

**WASTE STREAM****9H18****Miscellaneous Activated Components**

**SITE** Wylfa  
**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** ILW; SPD3

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	268.2 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		268.2 m <sup>3</sup>

Comment on volumes: The volumes given include small quantities of miscellaneous contaminated items which are accumulated with the activated components and are not included elsewhere in the Inventory.

Uncertainty factors on volumes:	Stock (upper):	x 1.2	Arisings (upper)	x
	Stock (lower):	x 0.9	Arisings (lower)	x

**WASTE SOURCE** Irradiated components removed from the reactors.

**PHYSICAL CHARACTERISTICS**

General description: Redundant or defective components such as absorber bars, fuelling machine equipment (ropes and grabs etc), thermocouple wires, BCD equipment (Pressure Safety Valves) and other debris. The presence of items that may require special handling has not been fully assessed.

Physical components (%vol): Absorber bars (~50%), BCD equipment (~10%), fuelling machine equipment (~30%) and other items (~10%).

Sealed sources: The waste does not contain sealed sources.

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

Comment on density: The assumption of 1 t/m<sup>3</sup> as the average bulk density may be subject to revision.

**CHEMICAL COMPOSITION**

General description and components (%wt): Principally steel (>90%), other components are not assessed.

Chemical state: Neutral

Chemical form of radionuclides: H-3: The tritium is likely to be incorporated in the steel.  
 C-14: Carbon 14 is principally incorporated in steel. There may also be some graphite contamination.  
 Cl-36: Chemical form of chlorine 36 has not been determined.  
 Se-79: The selenium content is insignificant.  
 Tc-99: The chemical form of technetium has not been determined.  
 Ra: The radium isotope content is expected to be insignificant.  
 Th: The thorium isotope content is insignificant.  
 U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.  
 Np: The neptunium content is insignificant.  
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Metal thicknesses have not been fully assessed, but bulk metal items are present.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	<1.0		
Other ferrous metals.....	>90.0		100.0
Iron.....			
Aluminium.....	<1.0		

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Beryllium.....	0	
Cobalt.....		
Copper.....	TR	
Lead.....	0	
Magnox/Magnesium.....	TR	
Nickel.....	P	Chromium and nickel will be present as alloy constituents.
Titanium.....		
Uranium.....		
Zinc.....	TR	
Zircaloy/Zirconium.....	TR	
Other metals.....	0	There are no "other" metals expected.

Organics (%wt):                      No organic material expected.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics .....	0		
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	0		
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.....	TR		
Cementitious material.....	TR		
Sand.....			

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Glass/Ceramics.....	0
Graphite.....	TR
Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	TR
Powder/Ash.....	TR

Inorganic anions (%wt):           None expected, possibly trace quantities.

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

Materials of interest for waste acceptance criteria:           There are no materials identified in the waste likely to present a fire or other non-radiological hazard.

	(%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.....		
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.....		

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Hazardous substances /  
non hazardous pollutants:      None expected.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....		
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....	P	Chromium and nickel will be present as alloy constituents.
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	

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Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs

**PACKAGING AND CONDITIONING**

Conditioning method: The waste is not expected to be supercompacted. The treatment envisaged is the placement of the waste in baskets followed by encapsulation.

Plant Name: None

Location: Wylfa Power Station

Plant startup date: 2098

Total capacity (m<sup>3</sup>/y incoming waste): ~5000.0

Target start date for packaging this stream: 2098

Throughput for this stream (m<sup>3</sup>/y incoming waste): ~45.0

Other information: The current proposal is that waste will remain as it is until Final Site Clearance.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	4m box (no shielding)	100.0	16.2	18.9	17

Likely container type comment: The container choice may be influenced by the Transport Regulations at the time of Final Site Clearance. The waste is assumed to be in baskets in the waste packages, so the occupied volume in the package is greater than the original waste volume.

Range in container waste volume: Not yet determined. No significant variability is expected.

Other information on containers: The container material is expected to be stainless steel.

Likely conditioning matrix: Blast Furnace Slag / Ordinary Portland Cement

Other information: The waste is assumed to be encapsulated.

Conditioned density (t/m<sup>3</sup>): ~3.0

Conditioned density comment: The conditioned waste density assumes that the waste will be encapsulated.

Other information on conditioning: The waste will be in baskets placed in the waste packages. Baskets of different Final Dismantling ILW wastes may be in the same waste packages. The encapsulation matrix would be likely to be BFS/OPC. The density of the encapsulated waste would probably be about 3 t/m<sup>3</sup>.

Opportunities for alternative disposal routing: -

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

**RADIOACTIVITY**

Source: Irradiated components removed from the reactor. There are also some contaminated components. Absorber bars are likely to be components of high activity, the majority of the activity being activation products.

Uncertainty: Specific activity is a function of Station operating history. The values quoted are indicative of the activities that may be expected.

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

Measurement of radioactivities:

Estimates are based upon theoretical assessments.

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	<2.55E+00	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-02	CD 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3E-05	CC 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	1.20E-05	CD 2			Pb 205		8		
Fe 55	9.44E+00	CD 2			Pb 210		8		
Co 60	4.13E+00	CD 2			Bi 208		8		
Ni 59	4E-02	CD 2			Bi 210m		8		
Ni 63	3.68E+00	CD 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	<4.50E-05	D 3			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		8		
Nb 94	4E-05	CD 2			Th 234	7E-09	CD 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	<1E-08	D 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	<6.09E-09	D 3		
Ag 108m	3.92E-05	CD 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	<7E-09	D 3		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	<2.73E-06	D 3		
Sn 123		8			Pu 239	<3E-06	D 3		
Sn 126		8			Pu 240	<4.00E-06	D 3		
Sb 125		8			Pu 241	<1.13E-04	D 3		
Sb 126		8			Pu 242	<2E-09	D 3		
Te 125m		8			Am 241	<1.17E-05	D 3		
Te 127m		8			Am 242m	<1.88E-08	D 3		
I 129		8			Am 243	<6.00E-09	D 3		
Cs 134	<7.12E-08	D 3			Cm 242	<1.55E-08	D 3		
Cs 135		8			Cm 243	<4.55E-09	D 3		
Cs 137	<1.52E-04	D 3			Cm 244	<1.27E-07	D 3		
Ba 133		8			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	<3.36E-07	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<8.20E-07	D 3			Other a				
Eu 152	1.08E-05	CD 2			Other b/g				
Eu 154	1.14E-05	CD 2			<b>Total a</b>	<b>2.16E-05</b>	<b>CC 2</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>1.99E+01</b>	<b>CC 2</b>	<b>0</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