WASTE STREAM 5B350 Uranium Recovery Plant ILW

SITE	Dounreay
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Dounreay Site Restoration Limited
WASTE TYPE	ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	6.0 m³
Future arisings -	1.4.2019 - 31.3.2021.....	0.2 m³
Total future arisings:		0.2 m³
Total waste volume:		6.2 m³

Comment on volumes: It should be noted that the DSRL site programme is under review and that arisings dates are subject to change. Arisings volumes have been updated after Predictive Inventory Walkdown exercise. Stock volumes have been re-evaluated since 2016 based on information in DMS: 30 CHILW Drums.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.02	Arisings (upper)	x 1.2
	Stock (lower):	x 0.98	Arisings (lower)	x 0.8

WASTE SOURCE The material will mainly be as metal items and some small items of plant equipment, all CHILW. Excludes any new facilities associated with Exotic Fuels management.

PHYSICAL CHARACTERISTICS

General description: The waste is varied in nature consisting of general soft wastes such as tissue, paper, PVC etc., and other more dense materials, e.g. contaminated pumps, motors, valves, pipework, extract filter housings etc.

Physical components (%wt): Metal (50%), soft organics (30%), plastics/rubber (18.5%), wood (1%), others including glass (0.5%).

Sealed sources: Not yet determined.

Bulk density (t/m³): 0.35

Comment on density: The bulk density is based on Consignor's records

CHEMICAL COMPOSITION

General description and components (%wt): Metal (50%), soft organics (30%), plastics/rubber (18.5%), wood (1%), others including glass (0.5%).

Chemical state: Neutral

Chemical form of radionuclides:
Cl-36: Not likely to be present
I-129: Not likely to be present
Th: Present as oxide.
U: Present as metal and oxide.

Metals and alloys (%wt): -

Stainless steel.....	~50.0
Other ferrous metals.....	NE
Iron.....	
Aluminium.....	NE
Beryllium.....	NE
Cobalt.....	0
Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	P

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	Zinc	NE
	Zircaloy/Zirconium	0
	Other metals	
Organics (%wt):	No breakdown of plastics/rubbers is available.	
	Total cellulosics	31.0
	Paper, cotton	30.0
	Wood	1.0
	Halogenated plastics	18.5
	Total non-halogenated plastics	P
	Condensation polymers	P
	Others	P
	Organic ion exchange materials	0
	Total rubber	P
	Halogenated rubber	P
	Non-halogenated rubber	P
	Hydrocarbons	
	Oil or grease	
	Fuel	
	Asphalt/Tarmac (cont.coal tar)	
	Asphalt/Tarmac (no coal tar)	
	Bitumen	
	Others	
	Other organics	0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs	0
	Soil	0
	Brick/Stone/Rubble	0
	Cementitious material	0
	Sand	0
	Glass/Ceramics	0.50
	Graphite	0
	Desiccants/Catalysts	0
	Asbestos	0
	Non/low friable	
	Moderately friable	
	Highly friable	
	Free aqueous liquids	0
	Free non-aqueous liquids	0
	Powder/Ash	0
Inorganic anions (%wt):	-	

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Fluoride	0
Chloride	NE
Iodide	NE
Cyanide	NE
Carbonate	NE
Nitrate	TR
Nitrite	NE
Phosphate	NE
Sulphate	NE
Sulphide	NE

Materials of interest for waste acceptance criteria: -

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

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: Remote Handled ILW will be packaged into 500 litre drums for long term storage. Contact Handled ILW will be supercompacted with the pucks being encapsulated in 500 litre drums for long term storage.

Plant Name: TBC

Location: Dounreay

Plant startup date: -

Total capacity (m^3/y incoming waste): NE

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): NE

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
500 l drum	100.0	1	0.5	7

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Likely container type comment:	The conditioning factor for RHILW is about 1.7, while that for CHILW is about 0.5.
Range in container waste volume:	It is estimated that between 2 and 8 CHILW pucks will be placed into each 500 ltr 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 500 ltr drum.
Other information on containers:	-
Likely conditioning matrix:	Cement
Other information:	-
Conditioned density (t/m³):	~2.5
Conditioned density comment:	The density is likely to be around 2 - 3 t/m³.
Other information on conditioning:	-
Opportunities for alternative disposal routing:	No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	The material processed through the facility is of varying enrichments, ranging from depleted uranium through to 93 % enriched uranium.
Uncertainty:	Stocks data is taken from CHILW drummed LoC.
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:	Arisings data has been taken from Consignors records; Stocks data is taken from CHILW drummed LoC.
Other information:	Specific activities have been re-evaluated since the 2016 UK Inventory.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	9.23E-12	C C 2			Pb 205				
Fe 55					Pb 210	1.37E-11	C C 2		
Co 60	6.25E-06	C C 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	9.07E-12	C C 2		
Zn 65					Ra 223	8.14E-10	C C 2		
Se 79					Ra 225	1.20E-14	C C 2		
Kr 81					Ra 226	8.59E-11	C C 2		
Kr 85					Ra 228	8.45E-10	C C 2		
Rb 87					Ac 227	8.23E-10	C C 2		
Sr 90	8.05E-04	C C 2			Th 227	8.14E-10	C C 2		
Zr 93					Th 228	1.85E-07	C C 2		
Nb 91					Th 229	1.21E-14	C C 2		
Nb 92					Th 230	2.73E-08	C C 2		
Nb 93m					Th 232	1.21E-09	C C 2		
Nb 94					Th 234	4.46E-06	C C 2		
Mo 93					Pa 231	3.24E-09	C C 2		
Tc 97					Pa 233	2.69E-07	C C 2		
Tc 99					U 232	1.80E-07	C C 2		
Ru 106	2.55E-10	C C 2			U 233	1.51E-11	C C 2		
Pd 107					U 234	2.27E-04	C C 2	6.64E-03	C C 2
Ag 108m					U 235	9.96E-06	C C 2	9.78E-05	C C 2
Ag 110m					U 236	1.16E-05	C C 2	9.13E-04	C C 2
Cd 109					U 238	4.46E-06	C C 2	9.09E-06	C C 2
Cd 113m					Np 237	2.7E-07	C C 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.40E-02	C C 2		
Sn 123					Pu 239	1.67E-02	C C 2		
Sn 126					Pu 240	2.48E-02	C C 2		
Sb 125	1.45E-07	C C 2			Pu 241	4.39E-01	C C 2		
Sb 126					Pu 242	2.22E-05	C C 2		
Te 125m	3.54E-08	C C 2			Am 241	4.37E-02	C C 2		
Te 127m					Am 242m	1.15E-06	C C 2		
I 129					Am 243	1.57E-10	C C 2		
Cs 134	2.62E-07	C C 2			Cm 242	9.59E-07	C C 2		
Cs 135					Cm 243	9.12E-10	C C 2		
Cs 137	1.09E-03	C C 2			Cm 244	9.45E-06	C C 2		
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	3.28E-06	C C 2			Cf 251				
Sm 147	1.85E-15	C C 2			Cf 252				
Sm 151	2.12E-05	C C 2			Other a				
Eu 152	2.90E-06	C C 2			Other b/g	1.06E-06	C C 2		
Eu 154	9.92E-06	C C 2			**Total a**	**9.94E-02**	**C C 2**	**7.66E-03**	**C C 2**
Eu 155	3.85E-06	C C 2			**Total b/g**	**4.41E-01**	**C C 2**	**0**	**C C 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