WASTE STREAM 9D41/1 FED Magnox - R1

SITE Hinkley Point A

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.....	78.0 m³
Total future arisings:		0 m³
Total waste volume:		78.0 m³

Comment on volumes: In calculating the volumes it has been assumed that the waste has a bulk density of 0.5t/m3. The total volume of waste is not known until the waste is retrieved; however it is anticipated to be between 60m3 and 96m3.

Uncertainty factors on volumes:

Stock (upper):	x 1.3	Arisings (upper)	x
Stock (lower):	x 0.7	Arisings (lower)	x

WASTE SOURCE Removal of splitters from fuel elements prior to dispatch of the elements to Sellafield.

PHYSICAL CHARACTERISTICS

General description: The waste consists of Magnox metal and swarf. Individual components may weigh up to about 100 g and be approx. 2 mm x 25 mm x (75-900) mm. Nimonic springs will also be present (see waste stream 9D43). There are no large items in the waste which will require special handling.

Physical components (%wt): Magnox metal (Zr 55), magnesium hydroxide, magnesium carbonate (99.5% wt). Small quantities of zirconium alloy (0.5% wt) in fuel element top end fittings.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.5

Comment on density: The bulk density of the waste ranges from 0.1 to 1.7 t/m3 with an average density of 0.5 t/m3. The packing factor will be variable.

CHEMICAL COMPOSITION

General description and components (%wt): Magnox Metal (Zr 55) (99.5% wt), zirconium alloy (0.5% wt) in fuel element top end fittings. Activation of trace components within the Magnox. Fission product and actinide contamination. Magnesium carbonate and hydroxide may also be present.

Chemical state: Alkali

Chemical form of radionuclides: H-3: Most tritium is expected to be present as surface contamination, possibly as water but perhaps in the form of other inorganic compounds or as organic compounds.
C-14: Carbon 14 will probably be present as graphite.
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: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: The chemical form of uranium isotopes may be uranium oxides.
Np: The chemical form of neptunium has not been determined.
Pu: The chemical form of plutonium isotopes may be plutonium oxides.

Metals and alloys (%wt): No bulk metal items expected.

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

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Beryllium	TR	
Cobalt		
Copper	0	
Lead	0	
Magnox/Magnesium	~99.5	Magnox alloy Zr 55, contains 0.55 wt% zirconium as an alloying constituent.
Nickel		
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	~0.50	
Other metals	TR	Manganese.

Organics (%wt): There may be organics present in trace quantities. Halogenated plastics or rubbers are not expected.

	(%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): Probably traces of graphite.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	0		
Inorganic sludges and flocs	NE		
Soil	0		
Brick/Stone/Rubble	0		
Cementitious material	0		
Sand			

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

Inorganic anions (%wt): Magnesium carbonate and hydroxide are anticipated.

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

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

	(%wt)	Type(s) and comment
Combustible metals	~99.5	
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	~99.5	
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.....	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): 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. In & of itself not a DI; Will likely contain "rogue" items (HDRIs) that will be (see Nimonic/Others)

PACKAGING AND CONDITIONING

Conditioning method: Loading of solids into standard 210-litre drum. Compacted drum 'pucks' pre-loaded into Mortuary Tubes in RCB.

Plant Name: -

Location: Hinkley Point A Site

Plant startup date: -

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): -

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
6m^3 concrete box (SD)	100.0	5.2	5.8	15

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

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: 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'.

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Measurement of radioactivities:	Values were derived from measurements, calculations of induced activity and estimates of likely contamination. Allowance has been made for zirconium alloy in top end fittings.
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	6.65E-03	C C 2			Gd 153		8		
Be 10	2.04E-07	C C 2			Ho 163	1.81E-08	C C 2		
C 14	5.56E-04	C C 2			Ho 166m	2.37E-05	C C 2		
Na 22		8			Tm 170		8		
Al 26	2.91E-05	C C 2			Tm 171		8		
Cl 36	1.95E-05	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40	<3.5E-06	C 3			Hf 182		8		
Ca 41	1.61E-07	C C 2			Pt 193		8		
Mn 53		8			Tl 204	8.76E-07	C C 2		
Mn 54	<1.37E-08	C 3			Pb 205		8		
Fe 55	8.2E-06	C C 2			Pb 210		8		
Co 60	1.89E-04	C C 2			Bi 208		8		
Ni 59	1.64E-05	C C 2			Bi 210m		8		
Ni 63	1.50E-03	C C 2			Po 210		8		
Zn 65	<1.50E-08	C 3			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	8.67E-03	C C 2			Th 227		8		
Zr 93	3.43E-09	C C 2			Th 228	1.37E-06	C C 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	3.05E-06	C C 2			Th 232		8		
Nb 94	6.73E-08	C C 2			Th 234	<5.82E-07	C 3		
Mo 93	6.47E-09	C C 2			Pa 231		8		
Tc 97		8			Pa 233	1.33E-06	C C 2		
Tc 99	3.58E-05	C C 2			U 232	1.76E-06	C C 2		
Ru 106	3.98E-07	C C 2			U 233	<2.45E-06	C 3		
Pd 107		8			U 234	1.13E-06	C C 2		
Ag 108m	1.95E-06	C C 2			U 235	1.56E-08	C C 2		
Ag 110m	<8.5E-09	C 3			U 236	7.74E-08	C C 2		
Cd 109	<5.49E-07	C 3			U 238	5.82E-07	C C 2		
Cd 113m	2.27E-05	C C 2			Np 237	<1.33E-06	C 3		
Sn 119m		8			Pu 236		8		
Sn 121m	1.36E-05	C C 2			Pu 238	1.39E-04	C C 2		
Sn 123		8			Pu 239	2.52E-04	C C 2		
Sn 126		8			Pu 240	2.58E-04	C C 2		
Sb 125	4.39E-09	C C 2			Pu 241	3.15E-03	C C 2		
Sb 126		8			Pu 242	1.36E-06	C C 2		
Te 125m	1.1E-09	C C 2			Am 241	9.61E-04	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134		8			Cm 242	3.88E-09	C C 2		
Cs 135		8			Cm 243	2.85E-07	C C 2		
Cs 137	9.30E-04	C C 2			Cm 244	3.30E-06	C C 2		
Ba 133	6.62E-06	C C 2			Cm 245		8		
La 137	1.73E-09	C C 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	<5.01E-08	C 3			Cf 249		8		
Pm 145	2.39E-07	C C 2			Cf 250		8		
Pm 147	3.16E-06	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	7.78E-04	C C 2			Other a				
Eu 152	4.07E-06	C C 2			Other b/g				
Eu 154	2.71E-05	C C 2			**Total a**	**1.62E-03**	**C C 2**	**0**	
Eu 155	8.13E-08	C C 2			**Total b/g**	**2.26E-02**	**C C 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