DISPOSAL OF RAINWATER WITH TRACE LEVELS OF RADIOLOGICAL CONTAMINATION FROM HMNB (Devonport)

Tidal X Berth Effluent System

RADIOLOGICAL IMPACT ASSESSMENT

BAT/EPR/LB3730DK/2021-02

Issue 01: 22 Mar 2021

PURPOSE	This report contains the radiological impact assessment to support application of Approval variation as recommended by BAT Assessment BAT/EPR/LB3730DK/2021-02.
SCOPE	The scope of this assessment is limited to aqueous disposals to the River Tamar (Hamoaze) based on Environment Agency guidance on radiological impact assessment to support Permit applications.
CATEGORY	N/A

Production and Approval of Issue 01			
	Name	**Signature**	**Date**
Author	HP(P)	Signed on original.	
Checked	Asst-Hd RPA	Signed on original.	
Approval for issue	NSA Dep-Hd	Signed on original.	

1. Abbreviations

BAT	Best Available Techniques
DRDL	Devonport Royal Dockyard Limited
EA	Environment Agency
EPR	Environmental Permitting Regulations (England and Wales) 2016 (As Amended)
HMNB(D)	Her Majesty's Naval Base (Devonport)
IRAT2	Integrated Radiological Assessment Tool Version 2
MOD	Ministry of Defence
NBC(D)	Naval Base Commander (Devonport)
TXB	Tidal X Berth

2. Introduction

This assessment has been produced to support an application to vary HMNB Devonport's Approval granted by the Environment Agency (EA) in accordance with the Environmental Permitting Regulations (England and Wales) 2016 (As Amended) (EPR).

3. Scope

This report summarises the radiological impact assessment conducted in support of HMNB Devonport's application to vary EA Approval LB3730DK[1] to permit direct discharge of rainwater ingress from the Tidal X Berth effluent tank pits to the Hamoaze[2].

4. Background

This assessment includes the individual radiological impact calculated from the proposed disposal route and the collective radiological impact calculated from the Devonport site from both Devonport Royal Dockyard Limited[3] (DRDL) and HMNB Devonport Naval Base discharges.

Calculations have been undertaken for the proposed maximum permitted discharge limits using the Environment Agency's Initial Radiological Assessment Tool (IRAT2) and associated guidance[4].

The proposed change in effluent management processes is estimated to reduce operator doses at the Devonport Site by approximately 30 man µSv y^{-1}.

5. Radiological Impact Assessment

The table below shows the total annual aqueous discharge to water limits granted by the EA to both DRDL and HMNB Devonport, and the proposed new discharge limits, for discharge to the Hamoaze.

Table 1: Current and proposed annual limits for discharge of aqueous waste to the Hamoaze from the Devonport Site.

Operator	Radionuclide	Current Limit	New Limit
DRDL	^{3}H	700 GBq	700 GBq
	^{60}Co	0.8 GBq	0.8 GBq
	^{14}C	1.7 GBq	1.7 GBq
	Other	0.3 GBq	0.3 GBq
HMNB Devonport	^{3}H	Not permitted	0.1 GBq
	^{60}Co	Not permitted	0.001 GBq
	^{14}C	Not permitted	Not specified
	Other	Not permitted	0.01 GBq

1 EA Approval – EPR/LB3730DK 08 July 2020
2 BAT/EPR/LB3730DK/2021-01 I Disposal of Rainwater with Trace Levels of Radiological Contamination from HMNB (Devonport) Tidal X Berth Effluent System Best Available Techniques Assessment
3 EA Permit – EPR/BB3098DX 08 July 2020
4 LIT 15790 RSR Permitting – Prospective Radiological Impact Assessments for People and Wildlife

Using the IRAT2 model for discharge to estuary/coastal locations, the Tamar estuary (Hamoaze) coastal location was selected, giving an average exchange rate of 40.04 m3 s^{-1}. Assuming annual discharges at 100% of annual limits for all radionuclides the following radiological impact was calculated. For the joint Devonport site, it is assumed both DRDL and HMNB Devonport discharge 100% of their annual permitted limits.

Table 2: Current and new radiological impact assessment for aqueous discharge to the Hamoaze from the Devonport Site.

Operator	Exposure Pathway	Current Impact	New Impact	Change
DRDL	Population (Fisherman)	9.4 µSv y^{-1}	9.4 µSv y^{-1}	0
	Food	2.1 µSv y^{-1}	2.1 µSv y^{-1}	0
	Wildlife (coastal)	$2.6x10^{-2}$ µGy h^{-1}	$2.6x10^{-2}$ µGy h^{-1}	0
HMNB Devonport	Population (Fisherman)	0 µSv y^{-1}	$1.4x10^{-2}$ µSv y^{-1}	$1.4x10^{-2}$ µSv y^{-1}
	Food	0 µSv y^{-1}	$8.3x10^{-4}$ µSv y^{-1}	$8.3x10^{-4}$ µSv y^{-1}
	Wildlife (coastal)	0 µGy h^{-1}	$4.2x10^{-5}$ µGy h^{-1}	$4.2x10^{-5}$ µGy h^{-1}
Joint Devonport Site	Population (Fisherman)	9.4 µSv y^{-1}	9.4 µSv y^{-1}	<0.1 µSv y^{-1}
	Food	2.1 µSv y^{-1}	2.1 µSv y^{-1}	<0.1 µSv y^{-1}
	Wildlife (coastal)	$2.6x10^{-2}$ µGy h^{-1}	$2.7x10^{-2}$ µGy h^{-1}	<0.1 µGy h^{-1}

The calculated radiological impact results in the following net changes for the Devonport site:

Public dose – Fisherman (coastal) – 0.15% increase

Public dose – Food – 0.04% increase

Wildlife dose – coastal – 0.15% increase

The variation application introduces no other changes to discharge routes (for example sewer, gaseous etc.) for either HMNB Devonport or DRDL. For completeness the site radiological impact from these discharge routes is summarised below.

DRDL previously assessed the radiological impact of gaseous discharges from the DRDL site in support of a Permit Variation application in May 2016[5]. This assessed the total radiological impact to the representative person to be 0.12 µSv y^{-1}, an increase of 0.04 µSv y^{-1} due to an increase in the ^{14}C annual discharge limit of 23 GBq. HMNB Devonport is approved to discharge 1.5 GBq ^{14}C which corresponds to approximately 2.6 nSv y^{-1} to the representative person.

The combined site disposals to sewer have been assessed using IRAT2 to be 5.3 µSv y^{-1} worst case to a farming family. For comparison to the aqueous disposals to water radiological impact calculated, the dose to fishermen (representative person for estuary discharges) from disposals to sewer is calculated to be 0.62 µSv y^{-1}.

[5] DNESQ/SF/hd/QU30/401/02(16) Babcock (Devonport Royal Dockyard Limited) Submission for Increased Carbon-14 Discharge Level – Environmental Permit EPR/BB3098DX

The Environment Agency employ a multi-stage assessment process when assessing potential radiological impact of discharges. A summary of the six stages is as follows:

Stage one: Initial radiological assessment using default data

Stage two: Initial radiological assessment using refined data

Stage three: Determine the need for a detailed or site-specific radiological assessment

Stage four: Site-specific radiological assessment

Stage five: Consulting other agencies

Stage six: Maintaining multiple release radiological assessments

This assessment comprises the Stage one assessment, using IRAT2 and default data (maximum permissible discharge values) to calculate the initial impact assessment. The Environment Agency's guidance indicates that no further assessment is required if the Stage one assessment indicates the dose rate to members of the public is less than 20 µSv y^{-1} and the dose rate to wildlife is less than 1 µGy h^{-1}. The assessed impact for both the new discharge route and the total Devonport site are significantly below these values, therefore no further assessment is required.

The actual radiological environmental impact will be less than calculated as it is not envisaged that discharges will be at the annual limits, and the new HMNB Devonport discharges will be mirrored by a reduction is discharges from DRDL who currently receive and discharge the rainwater effluent. Additionally, IRAT2 makes limited use of site-specific discharge modelling, resulting in conservatisms in the calculations.

The change is predominantly related to the management of tritiated aqueous effluent. The ion exchange process used by DRDL to treat aqueous effluent prior to discharge provides no abatement for tritium, therefore there is very little benefit in processing this effluent via the ion exchange system.

Due to the insignificant radiological impact of the new discharge route, it is not considered practicable for DRDL to apply for a Permit variation alongside this variation application.

6. Conclusion

The radiological impact to both the public and wildlife from the new discharge route from HMNB(D) has been assessed using IRAT2 to be significantly less than the values which would require a more refined radiological impact assessment.

The increase in radiological impact is conservatively assessed to be <0.1 µSv y^{-1} to a member of the public. This is in contrast to an estimated reduction in annual operator dose accrual of 30 man µSv, and a more practical and environmentally sustainable management of rainwater ingress to subterranean pits housing the submarine effluent discharge system.

These changes will reduce the demand on the site's infrastructure, enabling more focussed effort on other radioactive waste arisings, reduces operational risk to the submarine programme and represent best value for money for the UK tax payer.