

WASTE STREAM	5C52/C	Encapsulated Processed Remote Handled ILW
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SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025		= 101.6	145.0
Future arisings:				0.0
Total future arisings:			0.0	0.0
Total waste volume:			101.6	145.0

Number of waste packages in stock: At 1.4.2025..... 254 packages

Comment on arising rates: This waste stream represents wastes that have been packaged into 500 litre drums and have been cement encapsulated. The waste drums will be stored until such time as a GDF is available, when they will be exported to GDF.

Additional information on quantities: Volume updated to account for all drums held at a nominal 0.4m³ per drum

Uncertainty factors on volumes: Stock (upper): x 1.00 Arisings (upper): x -
Stock (lower): x 1.00 Arisings (lower): x -

WASTE SOURCE Packaging of RHILW streams: principally 5C30, also 6C32, 5C54, 5G25, and 5C318. Future arisings will also include 5G04, with possibly (parts of) 5C306, 5C308, and 5C310.

PHYSICAL CHARACTERISTICS

General description: Laboratory/cell wastes, sources, cut-up experimental rigs, glassware and concrete. The RHILW is varied in nature, but has all been size reduced to allow import into the facility; <50 litres and <100kg.

Changes since waste generated: Larger items may be disassembled as necessary to facilitate grout infiltration. In future, problem wastes (e.g. bulk particulate) will be separately conditioned in small containers before adding to the waste package; currently these are being retained.

Bulk density (t/m³): ~ 2.0

Comment on density: Conditioned density.

CHEMICAL COMPOSITION

General description and components (%wt): Ferrous metal (48.5%), plastics/rubber (18.9%), aluminium (6%), lead (6%), cellulose (8.6%), inert inorganics including glass (2.7%), inorganic chemicals (1%), other metals (~2.3%), concrete/sand/cement (6%).

Chemical state: Neutral

Sheet metal proportion / thickness: No additional information available.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 21.1	Where grade of stainless is specified, it is 18/8/1.	
Other ferrous metals.....	= 26.2	Other ferrous metals include 2.2% machine steel.	
Iron.....	= 1.2	-	
Aluminium.....	= 6.0	Where specified, Al is BS1471/N4 or BS1470/1050A.	
Beryllium.....	-	-	
Cobalt.....	TR	-	
Copper.....	= 1.6	-	
Lead.....	= 6.0	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	TR	-	
Titanium.....	-	-	
Uranium.....	= 0.40	-	
Zinc.....	< 0.10	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	= 0.30	Traces of Ag, W, Cd, Cr	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 8.6	-	
Paper, cotton.....	= 4.2	-	
Wood.....	= 4.4	-	
Halogenated plastics.....	= 15.4	-	
Total non-halogenated plastics.....	= 2.8	-	
Condensation polymers.....	= 1.3	-	
Others.....	= 1.5	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0.70	-	
Halogenated rubber.....	= 0.10	-	
Non-halogenated rubber.....	= 0.60	-	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	TR	wax	

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.....	= 1.1	-	
Cementitious material.....	= 6.0	-	
Sand.....		-	
Glass/Ceramics.....	= 2.5	-	
Graphite.....	= 0.04	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	Exact data unavailable	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	< 2.0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%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.....	0	-
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.....		-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	0	-
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.....		-
Thallium.....		-
Tin.....		-
Vanadium.....		-
Mercury compounds.....		-
Others.....		-

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....		-

Physical components:

	Number	Type(s) and comment
Sources.....		unknown
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

-

Conditioning method:

The stream represents waste that has been retrieved from storage tubes and is packaged and encapsulated in 500-litre enhanced drums.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

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Further information on the conditioning matrix:

3:1 PFA:OPC w/s 0.42.

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	500 l drum (pre-cast annular)	100.0	0.40	0.40	254	-

Range in container waste loading: Significant variation in waste loading is expected, based upon the precise nature of the waste being packaged at any time and the limits applying to their contents.

Other information on packaging and conditioning: -

Conditioned density (t/m³): ~ 2.0

Conditioned density comment: The density will vary according to the nature of individual drum contents

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	100.0		
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: Activated and contaminated items from historic R&D activities on the Harwell site including standard sources and fuel samples. Other beta/gamma not defined.

Uncertainty: Activities have been calculated from records.

Measurement of radioactivities: Combination of consignor's declarations and fissile/ gamma counting on packaging. All inventories enhanced by applying fingerprints according to waste origin.

Chemical form of radionuclides:

- H-3: Variable
- C-14: Activation products
- Cl-36: -
- Se-79: -
- Tc-99: -
- I-129: -
- Ra: Variable
- Th: Variable
- U: Variable
- Np: Variable
- Pu: Variable

WASTE STREAM 5C52/C Encapsulated Processed Remote Handled ILW									
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	6.21E-02	B B 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.96E-04	B B 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	4.68E-06	B B 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40	5.19E-05	B B 2			Hf 182		8		
Ca 41	6.30E-05	B B 2			Pt 193		8		
Mn 53		8			Tl 204	9.52E-08	B B 2		
Mn 54		8			Pb 205		8		
Fe 55	4.13E-05	B B 2			Pb 210	3.79E-06	B B 2		
Co 60	4.68E-02	B B 2			Bi 208		8		
Ni 59	8.90E-03	B B 2			Bi 210m		8		
Ni 63	4.36E-01	B B 2			Po 210	3.74E-06	B B 2		
Zn 65		8			Ra 223	1.92E-06	B B 2		
Se 79	1.83E-09	B B 2			Ra 225		8		
Kr 81		8			Ra 226	7.08E-06	B B 2		
Kr 85	1.45E-03	B B 2			Ra 228	2.50E-07	B B 2		
Rb 87		8			Ac 227	1.91E-06	B B 2		
Sr 90	2.20E+00	B B 2			Th 227	1.89E-06	B B 2		
Zr 93	8.46E-04	B B 2			Th 228	4.77E-07	B B 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230	1.51E-05	B B 2		
Nb 93m	2.25E-03	B B 2			Th 232	2.82E-07	B B 2		
Nb 94	1.30E-03	B B 2			Th 234	4.72E-05	B B 2		
Mo 93	4.84E-05	B B 2			Pa 231		8		
Tc 97		8			Pa 233	3.17E-05	B B 2		
Tc 99	2.14E-04	B B 2			U 232	2.37E-07	B B 2		
Ru 106		8			U 233	8.42E-07	B B 2		
Pd 107		8			U 234	8.25E-05	B B 2		
Ag 108m	2.09E-02	B B 2			U 235	2.04E-06	B B 2		
Ag 110m		8			U 236	3.17E-07	B B 2		
Cd 109		8			U 238	4.72E-05	B B 2		
Cd 113m	5.03E-02	B B 2			Np 237	3.17E-05	B B 2		
Sn 119m		8			Pu 236		8		
Sn 121m	9.55E-03	B B 2			Pu 238	3.45E-01	B B 2		
Sn 123		8			Pu 239	1.12E-02	B B 2		
Sn 126	1.30E-06	B B 2			Pu 240	1.00E-02	B B 2		
Sb 125	5.54E-04	B B 2			Pu 241	1.93E-01	B B 2		
Sb 126	1.82E-07	B B 2			Pu 242	2.17E-05	B B 2		
Te 125m	1.39E-04	B B 2			Am 241	1.57E-01	B B 2		
Te 127m		8			Am 242m	6.52E-05	B B 2		
I 129	1.32E-04	B B 2			Am 243	8.52E-05	B B 2		
Cs 134	4.72E-06	B B 2			Cm 242	5.38E-05	B B 2		
Cs 135	2.01E-03	B B 2			Cm 243	2.86E-06	B B 2		
Cs 137	6.56E-01	B B 2			Cm 244	5.12E-03	B B 2		
Ba 133	6.75E-07	B B 2			Cm 245	1.66E-09	B B 2		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250	3.43E-09	B B 2		
Pm 147	3.24E-05	B B 2			Cf 251		8		
Sm 147		8			Cf 252	2.74E-08	B B 2		
Sm 151	1.18E-02	B B 2			Unsp a				
Eu 152	7.25E-02	B B 2			Unsp b/g				
Eu 154	1.30E-02	B B 2			Total a	5.28E-01	*	0	*
Eu 155	5.51E-03	B B 2			Total b/g	3.79E+00	*	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 the 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
* Total calculated from the 114 declared radionuclides