

WASTE STREAM	5B360	Contaminated Oils and Solvents ILW
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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.....	153.0 m ³
Future arisings -	1.4.2019 - 31.3.2029.....	21.0 m ³
Total future arisings:		21.0 m ³
Total waste volume:		174.0 m ³

Comment on volumes: Mainly wastes arising from the storage tanks in the HALS and Evaporation plant (stocks) + ILW liquids across site (arisings). Arisings consist of a large volume of reprocessing solvents stored in tanks and miscellaneous oils/solvents generated within facilities. Stocks are held mainly within the HALS and Evaporation Plant.

Uncertainty factors on volumes: Stock (upper): x 1.2 Arisings (upper) x 1.2
 Stock (lower): x 0.8 Arisings (lower) x 0.8

WASTE SOURCE Fuel reprocessing and miscellaneous types of oils/solvents from experiments/operations.

PHYSICAL CHARACTERISTICS

General description: The waste contains a variety of solvents and liquids held mainly in the HALS and Evaporation plant. There are no large items in the waste. Most liquids are held in tanks. Some of the solvent is held in stainless steel drums.

Physical components (%vol): Washout liquor (88.37%), Reactive chemicals (0.06%), Solvent (7.89%), Stainless steel (3.69%),

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.25

Comment on density: Based on PWI estimates

CHEMICAL COMPOSITION

General description and components (%wt): Washout liquor (70.53%), Reactive chemicals (0.05%), Solvent (6.30%), Stainless steel (23.13%),

Chemical state: Neutral

Chemical form of radionuclides: H-3: Likely to be present as water.
 C-14: Likely to be present.
 Cl-36: Not known to be present.
 I-129: Likely to be present.
 Ra: Not known to be present.
 Th: Not known to be present.
 U: Likely to be present
 Np: Likely to be present
 Pu: Likely to be present.

Metals and alloys (%wt): -
 Stainless steel..... 23.3
 Other ferrous metals.....
 Iron.....
 Aluminium.....
 Beryllium.....
 Cobalt.....
 Copper.....
 Lead.....
 Magnox/Magnesium.....

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	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	The waste consists of lightly contaminated TBP/OK reprocessing solvent, and other lightly contaminated liquids including solvents and oils.		
	Total cellulose.....		
	Paper, cotton.....		
	Wood.....		
	Halogenated plastics		
	Total non-halogenated plastics.....		
	Condensation polymers.....		
	Others.....		
	Organic ion exchange materials....		
	Total rubber.....		
	Halogenated rubber		
	Non-halogenated rubber.....		
	Hydrocarbons.....	P	
	Oil or grease	P	
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	76.7	Lightly contaminated TBP/OK reprocessing solvent, and other lightly contaminated liquids including solvents and oils.
Other materials (%wt):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....		
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....		
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		

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	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	P
	Powder/Ash.....	
Inorganic anions (%wt):	Trace quantities of inorganic anions are present.	
	Fluoride.....	TR
	Chloride.....	TR
	Iodide.....	TR
	Cyanide.....	0
	Carbonate.....	TR
	Nitrate.....	TR
	Nitrite.....	NE
	Phosphate.....	TR
	Sulphate.....	TR
	Sulphide.....	TR
Materials of interest for waste acceptance criteria:	Quantities of substances are not estimated.	
	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.....	
	Generating toxic gases.....	
	Reacting with water.....	0
	Active particles.....	0
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	Traces of toxic metals may be present. Solvents (7.89%).	
	Acrylamide.....	
	Benzene.....	NE
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	NE
	Styrene.....	
	Tri-butyl phosphate.....	TR
	Other organophosphates.....	TR

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Vinyl chloride..... NE
 Arsenic..... NE
 Barium.....
 Boron..... NE
 Cadmium..... NE
 Caesium.....
 Selenium..... NE
 Chromium..... NE
 Molybdenum..... NE
 Thallium.....
 Tin..... NE
 Vanadium..... NE
 Mercury compounds..... TR
 Others..... NE

Electronic Electrical Equipment (EEE)

EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

Yes
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....

The waste contains tributyl phosphate.

Total complexing agents..... 5.0

PACKAGING AND CONDITIONING

Conditioning method: The liquid waste will be treated to result in an acceptable product. Plant Washout liquors may go through evaporation followed by a further washout of the tanks. Current strategy indicates that the waste will be transferred to a temporary cementation plant for cementation into 500L drums.

Plant Name: Temporary Cementation Plant

Location: Dounreay

Plant startup date: 2022

Total capacity
(m³/y incoming waste): 120.0

Target start date for
packaging this stream: 2022

Throughput for this stream
(m³/y incoming waste): -

Other information: -

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Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	0.25	0.5	696

Likely container type comment: The conditioning factor is expected to be about 2.0.

Range in container waste volume: -

Other information on containers: Stainless Steel. The container is likely to be manufactured from 316 stainless steel.

Likely conditioning matrix: Cement

Other information: Plant Washout liquors may undergo a stage of evaporation prior to consignment to the Temporary Cementation Plant, although this has yet to be finalised.

Conditioned density (t/m³): ~1.7

Conditioned density comment: Density is likely to be around 1.7 t/m³ once conditioned and cemented.

Other information on conditioning: -

Opportunities for alternative disposal routing: No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source: Aqueous + solvent wastes from MTR, DFR, PFR fuel reprocessing.

Uncertainty: Consignors data used to develop specific activities. However the number of consignments are limited, increasing the scope of uncertainty. Also, no LoC data is available for this waste stream at this time.

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: Based on PWI estimates. This combines the consignment data from each relevant facility. Stocks has been decayed from 2005 (based on CHILW consignment from the HALS and Evaporation Plant).

Other information: Specific Activity will be reassessed as part of generating the LoC.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	6.83E-07	CC 2	6.84E-07	CC 2	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	1.32E-07	CC 2	4.60E-06	CC 2	Pb 210				
Co 60	2.11E-05	CC 2	1.33E-04	CC 2	Bi 208				
Ni 59	8.76E-06	CC 2	8.76E-06	CC 2	Bi 210m				
Ni 63	1.42E-05	CC 2	1.56E-05	CC 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.08E-03	CC 2	1.51E-03	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m	3.83E-06	CC 2	2.43E-06	CC 2	Th 232				
Nb 94	1.70E-08	CC 2	1.70E-08	CC 2	Th 234				
Mo 93	5.53E-06	CC 2	5.55E-06	CC 2	Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	5.17E-04	CC 2	5.17E-04	CC 2
Ag 108m					U 235	7.62E-06	CC 2	7.62E-06	CC 2
Ag 110m					U 236	7.12E-05	CC 2	7.12E-05	CC 2
Cd 109					U 238	7.13E-07	CC 2	7.13E-07	CC 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	9.55E-06	CC 2	1.07E-05	CC 2
Sn 123					Pu 239	3.33E-05	CC 2	3.33E-05	CC 2
Sn 126					Pu 240	1.04E-05	CC 2	1.04E-05	CC 2
Sb 125	2.13E-07	CC 2	7.18E-06	CC 2	Pu 241	3.24E-03	CC 2	6.38E-03	CC 2
Sb 126					Pu 242				
Te 125m	5.20E-08	CC 2	1.07E-09	CC 2	Am 241	1.24E-04	CC 2	2.20E-05	CC 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	9.43E-07	CC 2	1.04E-04	CC 2	Cm 242	1.54E-16	CC 2	4.31E-07	CC 2
Cs 135					Cm 243				
Cs 137	2.83E-03	CC 2	3.91E-03	CC 2	Cm 244	1.37E-06	CC 2	2.35E-06	CC 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248	4.64E-05	CC 2	4.60E-05	CC 2
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	1.40E-05	CC 2	5.65E-04	CC 2	Cf 251				
Sm 147					Cf 252	1.47E-03	CC 2	5.76E-02	CC 2
Sm 151	1.53E-04	CC 2	1.70E-04	CC 2	Other a				
Eu 152	7.73E-06	CC 2	1.58E-05	CC 2	Other b/g				
Eu 154	5.05E-05	CC 2	1.56E-04	CC 2	Total a	2.29E-03	CC 2	5.83E-02	CC 2
Eu 155	2.07E-05	CC 2	1.60E-04	CC 2	Total b/g	7.45E-03	CC 2	1.31E-02	CC 2

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