

**WASTE STREAM****6C32****NDS Remote Handled ILW**

**SITE** Harwell  
**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.....	0.3 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		0.3 m <sup>3</sup>

Comment on volumes: Any receipt of waste from off-site sources is expected to be minimal.

Uncertainty factors on volumes:	Stock (upper):	x 1.05	Arisings (upper)	x
	Stock (lower):	x 0.95	Arisings (lower)	x

**WASTE SOURCE**

The waste arises from industry, research laboratories, educational establishments, institutes and hospitals - originally via the National Disposal Service. Newer arisings were consigned via Safeguard International.

**PHYSICAL CHARACTERISTICS**

General description: Laboratory waste, sealed sources, electrical equipment, compasses. The waste is packaged in cans with a maximum volume of 100 litres. Some sources have been segregated from the corresponding CHILW stream.

Physical components (%vol): Sources and their immediate shielding (79%), miscellaneous items.

Sealed sources: The waste contains sealed sources. Information not available

Bulk density (t/m<sup>3</sup>): ~1.2

Comment on density: Recorded mass divided by volume of outer containers. Not all consignments declare a mass.

**CHEMICAL COMPOSITION**

General description and components (%wt): Sources (79%), unspecified and ferrous metals (12%), plastics (7%), others (2%). Sources will comprise metal/ plastic/ mica holders and source material.

Chemical state: -

Chemical form of radionuclides: H-3: H3 may be present as gaseous sources, but is expected to be absorbed in metal targets.

C-14: Present as labelled organic compounds

Ra: Radium will be present in Ra and Ra/Be sources

U: Metal or oxide.

Metals and alloys (%wt): Metal is expected to be present mostly as small items. It has been assumed that source housings will be mostly stainless steel.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~10.0	The identity of steels/other alloys is not known.	
Other ferrous metals.....	~67.0	The identity of steels/other alloys is not known.	
Iron.....			
Aluminium.....	~0.10		
Beryllium.....			
Cobalt.....			
Copper.....	TR		
Lead.....	~10.0		

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Magnox/Magnesium.....	0	
Nickel.....		
Titanium.....		
Uranium.....		
Zinc.....	0	
Zircaloy/Zirconium.....	0	
Other metals.....	1.0	Tungsten and depleted uranium.

Organics (%wt): One source is encapsulated in vinyl ester styrene.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	~0.90		
Paper, cotton.....	~0.90	Only paper is declared	
Wood.....	0		
Halogenated plastics .....	~1.0	PVC is expected to be present together with small amounts of PTFE	
Total non-halogenated plastics.....	~10.0		
Condensation polymers.....	NE		
Others.....	~10.0		
Organic ion exchange materials....	0		
Total rubber.....	TR		
Halogenated rubber .....	TR	Neoprene and hypalon	
Non-halogenated rubber.....	TR		
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.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	~0.80		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	P		

Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	P
Free non-aqueous liquids.....	
Powder/Ash.....	NE

Inorganic anions (%wt): Inorganic anions are not present in significant quantities.

	(%wt)	Type(s) and comment
Fluoride.....	<0.01	
Chloride.....	<0.01	
Iodide.....	<0.01	
Cyanide.....	0	
Carbonate.....	<0.10	
Nitrate.....	<0.10	
Nitrite.....	<0.10	
Phosphate.....	<0.10	
Sulphate.....	<0.10	
Sulphide.....	<0.10	

Materials of interest for waste acceptance criteria: Free liquids mainly comprise inactive isopropyl alcohol in compasses which will be removed before conditioning. 2.2% combustible metals mainly consists of uranium.

	(%wt)	Type(s) and comment
Combustible metals.....	2.2	
Low flash point liquids.....	~0.30	
Explosive materials.....	<0.01	
Phosphorus.....	<0.01	
Hydrides.....	<0.01	
Biological etc. materials.....	0.10	
Biodegradable materials.....	0.01	
Putrescible wastes.....	<0.01	
Non-putrescible wastes.....		
Corrosive materials.....	<0.01	
Pyrophoric materials.....	<0.01	
Generating toxic gases.....	<0.01	
Reacting with water.....	<0.01	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: Hydrocarbons (0.13%), pharmaceutical compounds (0.1%).

	(%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): No

(%wt) Type(s) and comment

EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents..... 0

Potential for the waste to contain discrete items: Not yet determined. Subject to DI type assessment (specific clauses within WAC)

### PACKAGING AND CONDITIONING

Conditioning method: The waste will be co-packaged into 500-litre drums with 5C52

Plant Name: Head End Cells

Location: Harwell

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Plant startup date: -

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

Target start date for packaging this stream: -

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

Other information: Plant only packages waste. NDS RHILW will be co-packaged with Harwell RHILW as stream 5C52- see for details of conditioning

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages

Likely container type comment: Currently conditioning factors of ~1 are being achieved, but this will vary.

Range in container waste volume: Loading will vary depending on drum contents and specific limits.

Other information on containers: 314L Stainless Steel

Likely conditioning matrix: PFA/OPC and None

Other information: 3:1 PFA:OPC w/s 0.42

Conditioned density (t/m<sup>3</sup>): ~2.0

Conditioned density comment: Will vary according to nature of wastes.

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: Most activity from sealed sources. Remainder from contamination.

Uncertainty: Activities are currently only as accurate as the original declarations. This information will be verified as far as possible on packing the waste.

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: Declarations from waste consignors. Some fingerprints have been applied to generic terms.

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	3.70E-01	BB 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.52E-03	BB 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	5.81E-08	BB 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	2.57E-05	BB 2		
Mn 54		8			Pb 205		8		
Fe 55	4.11E-03	BB 2			Pb 210	6.14E-02	BB 2		
Co 60	1.44E-01	BB 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	1.04E-02	BB 2			Po 210	5.86E-02	BB 2		
Zn 65	3.42E-06	BB 2			Ra 223	1.84E-04	BB 2		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226	2.24E-01	BB 2		
Kr 85	3.57E-01	BB 2			Ra 228	1.26E-06	BB 2		
Rb 87		8			Ac 227	1.84E-04	BB 2		
Sr 90	1.01E+00	BB 2			Th 227	1.82E-04	BB 2		
Zr 93		8			Th 228	9.74E-07	BB 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232	1.9E-06	BB 2		
Nb 94		8			Th 234	6.12E-03	BB 2		
Mo 93		8			Pa 231	5.73E-09	BB 2		
Tc 97		8			Pa 233	1.69E-06	BB 2		
Tc 99		8			U 232		8		
Ru 106	8.12E-08	BB 2			U 233	4.95E-07	BB 2		
Pd 107		8			U 234	2.09E-05	BB 2		
Ag 108m		8			U 235	2.99E-05	BB 2		
Ag 110m		8			U 236		8		
Cd 109	1.61E-05	BB 2			U 238	6.12E-03	BB 2		
Cd 113m		8			Np 237	1.70E-06	BB 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	8.17E-02	BB 2		
Sn 123		8			Pu 239	3.44E-06	BB 2		
Sn 126		8			Pu 240	2.71E-07	BB 2		
Sb 125		8			Pu 241		8		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	3.94E-01	BB 2		
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	1.24E+01	BB 2			Cm 244		8		
Ba 133	8.21E-07	BB 2			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248	3.16E-08	BB 2		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	1.13E-01	BB 2			Cf 251		8		
Sm 147		8			Cf 252	3.94E-04	BB 2		
Sm 151		8			Other a				
Eu 152	8.02E-04	BB 2			Other b/g				
Eu 154		8			<b>Total a</b>	<b>7.65E-01</b>	<b>BB 2</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>1.45E+01</b>	<b>BB 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