WASTE STREAM 3L119 Care and Maintenance Preparations: OWPF Secondary Wastes LLW

SITE	Heysham 1
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	LLW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m^3
Future arisings -	1.4.2022 - 31.3.2026.....	0 m^3
	1.4.2027 - 31.3.2028.....	20.0 m^3
	1.4.2028 - 31.3.2029.....	71.0 m^3
	1.4.2029 - 31.3.2030.....	71.0 m^3
	1.4.2030 - 31.3.2031.....	71.0 m^3
	1.4.2031 - 31.3.2032.....	43.0 m^3
	1.4.2032 - 31.3.2033.....	15.0 m^3
	1.4.2033 - 31.3.2034.....	60.0 m^3
Total future arisings:		351.0 m^3
Total waste volume:		351.0 m^3

Comment on volumes: Waste volumes will be variable depending on station operating conditions. Volumes based on Back to Bio Shield strategy. Work is ongoing looking at optimising the strategy which could lead to a change in volume and timings of arisings across Pre C&M wastes (100s) and Final Site Clearance wastes (300s), in future submissions.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.25
Stock (lower):	x	Arisings (lower)	x 0.75

WASTE SOURCE General solid decommissioning LLW arisings. Waste arising from plant dismantling and associated contamination control procedures.

PHYSICAL CHARACTERISTICS

General description:	A variety of mixed decommissioning materials, including metals, organics and other mixed materials
Physical components (%wt):	Mild steel (~16%), Organics (~76%), sludge (4%), Rubble (~4%)
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	~0.810
Comment on density:	Density based on raw volume and weight

CHEMICAL COMPOSITION

General description and components (%wt):	Mild steel (~16%), Organics (~76%), sludge (4%), Rubble (~4%)
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: To be Determined C-14: To be Determined Cl-36: To be Determined Se-79: To be Determined Tc-99: To be Determined I-129: To be Determined Ra: To be Determined Th: To be Determined U: To be Determined Np: To be Determined Pu: To be Determined
Metals and alloys (%wt):	Not estimated

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	NE		
Other ferrous metals	~16.0		
Iron	NE		
Aluminium	NE		
Beryllium	NE		
Cobalt	NE		
Copper	NE		
Lead	NE		
Magnox/Magnesium	NE		
Nickel	NE		
Titanium	NE		
Uranium	NE		
Zinc	NE		
Zircaloy/Zirconium	NE		
Other metals	NE		

Organics (%wt): Organics ~75.6%

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	~33.6		
Paper, cotton	~32.8		
Wood	~0.84		
Halogenated plastics	~16.8		
Total non-halogenated plastics	~16.8		
Condensation polymers	~8.4		
Others	~8.4		
Organic ion exchange materials	~0		
Total rubber	~8.4		
Halogenated rubber	~4.2		
Non-halogenated rubber	~4.2		
Hydrocarbons	NE		
Oil or grease	NE		
Fuel	NE		
Asphalt/Tarmac (cont.coal tar)	NE		
Asphalt/Tarmac (no coal tar)	NE		
Bitumen	NE		
Others	NE		
Other organics	NE		

Other materials (%wt): -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	NE		
Inorganic sludges and flocs.....	~4.2		
Soil.....	NE		
Brick/Stone/Rubble.....	~4.2		
Cementitious material.....	NE		
Sand.....	NE		
Glass/Ceramics.....	NE		
Graphite.....	NE		
Desiccants/Catalysts.....	NE		
Asbestos.....	NE		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	NE		
Free non-aqueous liquids.....	NE		
Powder/Ash.....	NE		

Inorganic anions (%wt): Not estimated.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: None expected.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	~0	

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Corrosive materials	0
Pyrophoric materials	0
Generating toxic gases	0
Reacting with water	0
Higher activity particles	0
Soluble solids as bulk chemical compounds	0

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide	NE	
Benzene	NE	
Chlorinated solvents	NE	
Formaldehyde	NE	
Organometallics	NE	
Phenol	0	
Styrene	NE	
Tri-butyl phosphate	0	
Other organophosphates	NE	
Vinyl chloride	NE	
Arsenic	0	
Barium	NE	
Boron	0	
Boron (in Boral)	NE	
Boron (non-Boral)	NE	
Cadmium	0	
Caesium	NE	
Selenium	NE	
Chromium	0	
Molybdenum	0	
Thallium	NE	
Tin	0	
Vanadium	0	
Mercury compounds	0	
Others	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1	0	
EEE Type 2	0	
EEE Type 3	0	
EEE Type 4	0	
EEE Type 5	0	

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Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids…….	NE	
Other organic complexants.....	NE	
Total complexing agents.....	0	

Potential for the waste to contain discrete items: No.

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	Off-site	~11.3
Incineration	Off-site	~65.8
Solidification		
Decontamination		
Metal treatment	Off-site	~9.3
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None	Off-site	~14.0

Comment on planned treatments: In line with the waste hierarchy, wastes will be treated preferentially by incineration, metal decontamination/melting, supercompaction, optimal packaging in HHISOs or immobilisation by encapsulation where necessary, prior to ultimate disposal at the LLW Repository. These treatments will be carried out off-site under contract with companies such as LLWR Ltd, Cyclife, Tradebe Inutec. The percentages are based on the history of consignments across the fleet of EDF Energy Nuclear Generation stations.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~25.0	
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	~65.8	
Expected to be consigned to a Metal Treatment Facility	~9.3	
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: -

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

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Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known			

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m³	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	~25.0	~15.46	6

Other information: Waste loading is representative of the raw waste following further planned treatments. Supercompaction assumed to reduce volume to 20% of original. Solidification assumed to increase volume to 300% of original. No treatment results in the same volume.

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

Waste consigned for disposal to LLWR in year of generation: Not yet determined.

Non-Containerised Waste for In-Vault Grouting:

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: Contamination of mixed materials from facility area

Uncertainty: Approximate estimates have been made of the total specific activities.

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Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed beta/gamma emitting radionuclides plus 'other beta/gamma' not listed on the datasheet
Measurement of radioactivities:	Calculations based on operational wastestreams. More detailed characterisation work will be undertaken as the arising of the waste gets closer.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			1.31E-04	C C 2	Gd 153				
Be 10					Ho 163				
C 14			2.07E-06	C C 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36			6.46E-06	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			5.10E-05	C C 2	Pb 205				
Fe 55			6.00E-05	C C 2	Pb 210				
Co 60			2.40E-05	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			6.26E-05	C C 2	Po 210				
Zn 65			9.78E-07	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			1.58E-05	C C 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94			1.78E-07	C C 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106			3.67E-06	C C 2	U 233				
Pd 107					U 234			1.6E-08	C C 2
Ag 108m			6.24E-07	C C 2	U 235				
Ag 110m			1.56E-07	C C 2	U 236			4E-09	C C 2
Cd 109					U 238			4E-09	C C 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238			4.68E-06	C C 2
Sn 123					Pu 239			2.80E-06	C C 2
Sn 126					Pu 240			6.64E-06	C C 2
Sb 125			1.59E-06	C C 2	Pu 241			2.66E-04	C C 2
Sb 126					Pu 242				
Te 125m					Am 241			1.97E-05	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			8.68E-06	C C 2	Cm 242			4.4E-08	C C 2
Cs 135					Cm 243			1.6E-08	C C 2
Cs 137			7.92E-04	C C 2	Cm 244			9.74E-07	C C 2
Ba 133			7.14E-07	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144			1.11E-06	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147			4.09E-04	C C 2	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152			1.49E-06	C C 2	Other b/g			8.14E-07	C C 2
Eu 154			6.64E-07	C C 2	**Total a**	**0**		**3.49E-05**	**C C 2**
Eu 155			4.26E-07	C C 2	**Total b/g**	**0**		**1.84E-03**	**C C 2**

Bands (Upper and Lower)

A a factor of 1.5
B a factor of 3
C a factor of 10
D a factor of 100
E a factor of 1000

Note: Bands quantify uncertainty in mean radioactivity.

Code

1 Measured activity
2 Derived activity (best estimate)
3 Derived activity (upper limit)
4 Not present
5 Present but not significant
6 Likely to be present but not assessed
7 Present in significant quantities but not determined
8 Not expected to be present in significant quantity