

<b>WASTE STREAM</b>	<b>5B317</b>	<b>Pu Laboratory ILW</b>
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**SITE** Dounreay  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Dounreay Site Restoration Limited  
**WASTE TYPE** ILW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	18.2 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		18.2 m <sup>3</sup>
Comment on volumes:	Building demolished, no further arisings. The volume quoted is 'as stored' in 90x200 litre drums.	
Uncertainty factors on volumes:	Stock (upper): x 1.02	Arisings (upper) x
	Stock (lower): x 0.98	Arisings (lower) x

**WASTE SOURCE** Decommissioning of plutonium laboratory building.

**PHYSICAL CHARACTERISTICS**

General description: -  
Physical components (%wt): Mainly metal items (50%) such as gloveboxes, various plastics (10%), cellulosic materials (30% and small amounts of building materials (5%) and other unspecified materials (5%).  
Sealed sources: -  
Bulk density (t/m<sup>3</sup>): 0.53  
Comment on density: The density of 0.53 te/m<sup>3</sup> is based on consignor's drum records.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (50%), soil/concrete/rubble (5%), soft organics (5%), plastics/rubber (10%), wood (5%), sponge media (20%), others (5%).  
Chemical state: Neutral  
Chemical form of radionuclides: Cl-36: Not likely to be present  
I-129: Not likely to be present  
Ra: Radium isotopes may be present in a smoke detector.  
Pu: Wastes generated by this waste stream are generally contaminated with plutonium bearing residues principally PuNO<sub>3</sub>.  
Metals and alloys (%wt): Both sheet and bulk metals are present, proportions not specified.

Stainless steel.....	50.0
Other ferrous metals.....	TR
Iron.....	
Aluminium.....	
Beryllium.....	0
Cobalt.....	0
Copper.....	TR
Lead.....	TR
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	P
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	5.0

Other metals not specified.

**WASTE STREAM****5B317****Pu Laboratory ILW**

## Organics (%wt):

The waste contains small amounts of halogenated plastic, non-halogenated plastic and rubber.

Total cellulose	30.0
Paper, cotton	25.0
Wood	5.0
Halogenated plastics	10.0
Total non-halogenated plastics	NE
Condensation polymers	NE
Others	NE
Organic ion exchange materials	0
Total rubber	NE
Halogenated rubber	NE
Non-halogenated rubber	NE
Hydrocarbons	
Oil or grease	
Fuel	
Asphalt/Tarmac (cont.coal tar)	
Asphalt/Tarmac (no coal tar)	
Bitumen	
Others	
Other organics	TR

## Other materials (%wt):

-	
Inorganic ion exchange materials	0
Inorganic sludges and flocs	0
Soil	5.0
Brick/Stone/Rubble	TR
Cementitious material	TR
Sand	
Glass/Ceramics	
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

## Inorganic anions (%wt):

There may be trace quantities of inorganic anions.

<b>WASTE STREAM</b>	<b>5B317</b>	<b>Pu Laboratory ILW</b>
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Fluoride.....	NE
Chloride.....	NE
Iodide.....	NE
Cyanide.....	0
Carbonate.....	NE
Nitrate.....	TR
Nitrite.....	0
Phosphate.....	NE
Sulphate.....	NE
Sulphide.....	NE

Materials of interest for waste acceptance criteria:

There are no hazardous materials in the waste.

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.....	0
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Active particles.....	NE
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants:

-	
Acrylamide.....	
Benzene.....	NE
Chlorinated solvents.....	
Formaldehyde.....	
Organometallics.....	
Phenol.....	NE
Styrene.....	
Tri-butyl phosphate.....	NE
Other organophosphates.....	
Vinyl chloride.....	NE
Arsenic.....	NE
Barium.....	
Boron.....	NE

<b>WASTE STREAM</b>	<b>5B317</b>	<b>Pu Laboratory ILW</b>
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Cadmium..... NE  
 Caesium.....  
 Selenium..... NE  
 Chromium..... NE  
 Molybdenum..... NE  
 Thallium.....  
 Tin..... NE  
 Vanadium..... NE  
 Mercury compounds.....  
 Others..... NE  
 Electronic Electrical Equipment (EEE)  
     EEE Type 1.....  
     EEE Type 2.....  
     EEE Type 3.....  
     EEE Type 4.....  
     EEE Type 5.....

Complexing agents (%wt): No  
 EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents..... 0

**PACKAGING AND CONDITIONING**

Conditioning method: The 200 litre drums containing the waste will remain in store until they can be conditioned, when they are likely to be supercompacted and grouted inside 500 litre drums.  
 Plant Name: TBC  
 Location: Dounreay  
 Plant startup date: TBC  
 Total capacity (m<sup>3</sup>/y incoming waste): NE  
 Target start date for packaging this stream: -  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): NE  
 Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	500 l drum	100.0	1	0.5	19

<b>WASTE STREAM</b>	<b>5B317</b>	<b>Pu Laboratory ILW</b>
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Likely container type comment: It is assumed that 5 pucks will be packaged in each 500 litre drum, giving a conditioning factor of about 0.5.

Range in container waste volume: Not currently available.

Other information on containers: Stainless steel.

Likely conditioning matrix: Pulverised fuel ash/Ordinary Portland cement mixture

Other information: -

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

Conditioned density comment: The density is likely to be around 2 te/m<sup>3</sup>.

Other information on conditioning: -

Opportunities for alternative disposal routing: No

Treatment	Stream volume (%)	Comment
-	-	-

### RADIOACTIVITY

Source: The operations in the facility were originally conducted with grade A plutonium. This forms the only source of the resulting contamination within the facility.

Uncertainty: Within a factor of three for stocks.

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 isotopic composition of this material from the Building Safety Case is 0.1% Pu238, 95.1% Pu239, 4.5% Pu240, 0.1% Pu241, 0.01% Pu242 and 0.3% Am241. Total activities and radionuclide profiles are derived from the WSCD for this waste.

Other information: Radionuclide profiles are derived from WSCD for the Pu Laboratory decommissioning LLW.

**WASTE STREAM 5B317 Pu Laboratory ILW**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	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				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223	1.3E-14	BB 2		
Se 79					Ra 225	2.73E-15	BB 2		
Kr 81					Ra 226				
Kr 85					Ra 228	3.83E-19	BB 2		
Rb 87					Ac 227	1.31E-14	BB 2		
Sr 90					Th 227	1.29E-14	BB 2		
Zr 93					Th 228	3.52E-19	BB 2		
Nb 91					Th 229	2.74E-15	BB 2		
Nb 92					Th 230				
Nb 93m					Th 232	4.86E-19	BB 2		
Nb 94					Th 234				
Mo 93					Pa 231	3.11E-14	BB 2		
Tc 97					Pa 233	1.13E-08	BB 2		
Tc 99					U 232				
Ru 106					U 233	1.47E-12	BB 2		
Pd 107					U 234				
Ag 108m					U 235	4.90E-11	BB 2		
Ag 110m					U 236	3.28E-10	BB 2		
Cd 109					U 238				
Cd 113m					Np 237	1.13E-08	BB 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239	8.29E-04	BB 2		
Sn 126					Pu 240	1.85E-04	BB 2		
Sb 125					Pu 241	2.99E-03	BB 2		
Sb 126					Pu 242				
Te 125m					Am 241	5.78E-04	BB 2		
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					Other a				
Eu 152					Other b/g				
Eu 154					<b>Total a</b>	<b>1.59E-03</b>	<b>BB 2</b>	<b>0</b>	
Eu 155					<b>Total b/g</b>	<b>2.99E-03</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