

WASTE STREAM	5B19	Uranium Contaminated Materials
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SITE Dounreay

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	= 75.8		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		75.8		

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

Comment on arising rates: No future arisings. Any further arisings of uranium contaminated material will be covered by decommissioning streams.

Additional information on quantities: The natural and depleted uranium metal may not be consigned as part of this waste stream.

Uncertainty factors on volumes: Stock (upper): x 1.02 Arisings (upper): x -
Stock (lower): x 0.98 Arisings (lower): x -

WASTE SOURCE Stored wastes are mainly concrete from floor of building, from refurbishment exercise and additional materials such as uranium slag materials from uranium processing. There are also two drums containing natural uranium and six drums containing depleted uranium metal.

PHYSICAL CHARACTERISTICS

General description: Concrete, sand and plant residues. Smaller amounts of graphite, tools, metal, swabs and plastic bags. In addition there is natural uranium in metal form. Uranium bearing slags originate from the 'billet reduction' stage of operations carried out in the MTR fuel fabrication plant. The slags consist of Calcium Fluoride / Magnesium Fluoride with a small % of Uranium carried over. All items have diameters of less than 16.5cm which is the inner diameter of containers.

Changes since waste generated: -

Bulk density (t/m³): = 0.30

Comment on density: The density is based on consignor's records, and includes the sacrificial containers in which the waste is packed.

CHEMICAL COMPOSITION

General description and components (%wt): Ferrous metals (37%), uranium (5%), paper (21%), wood (1%), halogenated plastics (14%), non-halogenated plastics (1%), soil (2%), concrete (5%), residues (14%).

Chemical state: Neutral

Sheet metal proportion / thickness: Small amount of material may be present as bulk metal associated with the depleted uranium.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	P	-	
Other ferrous metals.....	= 37.0	-	
Iron.....	= 0	-	
Aluminium.....	= 0	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	= 5.0	-	
Zinc.....	= 0.10	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 13.9	Metal largely associated with the small amounts of alloys. Molybdenum will be present in small quantities (0.001%). Includes allowance for plant residues.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 22.0	-	
Paper, cotton.....	= 21.0	-	
Wood.....	= 1.0	-	
Halogenated plastics.....	= 14.0	-	
Total non-halogenated plastics.....	= 1.0	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	= 0	-	
Oil or grease.....	= 0	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	= 0	-	
Asphalt/Tarmac (no coal tar).....	= 0	-	
Bitumen.....	= 0	-	
Others.....	= 0	-	
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.....	= 2.0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 5.0	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	P	-	
Desiccants/Catalysts.....	= 0	-	
Asbestos.....	= 0	-	
Non/low friable.....	NE	-	
Moderately friable.....	NE	-	
Highly friable.....	NE	-	
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.....	= 8.0	-
Chloride.....	NE	-
Iodide.....	NE	-
Cyanide.....	NE	-
Carbonate.....	NE	-
Nitrate.....	P	-
Nitrite.....	NE	-
Phosphate.....	NE	-
Sulphate.....	NE	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

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

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	NE	-
Benzene.....	NE	-
Chlorinated solvents.....	NE	-
Formaldehyde.....	NE	-
Organometallics.....	NE	-
Phenol.....	NE	-
Styrene.....	NE	-
Tri-butyl phosphate.....	NE	-
Other organophosphates.....	NE	-
Vinyl chloride.....	NE	-
Arsenic.....	NE	-
Barium.....	NE	-
Boron.....	NE	-
Boron (in Boral).....	NE	-
Boron (non-Boral).....	NE	-
Cadmium.....	NE	-
Caesium.....	NE	-
Selenium.....	NE	-
Chromium.....	NE	-
Molybdenum.....	NE	-
Thallium.....	NE	-
Tin.....	NE	-
Vanadium.....	NE	-
Mercury compounds.....	NE	-
Others.....	NE	-

Complexing agents (%wt):

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

Physical components:

	Number	Type(s) and comment
Sources.....	= 0	-
Electronic & Electrical Equipment (EEE)		
EEE Type 1.....	= 0	-
EEE Type 2.....	= 0	-
EEE Type 3.....	= 0	-
EEE Type 4.....	= 0	-
EEE Type 5.....	= 0	-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	~ 100.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	On-site	= 100.0
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:

It is estimated that between 2 and 8 CHILW pucks will be placed into each 500l drum with the average being 5 drums per 500l drum. A small percentage of drums may not be suitable for supercompaction and will be directly immobilised into the 500l drum.

Conditioning method:

Waste will be conditioned using a grout matrix into 500L drums. This will be done through a dedicated ILW repackaging facility, which will handle both RHILW and CHILW 200L drums. This facility will produce conditioned 500L drums.

Conditioning plants:

Plant Name	Location
Combined ILW Repackaging Facility	Dounreay

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

This will match 5B03. Dounreay will use OPC 3:1 PFA 42% water.

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 (pucks)	100.0	1.0	0.40	76	-

Range in container waste loading: It is estimated that between 2 and 8 CHILW pucks will be placed into each 500l drum with the average being 5 drums per 500l drum. A small percentage of drums may not be suitable for supercompaction and will be directly immobilised into the 500l drum.

Other information on packaging and conditioning: -

Conditioned density (t/m³): ~ 2.5

Conditioned density comment: The density of the conditioned waste is expected to be around 2 - 3 te/m³. This will match the estimate for 5B03.

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: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Non-NSDF HAW	Dounreay LLWDV	NE	RED	There is potential for LLW to be diverted out of this stream during repackaging of ILW into 500L drums. However, details of this will be confirmed through the design process of the repackaging facility

RADIOACTIVITY

Source: Uranium fuel contamination.

Uncertainty: Within a factor of three.

Measurement of radioactivities: The activities in the stocks are based on consignor's records which are based on non-destructive assay.

Chemical form of radionuclides:

H-3: -
C-14: -
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: Present in trace amounts.
Th: -
U: Uranium is present mainly as metal. A small quantity may also be present as dioxide and fluoride.
Np: Present in trace amounts.
Pu: -

WASTE STREAM		5B19		Uranium Contaminated Materials					
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					Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210	3.42E-10	B B 2		
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	3.17E-10	B B 2		
Zn 65					Ra 223	3.11E-09	B B 2		
Se 79					Ra 225				
Kr 81					Ra 226	1.81E-09	B B 2		
Kr 85					Ra 228	1.06E-13	B B 2		
Rb 87					Ac 227	3.24E-09	B B 2		
Sr 90					Th 227	3.11E-09	B B 2		
Zr 93					Th 228	8.69E-14	B B 2		
Nb 91					Th 229				
Nb 92					Th 230	4.30E-07	B B 2		
Nb 93m					Th 232	1.66E-13	B B 2		
Nb 94					Th 234	9.66E-06	B B 2		
Mo 93					Pa 231	3.80E-08	B B 2		
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	2.55E-03	B B 2		
Ag 108m					U 235	7.81E-05	B B 2		
Ag 110m					U 236	1.64E-04	B B 2		
Cd 109					U 238	9.66E-06	B B 2		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152					Unsp b/g				
Eu 154					Total a	2.80E-03	*	0	*
Eu 155					Total b/g	9.66E-06	*	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