WASTE STREAM 9H310 Mild Steel (Reactor) ILW

SITE Wylfa

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m³
Future arisings -	1.4.2101 - 31.3.2106.....	371.0 m³
Total future arisings:		371.0 m³
Total waste volume:		371.0 m³

Comment on volumes: For inventory purposes the arisings are assumed to arise at a uniform rate over five years. Final Dismantling & Site Clearance is assumed to commence in 2097 with reactor dismantling commencing in 2101 and lasting for 5 years. The volumes and radioactivity have been calculated for 85 years after reactor shutdown, i.e.2100 .

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.2
Stock (lower): x Arisings (lower) x 0.8

WASTE SOURCE Mild steel items from the reactor structure.

PHYSICAL CHARACTERISTICS

General description: A variety of mild steel items. Waste can be packaged in standard NDA packages.

Physical components (%wt): Mild steel items (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.4

Comment on density: The density is of the waste as cut for packaging.

CHEMICAL COMPOSITION

General description and components (%wt): Mild steel (100%).

Chemical state: Neutral

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

Metals and alloys (%wt): All of the waste will be bulk metal items which have been cut for packaging. Metal thicknesses will probably range from a few mm to about 100 mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	100.0	Mild steel type is BS15.	100.0
Iron.....			
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	<0.03	Data based on test specimens of a	

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		general Magnox reactor pressure vessel.
Copper	0	
Lead	0	
Magnox/Magnesium	0	
Nickel	<0.15	Data based on test specimens of a general Magnox reactor pressure vessel.
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	0	
Other metals	TR	Silver and niobium.

Organics (%wt): None expected. There are no halogenated plastics and rubbers present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	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): Some graphite dust may be associated with reactor materials.

	(%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		

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

Inorganic anions (%wt): There may be a trace of chloride present.

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

Materials of interest for waste acceptance criteria: No materials likely to pose a fire or other non-radiological hazard have been identified.

	(%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.....		
Molybdenum.....	<0.03	Data based on test specimens of a general Magnox reactor pressure vessel.
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): Yes

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

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Potential for the waste to contain discrete items:	Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs. NB If recycled then DI Limits n/a

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:	2101
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	2101
Throughput for this stream (m^3/y incoming waste):	28.5
Other information:	The processing strategy has not yet been determined.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
4m box (no shielding)	100.0	16.2	18.9	23

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 package 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^3):	~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 & Site Clearance ILW wastes may be in the same waste package. The encapsulation matrix is likely to be BFS/OPC. Data have been presented as if the waste will be placed in a container with other ILW.
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:	Activation of the mild steel and its impurities.
Uncertainty:	The values quoted were derived by calculation from available material specifications and are indicative of the activities that are to be expected. The major source of uncertainty is the impurity levels.

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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:	The specific activities were estimated from neutron activation calculations of the material and its impurities.
Other information:	The activities quoted are those at 85 years after reactor shutdown. There may be some contamination by Cs137.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.64E-02	C C 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			2.92E-06	C C 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			3.69E-08	C C 2
Mn 54				8	Pb 205				8
Fe 55			8.15E-08	C C 2	Pb 210				8
Co 60			1.08E-04	C C 2	Bi 208				8
Ni 59			1.37E-03	C C 2	Bi 210m				8
Ni 63			7.81E-02	C C 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				8	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92			2.34E-09	C C 2	Th 230				8
Nb 93m				6	Th 232				8
Nb 94			7.59E-06	C C 2	Th 234				8
Mo 93			1.48E-04	C C 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			3.35E-05	C C 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			1.07E-05	C C 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
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				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				6	Cm 244				8
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				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152				8	Other b/g				
Eu 154				8	**Total a**	**0**		**0**	
Eu 155				8	**Total b/g**	**0**		**9.62E-02**	**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