

WASTE STREAM	5G01	Miscellaneous Reactor Hardware ILW
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SITE Winfrith

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	= 0.8		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		0.8		

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

Comment on arising rates: -

Additional information on quantities: Volumes based on assessment (ILW/LLW) of individual items.

Uncertainty factors on volumes: Stock (upper): x 1.20 Arisings (upper): x -
Stock (lower): x 0.80 Arisings (lower): x -

WASTE SOURCE The waste consists of miscellaneous activated materials from SGHWR.

PHYSICAL CHARACTERISTICS

General description: Redundant components from operations that have been stored in SGHWR since operations ceased. The majority of components are stored in the mortuary holes pending retrieval. Components are primarily metallic and include Nimonic 90 springs, hanger bar couplings, hanger bar springs, various pressure tube sections, rigs and shield plugs. Maximum diameter of any item is approximately 150mm. Stream comprises ten 10 litre cans containing nimonic springs (max 18 per can) and five 10 litre cans containing pencil loop sections. Waste stream may also include other hotspots and anything not suitable for a 6m3 box, so isn't limited to the above.

Changes since waste generated: -

Bulk density (t/m³): = 1.0

Comment on density: The mean bulk density is based on 2004 RWI gross envelope material calculations. It should be noted that an updated waste estimate since has given a total mass of 6011.00 kg and a corresponding net material volume of 0.82 m3 (based on material density). This gives a mean waste material density of 7.31 te/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Mild Steel (59.16%),Others (39.78%), Nimonic-90 (1.06%).

Chemical state: Neutral

Sheet metal proportion / thickness: ~12 cm diameter tubes maximum 1 m long.
Seal plugs ~ 12 x 12 cm section.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 59.2	-	
Iron.....		-	
Aluminium.....	NE	-	
Beryllium.....	= 0	-	
Cobalt.....		-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	= 1.1	Nimonic-90	
Titanium.....		-	
Uranium.....	TR	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	P	-	
Other metals.....	= 39.8	Other metals not specified, it is likely that a proportion will be Zircalloy.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	TR	PVC used as wrapping.	
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.....	= 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	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	= 0	-
Chloride.....	= 0	-
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	= 0	-
Nitrate.....	= 0	-
Nitrite.....	= 0	-
Phosphate.....	= 0	-
Sulphate.....	= 0	-
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.....		-
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	Off-site	100.0

Comments on planned treatments:

-

Conditioning method:

No pretreatment requirement has been established. The flattening of tubes and pipes would no longer be undertaken. Mild steel pipes will be sectioned and loaded into waste packages using specially designed furniture. Non-stainless steel wastes will be volume reduced. Waste to be sent to Harwell for processing into 500 litre drums and storage.

Conditioning plants:

Plant Name	Location
HAR SWC	Harwell

Likely conditioning matrix:

Unknown

Further information on the conditioning matrix:

3:1 PFA/OPC at a 0.42 w/s ratio.

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	0.41	0.40	2	-

Range in container waste loading: The volume of raw waste per package will vary with campaign. It is expected to be in the range 0.11 to 2.42 m³, but this comprises of waste from both 5G01 and 5G302.

Other information on packaging and conditioning: The packaging plant will be inside the SGHWR building.

Conditioned density (t/m³): ~ 2.6

Conditioned density comment: An average value for all waste packages is given above. The conditioned density is expected to vary with packaging campaign, between 2.0 to 6.3.

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: Activation products from reactor structural components.

Uncertainty: The activity is an estimated value only.

Measurement of radioactivities: A reactor activation modelling study was carried out based on a 3-D Monte Carlo neutron transport code to determine energy dependent neutron flux spectra, and on the EASY/FISPACT neutron activation code. Dose rate measurements were also carried out on waste items.

Chemical form of radionuclides:

- H-3: Tritium isotope present as trace element in the activated materials.
- C-14: Carbon-14 isotope present as trace element in the activated materials.
- Cl-36: Chlorine-36 isotope present as trace element in the activated materials.
- Se-79: Selenium-79 isotope present as trace element in the activated materials.
- Tc-99: Technetium-99 isotope present as trace element in the activated materials.
- I-129: Iodine-129 isotope present as trace element in the activated materials.
- Ra: Radium isotopes present as trace elements in the activated materials.
- Th: Thorium isotopes present as trace elements in the activated materials.
- U: Uranium isotopes present as trace elements in the activated materials.
- Np: Neptunium isotopes present as trace elements in the activated materials.
- Pu: Plutonium isotopes present as trace elements in the activated materials.

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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	3.17E-02	B B 2			Gd 153		8		
Be 10	1.06E-07	B B 2			Ho 163	5.33E-08	B B 2		
C 14	4.48E-03	B B 2			Ho 166m	7.18E-06	B B 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	6.56E-07	B B 2			Lu 174		8		
Ar 39	1.55E-04	B B 2			Lu 176		8		
Ar 42		8			Hf 178n	1.23E-05	B B 2		
K 40	1.04E-08	B B 2			Hf 182		8		
Ca 41	2.45E-05	B B 2			Pt 193	2.63E-06	B B 2		
Mn 53		8			Tl 204	2.95E-05	B B 2		
Mn 54		8			Pb 205		8		
Fe 55	3.58E-03	B B 2			Pb 210		8		
Co 60	1.59E+01	B B 2			Bi 208		8		
Ni 59	1.87E-01	B B 2			Bi 210m		8		
Ni 63	1.64E+01	B B 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	1.54E-08	B B 2			Ra 225	1.22E-09	B B 2		
Kr 81	2.54E-08	B B 2			Ra 226		8		
Kr 85	6.71E-06	B B 2			Ra 228	2.64E-08	B B 2		
Rb 87	2.10E-07	B B 2			Ac 227		8		
Sr 90		8			Th 227		8		
Zr 93	2.63E-07	B B 2			Th 228	2.64E-08	B B 2		
Nb 91	1.74E-08	B B 2			Th 229	1.22E-09	B B 2		
Nb 92		8			Th 230		8		
Nb 93m	1.44E-04	B B 2			Th 232	2.64E-08	B B 2		
Nb 94	3.07E-05	B B 2			Th 234	1.07E-07	B B 2		
Mo 93	1.07E-05	B B 2			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	1.81E-06	B B 2			U 232		8		
Ru 106		8			U 233	2.15E-07	B B 2		
Pd 107		8			U 234	1.06E-07	B B 2		
Ag 108m	1.17E-05	B B 2			U 235	4.92E-09	B B 2		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	1.07E-07	B B 2		
Cd 113m	3.27E-05	B B 2			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m	3.35E-06	B B 2			Pu 238		8		
Sn 123		8			Pu 239	3.80E-06	B B 2		
Sn 126		8			Pu 240	2.15E-08	B B 2		
Sb 125	1.22E-07	B B 2			Pu 241	2.97E-09	B B 2		
Sb 126		8			Pu 242		8		
Te 125m	3.06E-08	B B 2			Am 241		8		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	2.78E-08	B B 2			Cm 242		8		
Cs 135		8			Cm 243		8		
Cs 137	2.47E-07	B B 2			Cm 244		8		
Ba 133	6.26E-05	B B 2			Cm 245		8		
La 137	3.08E-09	B B 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	1.05E-07	B B 2			Cf 250		8		
Pm 147		8			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	2.31E-05	B B 2			Unsp a				
Eu 152	2.72E-03	B B 2			Unsp b/g				
Eu 154	1.08E-04	B B 2			Total a	4.31E-06	*	0	*
Eu 155	2.02E-07	B B 2			Total b/g	3.25E+01	*	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