

WASTE STREAM	9G34/C	FED Magnox
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SITE Trawsfynydd

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	37.7 m ³	42.5 m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		37.7 m ³	42.5 m ³
Number of waste packages in stock:	At 1.4.2022.....	13 package(s)	
Comment on volumes:	-		
Uncertainty factors on volumes:	Stock (upper):	x 1.0	Arisings (upper) x
	Stock (lower):	x 1.0	Arisings (lower) x

WASTE SOURCE The source of the waste is the removal of splitters from fuel elements prior to dispatch of the elements to Sellafield.

PHYSICAL CHARACTERISTICS

General description: The waste mainly consists of Magnox metal which may be contaminated by fission products and actinides. The waste is conditioned and packaged in 3m³ stainless steel boxes.

Physical components (%wt): Grout (84.7% wt), Magnox ZR55 (11.5% wt), Magnox MN80 (3.52% wt), Zircaloy (0.12% wt), Nimonic 80A (0.19% wt) and other materials (~1% wt).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 2.29

Comment on density: The density of 2.29 Te/m³ is calculated using the known wastefrom masses and the wastefrom volumes.

CHEMICAL COMPOSITION

General description and components (%wt): Grout (84.7% wt), Magnox ZR55 (11.5% wt), Magnox MN80 (3.52% wt), Zircaloy (0.12% wt), Nimonic 80A (0.19% wt) and other materials (~1% wt).

Chemical state: Alkali

Chemical form of radionuclides:
 H-3: Tritium is expected to be present as surface contamination, possibly as water but perhaps in the form of other inorganic or organic compounds.
 Cl-36: Chlorine 36 incorporated in the Magnox may be associated with barium impurity (barium chloride), other chlorine 36 may be associated with surface contamination.
 Se-79: The selenium content is insignificant.
 Tc-99: The chemical form of technetium has not been determined.
 Ra: Radium isotope content is not significant.
 Th: The thorium isotope content is insignificant.
 U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The chemical form of neptunium has not been determined.
 Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): There are no bulk metal items present in this waste stream.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0.06	Weak link brace	
Other ferrous metals.....	<0.01	Mild steel (fuel pot).	
Iron.....			
Aluminium.....	0		
Beryllium.....	TR		
Cobalt.....			
Copper.....	0		
Lead.....	0		
Magnox/Magnesium.....	15.0	11.47 wt% Magnox alloy ZR55, which contains 0.55 wt% Zr as an alloying constituent from splitters/braces. 3.518 wt% Magnox alloy MN80 from top end fittings.	
Nickel.....	0.19	Nimonic 80A (spring).	
Titanium.....			
Uranium.....	<0.01	Fuel	
Zinc.....			
Zircaloy/Zirconium.....	0.12	Zircaloy from top end fitting inserts (pin).	
Other metals.....	0		

Organics (%wt): There may be organics present in trace quantities. There are no halogenated plastics or rubbers present with the waste.

	(%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.....	TR		

Other materials (%wt): Expect traces of graphite.

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	(%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.....	84.7	Grout (9:1 BFS/OPC)	
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	TR		

Inorganic anions (%wt): Inorganic anions are not expected to be present at greater than trace concentrations.

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

Materials of interest for waste acceptance criteria: Magnox will ignite under appropriate conditions.

	(%wt)	Type(s) and comment
Combustible metals.....	15.0	
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.....		

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Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	15.0
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / None expected
non hazardous pollutants:

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

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Complexing agents (%wt): Yes

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

Potential for the waste to contain discrete items: Not yet determined. For a LLWR Disposal HDRIs MUST be removed so n/a; however for an NSD/GDF context they could remain (but then DI Limits n/a)

PACKAGING AND CONDITIONING

Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	3m ³ box (round corners)	100.0	2.9	2.9	13

Container type comment: -

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

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

Conditioned density (t/m³): 2.29

Conditioned density comment: The conditioned density is calculated using the known waste package mass and package volume.

Other information on conditioning: Waste streams 9G34 and 9G40 will be processed as a single waste for disposal as ILW. Nimonic springs are distributed throughout the waste.

RADIOACTIVITY

Source: The source of the waste is the removal of splitters from fuel elements prior to dispatch of the elements to Sellafield. Activation of trace nuclides in the Magnox and contamination by fission products and actinides will be main sources of activity.

Uncertainty: The values quoted are indicative of the activities that might be expected.

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: Values are from the inventory of the South Magnox Vault Packages 1-13 and the wastestream volume.

Other information: -

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	5.39E-03	CC 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.62E-04	CC 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.72E-06	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		8			Pb 205		8		
Fe 55	9.77E-06	CC 2			Pb 210		8		
Co 60	1.3E-02	CC 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	5.75E-01	CC 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	7.93E-08	CC 2			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	6.09E-03	CC 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		8		
Nb 94		8			Th 234	1.83E-06	CC 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	4.71E-09	CC 2		
Tc 99	2.41E-06	CC 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	2.39E-06	CC 2		
Ag 108m	2.95E-06	CC 2			U 235	6.9E-08	CC 2		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	1.83E-06	CC 2		
Cd 113m		8			Np 237	4.76E-09	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	4.11E-04	CC 2		
Sn 123		8			Pu 239	2.96E-04	CC 2		
Sn 126		8			Pu 240	3.79E-04	CC 2		
Sb 125	7.39E-08	CC 2			Pu 241	2.84E-03	CC 2		
Sb 126		8			Pu 242		8		
Te 125m	1.85E-08	CC 2			Am 241	1.35E-03	CC 2		
Te 127m		8			Am 242m		8		
I 129	7.59E-09	CC 2			Am 243		8		
Cs 134	4.81E-08	CC 2			Cm 242		8		
Cs 135		8			Cm 243	1.12E-06	CC 2		
Cs 137	6.96E-03	CC 2			Cm 244	1.54E-05	CC 2		
Ba 133	1.34E-06	CC 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	4.14E-06	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Other a				
Eu 152	4.12E-06	CC 2			Other b/g				
Eu 154	1.42E-05	CC 2			Total a	2.46E-03	CC 2	0	
Eu 155	7.86E-07	CC 2			Total b/g	6.09E-01	CC 2	0	

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