WASTE STREAM 5B29 LSA Scale

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

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	235.0 m³
Total future arisings:		0 m³
Total waste volume:		235.0 m³

Comment on volumes: No more arisings of this waste as the facility which generated this waste is no longer operational. The waste is stored in 1175 x 200 litre drums which are currently stored in 29 HHISO containers. There is only a small uncertainty factor, as the waste has already been packaged into LLW drums.

Uncertainty factors on volumes:

Stock (upper):	x 1.02	Arisings (upper)	x
Stock (lower):	x 0.98	Arisings (lower)	x

WASTE SOURCE Between 1989 and 2003 pipeline tubulars and platform components originating from North Sea offshore operations have been cleaned in a dedicated facility on the Dounreay Site. The cleaning operation is required to remove the Low Specific Activity (LSA) scale which is deposited on the pipeline and associated equipment while it is in service. Work is ongoing to determine alternative disposal options.

PHYSICAL CHARACTERISTICS

General description: The waste consists of LSA scale cemented into 200 litre drums. The LSA Scale is composed of precipitated barium sulphate and radium sulphate. The fragments of scale range from particles >100mm in size down to particulate material in the micron range.

Physical components (%wt): LSA Scale (precipitated barium sulphate and radium sulphate) (85.5%), mild steel drums (5%), cement (9.5%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.91

Comment on density: The density is estimated from the consignor's records of drum weights.

CHEMICAL COMPOSITION

General description and components (%wt): LSA Scale (precipitated barium sulphate and radium sulphate) (85.5%), mild steel drums (5%), cement (9.5%).

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Not known to be present.
C-14: Not known to be present.
Cl-36: Not known to be present.
Se-79: Not known to be present.
Tc-99: Not known to be present.
I-129: Not known to be present.
Ra: Present as LSA scale.
Th: Present as LSA scale.
U: Not known to be present.
Np: Not known to be present.
Pu: Not known to be present.

Metals and alloys (%wt): Mild steel drums (5%).

Stainless steel.....	0	
Other ferrous metals.....	5.0	Mild steel
Iron.....		
Aluminium.....		
Beryllium.....	0	
Cobalt.....	0	

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	Copper	
	Lead	0
	Magnox/Magnesium	0
	Nickel	
	Titanium	
	Uranium	0
	Zinc	0
	Zircaloy/Zirconium	0
	Other metals	0
Organics (%wt):	-	
	Total cellulosics	0
	Paper, cotton	0
	Wood	0
	Halogenated plastics	0
	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):	Barium sulphate and radium sulphate (85.5%) has been included in cement total, as no other place to include.	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs	0
	Soil	0
	Brick/Stone/Rubble	0
	Cementitious material	95.0
	Sand	0
	Glass/Ceramics	
	Graphite	0
	Desiccants/Catalysts	0
	Asbestos	0
	Non/low friable	
	Moderately friable	

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	Highly friable.....		
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	Barium sulphate and radium sulphate present (85%)		
	Fluoride.....	0	
	Chloride.....	0	
	Iodide.....	0	
	Cyanide.....	0	
	Carbonate.....	0	
	Nitrate.....	0	
	Nitrite.....	0	
	Phosphate.....	0	
	Sulphate.....	<85.0	Barium and radium sulphate
	Sulphide.....	0	
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	

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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:	This waste will be removed from the HHISOs it is currently stored in and will grouted into 6m3 concrete boxes.
Plant Name:	Not established
Location:	Dounreay
Plant startup date:	-
Total capacity (m^3/y incoming waste):	-
Target start date for packaging this stream:	-
Throughput for this stream (m^3/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
6m^3 concrete box (SD)	100.0	1.6	5.76	147

Likely container type comment:	6m3 concrete box is an option if the waste goes as ILW.
Range in container waste volume:	Assumes 6 drums per 6m3 concrete box and no allowance for furniture. Could potentially be up to 8 drums.
Other information on containers:	Normal density 6m3 concrete box grout.
Likely conditioning matrix:	
Other information:	-
Conditioned density (t/m^3):	~2.0
Conditioned density comment:	To be confirmed.
Other information on conditioning:	-
Opportunities for alternative disposal routing:	Yes

Treatment	Stream volume (%)	Comment
-	-	-
Potential for disposal as LLW	100.0	This is under review
Potential for disposal as NORM waste	100.0	This is under review

RADIOACTIVITY

Source:	Between 1989 and 2003, pipeline tubulars and platform components originating from North Sea offshore operations have been cleaned in a dedicated facility on the Dounreay Site. The cleaning operation is required to remove the Low Specific Activity (LSA) scale which is deposited on the pipeline and associated equipment while it is in service. The scale contains low levels of naturally occurring U and Th daughter products and after removal it is currently drummed and stored on the Dounreay Site.
Uncertainty:	The information is accurate to within a factor of 10.
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 specific activity is based on the consignor's records.
Other information:	Stock and arising activity based on consignor's declarations.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ 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	1.91E-05	C C 2		
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	1.82E-05	C C 2		
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	7.18E-05	C C 2		
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
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					Other a	4.67E-04	C C 2		
Eu 152					Other b/g	3.96E-04	C C 2		
Eu 154					**Total a**	**5.57E-04**	**C C 2**	**0**	
Eu 155					**Total b/g**	**4.15E-04**	**C C 2**	**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 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