprop*	500.00	0.000001	505.00	No
Propazine*	180.00	0.000001	181.80	No
Chlorpyriphos	0.03	0.000001	0.03	No
Polycyclic aromatic hydrocarbons				
Benzo 1,12 perylene*	0.0008200	0.0000004	0.0008282	No
Benzo 3,4 fluoranthene*	0.0170000	0.0000002	0.0171700	No
Benzo 11,12 fluoranthene*	0.0170000	0.0000003	0.0171700	No
Indeno 1,2,3-CD pyrene	0.0001700	0.0000006	0.0001717	No

CHEMICAL DISCHARGE	MAC EQS (OR EQUIVALENT)	MAXIMUM CONCENTRATION IN THE EFFLUENT (µG/L)	MAC EQS +1%	IS DISCHARGE >EQS OR SURROGATE EQS+1%?
Trihalomethanes				
Trichloromethane	2.50	0.05	2.53	No
Dichlorobromo-methane*	24.00	0.0026	24.24	No
Tribromomethane*	5.00	0.04	5.05	No
Dibromochloro-methane	0.63	0.0027	0.64	No
Total Organic Carbon*	5130.00	5129.92	5181.30	No
Chlorine Free *	0.04	0.000043	0.04	No
Total chlorine*	0.04	0.000069	0.04	No
Trihalomethanes*	146.00	0.00866	147.46	No
Sodium hydroxide	See individual constituents of sodium hydroxide			
Sodium carbonate	See individual constituents of sodium carbonate			
Sodium chloride*	5000.00	0.02	5050.00	No
Sodium sulphate	1109.00	0.02	1120.09	No
Sulphuric acid	See individual constituents of sulphuric acid			
Ammonia	21.00	0.0005	21.21	No
Zinc	6.80	6.21	6.87	No

7 H1 Assessment summary further assessment

Of all of the chemical discharges expected to arise from the Power Station, only sodium nitrite was not immediately screened out of the need for further assessment:

- Sodium nitrite will be used as a corrosion inhibitor in closed loop systems such as the RCW and TCW systems and will be dosed at a maximum concentration of 500ppm. Sodium nitrite will be present in the maintenance batch discharge from the NSD and CAD during outage. The discharge to the NSD and CAD during outage will arise from the drain down of the RCW and TCW systems. The discharge from the CAD will be 33.3m3/d and the discharge from the NSD will be 240m3/d.
- Further assessment has been conducted for sodium nitrite, presented in Appendix A.
- This assessment includes modelling of this chemical in the marine environment, and the calculation of sea surface and sea bed mixing zones.
- The assessment identified that the modelling presented would be worst case as this would be from a discrete discharge and only occur over a matter of a few days during an outage. Furthermore, sodium nitrite would be rapidly converted to sodium nitrate in the marine environment.

8 References

Table 8-1 References

REF. NO.	TITLE
[RD1]	Environment Agency. H1 Software Tool User Guide. Version 2.74
[RD2]	Environment Agency H1 website https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit
[RD3]	Estuaries and coastal waters specific pollutants and operational environmental quality standards (EQS)
[RD4]	Estuaries and coastal waters priority hazardous substances, priority substances and other pollutants
[RD5]	H1 Assessment of Chemical Discharges from Hinkley Point C on the Marine Environment (incorporating revised dilution factors – March 2012) 31719-025-A Issue 2 April 2012.
[RD6	http://www.cpchem.com/msds/100000000434_SDS_EU_EN.PDF
[RD7]	http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/Specific%20pollutants%20proposals_Final_010608.pdf
[RD8]	https://www.ncbi.nlm.nih.gov/pubmed/25318392
[RD9]	http://www.antimony.com/files/cms1/publications/position-paper-pbt-antimony-arche-and-i2a-revision-august-2014.pdf
[RD10]	http://www.lenntech.com/composition-seawater.htm
[RD11]	http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20Summary%20Report%20interim%20190213%20final_0.pdf
[RD12]	http://www.ineris.fr/substances/fr/substance/cas/1918-00-9/3
[RD13]	Hempel. Hempel's Antifouling Oceanic +73950 Safety data sheet version 0.06
[RD14]	http://headland-ag.co.uk/image/catalog/pdf/Butoxone.pdf
[RD15]	EC50/72h/algae. https://www.harrells.com/resources/exports/file?n=ASULOX&t=sds
[RD16]	https://circabc.europa.eu/sd/a/da467cde-e64b-4296-9fdf-1e0fd77c3101/Draft%20assessment%20report%20fenpropimorph.pdf
[RD17]	http://www.norman-

	network.com/empodat/ecotox/factsheet_show.php?esub_id=678
[RD18]	https://brage.bibsys.no/xmlui/bitstream/handle/11250/191574/DBP%20article%20revised%20version%20May%202013%20final.pdf?sequence=1
[RD19]	Jacobs 2016. Wylfa Newydd. Horizon Nuclear Power. Marine Hydrodynamic Modelling
[RD20]	https://echa.europa.eu/documents/10162/a5ae9101-7a5d-49cc-af75-d14d1162b3f8
[RD21]	Perstop. Safety data sheet according to 1907/2006/EC, Article 31 version:1. Sodium Chloride https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwijpIfYoK7TAhUJJVAKHXUkAhsQFggrMAE&url=https%3A%2F%2Fwww.perstorp.com%2F-%2Fmedia%2Ffiles%2Fperstorp%2Fmsds%2Fsodium%2520chloride%2Fmsds_sodium%2520chloride_eng-1694.pdf&usg=AFQjCNFEMgvTDBQ1IhghxJk_cPOtud4o7w
[RD22]	Perstop Safety data sheet according to 1907/2006/EC, Article 31 version 1. Sodium Sulphate. https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwihvoTMoq7TAhWIZ1AKHfO1BcAQFgglMAA&url=https%3A%2F%2Fwww.perstorp.com%2F-%2Fmedia%2Ffiles%2Fperstorp%2Fmsds%2Fsodium%2520sulphate%2Fmsds_sodium%2520sulphate_eng-4105.pdf&usg=AFQjCNHRZzpJj4qU6vrU6qxCxKh44t1sYw
[RD23]	https://www.carlroth.com/downloads/sdb/en/4/SDB_4411_GB_EN.pdf
[RD24]	https://echa.europa.eu/registration-dossier/-/registered-dossier/14234/6/1
[RD25]	Chronic NOEC. Japanese Ministry of the Environment
[RD26]	Saltwater PNEC. Guidance on the Biocidal Products Regulation Volume V, Guidance on Disinfection By-Products. European Chemicals Agency 2017. https://echa.europa.eu/documents/10162/23036412/bpr_guidance_vol_v_dbp_new_en.pdf/c7d11d09-8ae5-317f-0eeb-ec8b2aa938b3
[RD27]	https://echa.europa.eu/registration-dossier/-/registered-dossier/15360/6/2/2
[RD28]	Proposed EQS https://circabc.europa.eu/sd/a/53641c85-d467-4c03-9100-b5fddf8bbfce/Heptachlor%20EQS%20dossier%202011.pdf
[RD29]	Organohalegenated compound covered by https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20%20approach%20to%20revoked%20directives_Draft_160210.pdf

[RD30]	Algae - Acute 72 hour EC50, growth. http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/663.htm
[RD31]	Fish - Acute 96 hour LC50 http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/1532.htm
[RD32]	Aquatic invertebrates - Chronic 21 day NOEC http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/307.htm
[RD33]	Algae - Acute 72 hour EC50, growth http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/5.htm
[RD34]	Algae - Chronic 96 hour NOEC, growth http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/60.htm
[RD35]	Fish - Chronic 21 day NOEC http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/278.htm
[RD36]	Fish - Acute 96 hour LC50 http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/218.htm
[RD37]	Algae - Acute 72 hour EC50, growth (mg/l)) http://sitem.herts.ac.uk/aeru/ppdb/en/Reports/548.htm
[RD38]	PNECs in produced water (does not account for bioaccumulation) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/361476/OSPAR_RBA_Predicted_No_Effect_Concentrations__PNECs__Background_Document.pdf
[RD39]	PNEC saltwater organisms Sodium hypochlorite CAS No.: 7681-52-9 EINECS No.: 231-668-3 Summary risk assessment report

Appendix A

Sodium nitrite discharge modelling (an intermittent batch discharge during outages)

Sodium nitrite is used within the closed loop cooling water system as a corrosion inhibitor. There would be no discharge of sodium nitrite under normal operations, only during maintenance outages when the closed loop system would be drawn down as a batch discharge for release via the main cooling water discharge.

Average and maximum sodium nitrite concentrations would only exceed the PNEC (6µg/l in marine waters) during maintenance outages when the closed loop system is drawn down. The maximum concentration at point of discharge would be 24.8 µg/l.

As the closed loop system will contain a relatively small volume of water, the batch discharges would be discrete and only occur over a matter of a few days during an outage. At this time, the volume and pattern of release from the closed loop system have yet to be determined. As such, the modelling output presented in this sections represents a situation where sodium nitrite is represented as a constant daily release into the marine environment over a prolonged period (spring-neap- spring tidal sequence), to a point where the resulting plume has effectively reached a steady state. Consequently, the results presented in this section represent a worst case.

As sodium nitrite would be rapidly converted to sodium nitrate in the marine environment, a PNEC for sodium nitrate is also relevant here and equates to 45 µg/l[1] . The concentrations in the maintenance discharges would subsequently screen out relative to this.

The areas of sodium nitrite concentrations exceeding the PNEC equate to the following at the surface and bed:

Area exceeding PNEC at the bed (summer base case, to the nearest Ha)	Area exceeding PNEC at the surface (summer base case, to the nearest Ha)
1	47

Figures 1 and 2 demonstrate this on a spatial scale. It can be seen that the plume does not extend towards the neighbouring Cemaes or Cemlyn Bays.

The large difference between the two areas can be seen to be a function of the buoyant cooling water plume and demonstrates that in practice on a vertical scale, areas of exceedance would be a small proportion of the overall water depth.

In summary, the modelled output represents a worst case estimate as:

- Under likely outage conditions, the sodium nitrite concentrations would only exceed the PNEC during short term (i.e. of a few days' duration), discrete closed loop draw down

[1] http://www.askimya.net/lib/images/urunler/7822_sarimsi-beyaz-kristal_msds.pdf

discharges, on an annual scale, rather than as a continuous daily discharge over longer term periods (as presented in the modelling output);

- areas of PNEC exceedance during an outage would be a very small proportion of the overall water volume; and
- the sodium nitrite discharge will not behave conservatively (it will be subject to decay) and will be converted to sodium nitrate in the receiving waters. Therefore, the concentration will not exceed the PNEC of sodium nitrate.

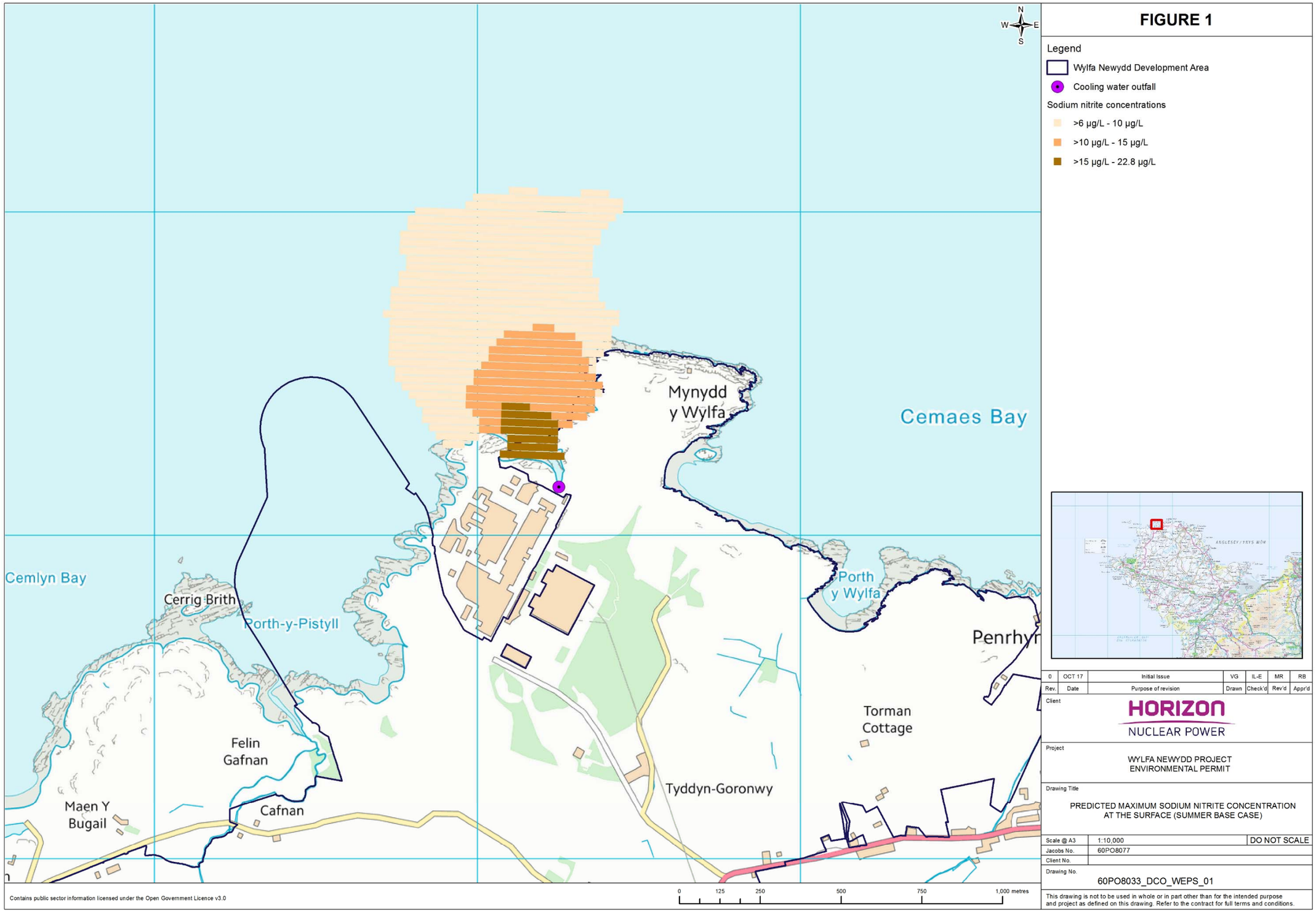

FIGURE 1

Legend

- Wylfa Newydd Development Area
- Cooling water outfall

Sodium nitrite concentrations

- >6 µg/L - 10 µg/L
- >10 µg/L - 15 µg/L
- >15 µg/L - 22.8 µg/L

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	OCT 17	Initial Issue	VG	IL-E	MR	RB

Client: HORIZON NUCLEAR POWER

Project: WYLFA NEWYDD PROJECT
ENVIRONMENTAL PERMIT

Drawing Title: PREDICTED MAXIMUM SODIUM NITRITE CONCENTRATION AT THE SURFACE (SUMMER BASE CASE)

Scale @ A3	1:10,000	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.		

Drawing No.: 60PO8033_DCO_WEPS_01

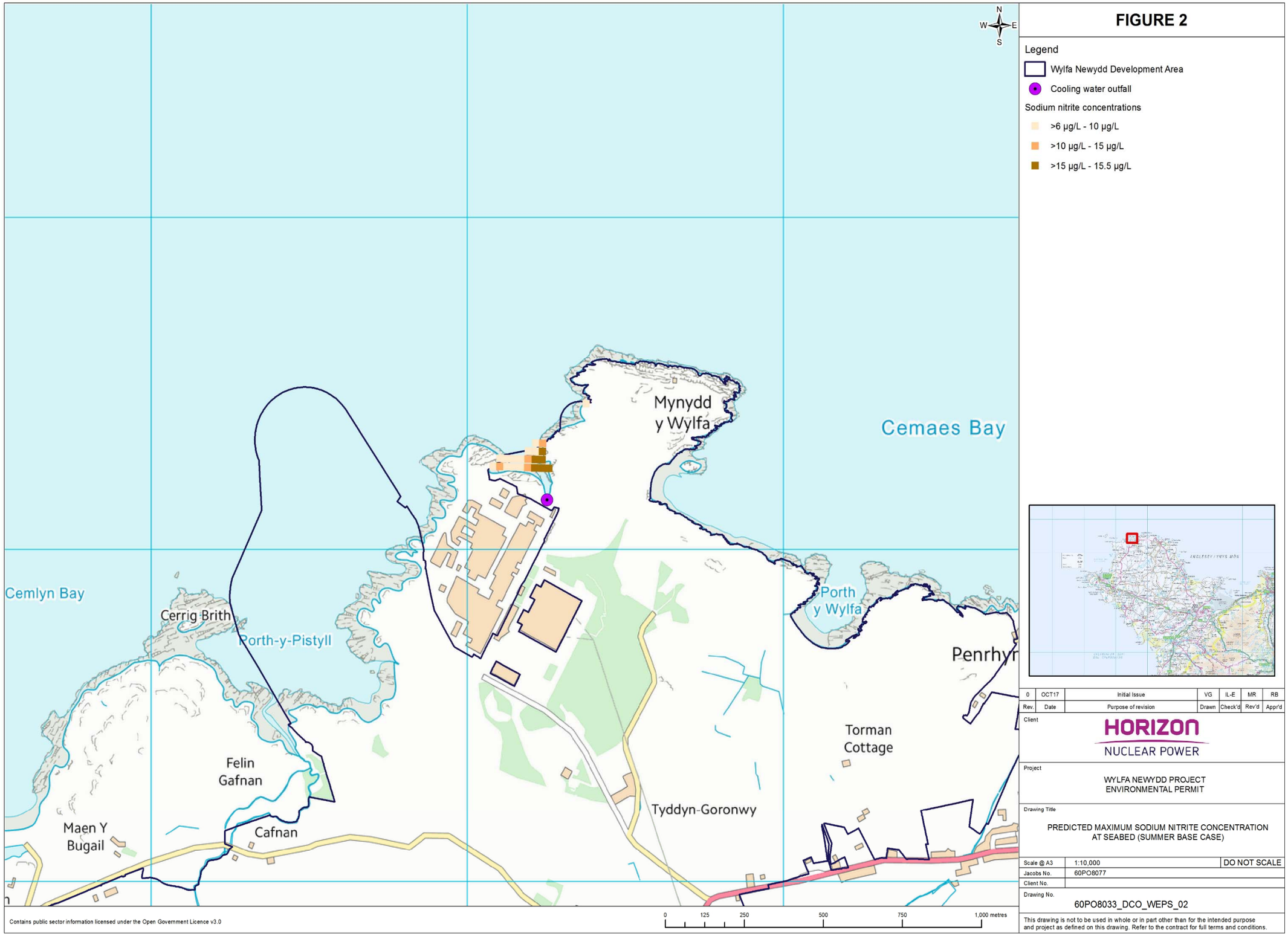

FIGURE 2

Legend

- Wylfa Newydd Development Area
- Cooling water outfall

Sodium nitrite concentrations

- >6 µg/L - 10 µg/L
- >10 µg/L - 15 µg/L
- >15 µg/L - 15.5 µg/L

Rev.	Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
0	OCT17	Initial Issue	VG	IL-E	MR	RB

Client: HORIZON NUCLEAR POWER

Project: WYLFA NEWYDD PROJECT
ENVIRONMENTAL PERMIT

Drawing Title: PREDICTED MAXIMUM SODIUM NITRITE CONCENTRATION AT SEABED (SUMMER BASE CASE)

Scale @ A3	1:10,000	DO NOT SCALE
Jacobs No.	60PO8077	
Client No.		

Drawing No.: 60PO8033_DCO_WEPS_02