

<b>WASTE STREAM</b>	<b>9G112</b>	<b>Redundant Sealed Sources</b>
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**SITE** Trawsfynydd  
**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** LLW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	0 m <sup>3</sup>
Future arisings -	1.4.2030 - 31.3.2031.....	< 0.1 m <sup>3</sup>
Total future arisings:		< 0.1 m <sup>3</sup>
Total waste volume:		< 0.1 m <sup>3</sup>
Comment on volumes:	A small number of sources accounted for in future arisings maybe disposed of prior to 2030. Common volume assumption of 0.0002m3 per source (10cm x 10cm x 2cm) has been applied. Data from site source register shows 113 forecast future arisings.	
Uncertainty factors on volumes:	Stock (upper): x	Arisings (upper) x 1.2
	Stock (lower): x	Arisings (lower) x 0.8

**WASTE SOURCE** Redundant sealed sources used for a variety of purposes around the site.

**PHYSICAL CHARACTERISTICS**

General description: Various sealed sources. The sources are to be grouted in cementitious matrix into small paint-tin type containers before being placed in disposal containers.

Physical components (%wt): Plastic (60%), Paper (30%), Metal (10%)

Sealed sources: The waste contains sealed sources. 113 sources on register due to arise as waste at end of Care and Maintenance Preparations phase

Bulk density (t/m<sup>3</sup>): ~1

Comment on density: Density refers to sources on bases only, when they have been stripped of all extraneous materials, which are disposed of as non-active material. Redundant sources will then be encapsulated for disposal as LLW.

**CHEMICAL COMPOSITION**

General description and components (%wt): Plastic bases for sources are mainly PVC. Metal bases mainly Stainless Steel. Plastic (60%), Paper (30%), Metal (10%).

Chemical state: -

Chemical form of radionuclides:  
H-3: Tritium is not present  
C-14: The chemical form of the C14 is not known  
Se-79: Selenium is not present  
Tc-99: Technetium is not present  
Ra: The chemical form of the radium is not known  
Th: The chemical form of the Thorium is not known  
U: Uranium is not present  
Np: Neptunium is not present  
Pu: The chemical form of the plutonium is not known

Metals and alloys (%wt): Small source capsules and thin mild steel.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~10.0		
Other ferrous metals.....	0		
Iron.....			
Aluminium.....	0		
Beryllium.....			
Cobalt.....			

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Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~30.0		
Paper, cotton.....	~30.0		
Wood.....			
Halogenated plastics .....	60.0	PVC	
Total non-halogenated plastics.....	NE		
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	0		
Total rubber.....	~0		
Halogenated rubber .....	NE		
Non-halogenated rubber.....	NE		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	0		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			

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Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	NE	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	NE	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: -

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

Hazardous substances / non hazardous pollutants: None

	(%wt)	Type(s) and comment
Acrylamide.....		

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

Complexing agents (%wt):      No

(%wt)      Type(s) and comment

EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents..... 0

Potential for the waste to contain discrete items:      Not yet determined. Subject to DI type assessment (specific clauses within WAC)

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**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None		100.0

Comment on planned treatments:

Sources will be stripped of all extraneous material and encapsulated in grout in "paint-tin" type containers. The majority of sources are LLW but the possibility remains that some may be ILW and have to be treated as such. This is under review.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
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	100.0	2.4

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):**

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:**

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Container	Stream volume %	Waste loading m <sup>3</sup>	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	100.0	15.5	< 1

Other information:                      Only one paint-tin type container is allowed per disposal container for sealed sources. It is expected that this stream will be disposed with other LLW streams. Waste will not be drummed and supercompacted but encapsulated into 100ml grout.

**Waste Planned for Disposal at the LLW Repository:**

Container voidage:                      Significant inaccessible voidage is not expected.

Waste Characterisation Form (WCH):                      The waste meets the LLWR's Waste Acceptance Criteria (WAC).  
The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation:                      No. Only one paint tin sized container of encapsulated sources can be disposed of per HHISO so timings of waste disposal are to be spread over a number of years.

**Non-Containerised Waste for In-Vault Grouting:**      (Not applicable to this waste stream)

Stream volume (%):                      -

Waste stream variation:                      -

Bounding cuboidal volume:

Inaccessible voidage:                      -

Other information:                      -

**RADIOACTIVITY**

Source:                                      Redundant sealed sources used for a variety of purposes around the power station site.

Uncertainty:                              Data taken from site source register and decayed to common stock reference date/start date of first arising

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 alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.

Measurement of radioactivities:                      Data on specific activities is obtained from site records.

Other information:                      -

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			8.37E-05	BB 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.95E-04	BB 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.75E-05	BB 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			1.73E-02	BB 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			2.47E+00	BB 2	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226		5.14E-01	BB 2	8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			9.13E-02	BB 2	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232		9E-06	BB 2	8
Nb 94				8	Th 234				8
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				6
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238				8
Sn 123				8	Pu 239				8
Sn 126				8	Pu 240				8
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		2.38E-06	BB 2	8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			8.38E-01	BB 2	Cm 244				8
Ba 133			7.31E-04	BB 2	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152			9.15E-05	BB 2	Other b/g				
Eu 154				8	<b>Total a</b>	<b>0</b>	<b>5.14E-01</b>	<b>BB 2</b>	
Eu 155			5.52E-05	BB 2	<b>Total b/g</b>	<b>0</b>	<b>3.42E+00</b>	<b>BB 2</b>	

**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