

WASTE STREAM**9R02****Miscellaneous ILW**

SITE Berkeley

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.....	11.0 m ³
Total future arisings:		0 m ³
Total waste volume:		11.0 m ³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

WASTE SOURCE

The waste is redundant equipment and material usually arising from examination of irradiated fuel, steel and graphite and there may be items resulting from the refurbishing of facilities, irradiated fuel handling and pond operations. This waste includes 8.468m³ of PIE waste that is the responsibility of EDF Energy.

PHYSICAL CHARACTERISTICS

General description: Graphite moderator sample waste, Magnox surveillance sample set carriers, irradiated steels. Filters, contaminated machine components and service materials. Waste will generally be compacted into 0.056 m³ or 0.028 m³ drums. There are no items that might require special handling.

Physical components (%wt): Metal (~50% wt), glassware (~3% wt), Filters (~10% wt), Plastic/rubber (~30% wt), Graphite (~7% wt). The metal content includes the drums containing the waste.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.6

Comment on density: The density of the waste as contained in 0.056 m³ and 0.028 m³ drums is estimated to be 0.6 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is expected to be principally steel and ferrous metals (~30%), low carbon stainless steel drums (~20%), lead (~2%), glass (~3%), Glass fibre (~4%) and epoxy resin (~4%) plastics and rubbers (~30%), and graphite (~7%). Fission products, actinides and other activation products will be present as contaminants.

Chemical state: Neutral

Chemical form of radionuclides:
 H-3: The chemical form of tritium has not been determined.
 C-14: Carbon 14 will be predominantly in the form of graphite with some incorporated in the steel or as contamination.
 Cl-36: The chemical form of chlorine 36 has not been determined.
 Se-79: The selenium content is insignificant.
 Tc-99: The technetium content is insignificant.
 Ra: Radium isotopes are not present.
 Th: The thorium content is insignificant.
 U: Uranium isotopes are expected to be present in the form of metal and uranium oxides.
 Np: The neptunium content is insignificant.
 Pu: Plutonium isotopes are expected to be present possibly in the form of plutonium metal or plutonium oxides.

Metals and alloys (%wt): There is no sheet metal present apart from drums containing the waste.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~30.0		
Other ferrous metals.....	~20.0		
Iron.....			
Aluminium.....	<1.0		
Beryllium.....	0		
Cobalt.....	<1.0	Stellite	
Copper.....	<1.0		
Lead.....	~2.0		
Magnox/Magnesium.....	<1.0		
Nickel.....	<1.0	Inconel	
Titanium.....			
Uranium.....			
Zinc.....	<1.0		
Zircaloy/Zirconium.....	<1.0		
Other metals.....	<1.0	"Other" metals have not been identified.	

Organics (%wt): Epoxy resin is present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	TR		
Paper, cotton.....	TR		
Wood.....	0		
Halogenated plastics	~5.0		
Total non-halogenated plastics.....	~24.0		
Condensation polymers.....	~4.0		
Others.....	~20.0		
Organic ion exchange materials....	0		
Total rubber.....	~5.0		
Halogenated rubber	~2.5		
Non-halogenated rubber.....	~2.5		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	TR		

Other materials (%wt): -

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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.....	0		
Sand.....			
Glass/Ceramics.....	~3.0		
Graphite.....	~7.0		
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): The inorganic anion content of the waste is anticipated in trace levels only.

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

Materials of interest for waste acceptance criteria: Magnox is present in the waste in very small quantities, and can ignite under the appropriate conditions.

	(%wt)	Type(s) and comment
Combustible metals.....	<1.0	
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.....	<1.0
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / non hazardous pollutants: Lead will be present in small quantities.

	(%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.....	TR	Decontamination agents may be present in trace quantities.
Total complexing agents.....	TR	

Potential for the waste to contain discrete items: Not yet determined. In & of itself not a DI; waste stream may include DIs (notably any stainless steel components)

PACKAGING AND CONDITIONING

Conditioning method: To be co-packaged with 9R10, 9R13, 9R17, 9R19, 9R101, 9R112, 9R118. Packages are assigned to 9R02 & 9R101.

- Plant Name: -
- Location: -
- Plant startup date: -
- Total capacity (m³/y incoming waste): -
- Target start date for packaging this stream: -
- Throughput for this stream (m³/y incoming waste): -
- Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	500 l RS drum (0mm Pb)	100.0	~1.834	0.49	6

- Likely container type comment: -
- Range in container waste volume: -
- Other information on containers: -
- Likely conditioning matrix: -
- Other information: -
- Conditioned density (t/m³): -
- Conditioned density comment: -
- Other information on conditioning: -
- Opportunities for alternative disposal routing: -

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

Source: The waste usually arises from the examination of irradiated fuel, steel and graphite and there may be items resulting from the refurbishing of facilities, irradiated fuel handling and pond operations. Components that have been associated with fuel pond operations are likely to be of high activity. Wastes arising from post irradiation examination work are also likely to be a major contributor to 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: The arisings activities have been normalised and the stocks activities have been derived from measurements of the packages.

Other information: Specific activity is a function of operating history. Figures were derived by estimation based upon available 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	3.44E-02	CC 2			Gd 153			8	
Be 10	8E-08	CC 2			Ho 163			8	
C 14	2.00E-03	CC 2			Ho 166m			8	
Na 22		8			Tm 170			8	
Al 26		8			Tm 171			8	
Cl 36	6E-03	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	1E-05	CC 2			Pt 193			8	
Mn 53		8			Tl 204			8	
Mn 54		8			Pb 205			8	
Fe 55	6.58E-02	CC 2			Pb 210			8	
Co 60	6.95E-02	CC 2			Bi 208			8	
Ni 59	1E-05	CC 2			Bi 210m			8	
Ni 63	2.70E-02	CC 2			Po 210			8	
Zn 65		8			Ra 223			8	
Se 79	5.17E-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	4.19E-01	CC 2			Th 227			8	
Zr 93	2E-05	CC 2			Th 228			8	
Nb 91		8			Th 229			8	
Nb 92		8			Th 230			8	
Nb 93m	1.14E-05	CC 2			Th 232			8	
Nb 94	1.00E-04	CC 2			Th 234	3E-06	CC 2		
Mo 93		8			Pa 231			8	
Tc 97		8			Pa 233	2.11E-06	CC 2		
Tc 99	1E-04	CC 2			U 232			8	
Ru 106	1.33E-08	CC 2			U 233			8	
Pd 107	2E-09	CC 2			U 234	8.32E-06	CC 2		
Ag 108m	1.95E-04	CC 2			U 235	1E-07	CC 2		
Ag 110m		8			U 236	2.00E-06	CC 2		
Cd 109		8			U 238	3E-06	CC 2		
Cd 113m		8			Np 237	2.11E-06	CC 2		
Sn 119m		8			Pu 236			8	
Sn 121m	1.64E-04	CC 2			Pu 238	7.11E-03	CC 2		
Sn 123		8			Pu 239	3E-03	CC 2		
Sn 126	2.17E-06	CC 2			Pu 240	7.00E-03	CC 2		
Sb 125	1.14E-05	CC 2			Pu 241	1.46E-01	CC 2		
Sb 126	3.04E-07	CC 2			Pu 242	2E-05	CC 2		
Te 125m	2.85E-06	CC 2			Am 241	2.46E-02	CC 2		
Te 127m		8			Am 242m	4.65E-05	CC 2		
I 129	2E-07	CC 2			Am 243	9.99E-05	CC 2		
Cs 134	2.60E-05	CC 2			Cm 242	3.84E-05	CC 2		
Cs 135	3E-06	CC 2			Cm 243	6.37E-05	CC 2		
Cs 137	4.95E-01	CC 2			Cm 244	1.13E-04	CC 2		
Ba 133	7.49E-07	CC 2			Cm 245	4.00E-07	CC 2		
La 137		8			Cm 246	9.99E-08	CC 2		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	7.60E-04	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	8.90E-04	CC 2			Other a				
Eu 152	1.39E-06	CC 2			Other b/g				
Eu 154	1.50E-03	CC 2			Total a	4.21E-02	CC 2	0	
Eu 155	3.59E-04	CC 2			Total b/g	1.27E+00	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