WASTE STREAM 9J45 Miscellaneous Activated Components R1

SITE Hunterston A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW; SPD3

WASTE VOLUMES

		Reported		
Stocks:	At 1.4.2019.....	0.8 m³		
Total future arisings:		0 m³		
Total waste volume:		0.8 m³		
Comment on volumes:	No future arisings.			
Uncertainty factors on volumes:	Stock (upper): x 1.2		Arisings (upper) x	
	Stock (lower): x 0.8		Arisings (lower) x	

WASTE SOURCE The source of the waste is in-core components.

PHYSICAL CHARACTERISTICS

General description:	The waste consists of redundant control rods and associated equipment such as distance tubes. Control rods are approximately 200 kg each and are 7.08 m long (120 mm maximum diameter).
Physical components (%wt):	Control rods and distance tubes (100%).
Sealed sources:	-
Bulk density (t/m³):	~2.5
Comment on density:	Bulk density is raw, as stored, and is estimated.

CHEMICAL COMPOSITION

General description and components (%wt):	The waste consists principally of stainless steel, with other unspecified metals.
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: The chemical form of tritium has not been determined but may be present as water or as other inorganic compounds or as organic compounds. C-14: Carbon 14 will be present as graphite. Cl-36: The chemical form of chlorine 36 content has not been determined. Se-79: The selenium content is insignificant. Tc-99: The chemical form of technetium has not been determined. Ra: The radium isotope content is insignificant. Th: The thorium isotope content is insignificant. U: The chemical form of uranium isotopes has not been determined but may be uranium oxides. Np: The neptunium content is insignificant. Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
Metals and alloys (%wt):	Control rods (~100%). 7.06 m long x 0.12 m maximum diameter.

Stainless steel.....	~90.0	The waste contains steel and other metals.
Other ferrous metals.....	NE	Control rods contain boron steel inserts.
Iron.....		
Aluminium.....	NE	
Beryllium.....	NE	
Cobalt.....		
Copper.....	NE	
Lead.....	NE	
Magnox/Magnesium.....	TR	

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	Nickel	NE	Alloying proportions of tin, nickel, niobium and molybdenum may be present.
	Titanium		
	Uranium		
	Zinc	NE	
	Zircaloy/Zirconium	TR	
	Other metals	NE	"Other" metals not fully assessed.
Organics (%wt):	None expected.		
	Total cellulosics	0	
	Paper, cotton	0	
	Wood	0	
	Halogenated plastics	0	
	Total non-halogenated plastics	NE	
	Condensation polymers	NE	
	Others	NE	
	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):	Traces of graphite may be present.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	0	
	Graphite	NE	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	

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Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt): There are no inorganic anions present.

Fluoride..... 0

Chloride..... 0

Iodide..... 0

Cyanide..... 0

Carbonate..... 0

Nitrate..... 0

Nitrite..... 0

Phosphate..... 0

Sulphate..... 0

Sulphide..... 0

Materials of interest for waste acceptance criteria: There are no hazardous materials present.

Combustible metals..... 0

Low flash point liquids..... 0

Explosive materials..... 0

Phosphorus..... 0

Hydrides..... 0

Biological etc. materials..... 0

Biodegradable materials.....

Putrescible wastes..... 0

Non-putrescible wastes.....

Corrosive materials..... 0

Pyrophoric materials..... 0

Generating toxic gases..... 0

Reacting with water..... 0

Active particles.....

Soluble solids as bulk chemical compounds.....

Hazardous substances / non hazardous pollutants: None expected.

Acrylamide.....

Benzene.....

Chlorinated solvents.....

Formaldehyde.....

Organometallics.....

Phenol.....

Styrene.....

Tri-butyl phosphate.....

Other organophosphates.....

Vinyl chloride.....

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	Arsenic.....
	Barium.....
	Boron.....
	Cadmium.....
	Caesium.....
	Selenium.....
	Chromium.....
	Molybdenum.....
	Thallium.....
	Tin.....
	Vanadium.....
	Mercury compounds.....
	Others.....
	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 waste is not expected to be supercompacted. It will be placed in baskets in a 4m stainless steel ILW Box and is now assumed to be encapsulated.
Plant Name:	-
Location:	Hunterston A Decommissioning Site
Plant startup date:	2072
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	2075
Throughput for this stream (m^3/y incoming waste):	<1.0
Other information:	The current proposal is to store the waste as at present until Final Dismantling commencing in 2072. All waste is expected to be retrieved when a conditioning campaign is undertaken. Baskets of different ILW wastes may be in the same package.

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Likely container type:

Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
4m box (no shielding)	100.0	~16.2	18.9	< 1

Likely container type comment:	Container choice may be influenced by the Transport Regulations at the time of Final Site Clearance. The waste is assumed to be in baskets in the waste package so the occupied volume in the package is greater than the original waste volume.
Range in container waste volume:	This waste will only occupy one box.
Other information on containers:	Likely to be stainless steel.
Likely conditioning matrix:	Blast Furnace Slag / Ordinary Portland Cement
Other information:	The waste is assumed to be encapsulated. The matrix is likely to be BFS/OPC.
Conditioned density (t/m³):	~3.0
Conditioned density comment:	The density assumes that the waste is encapsulated.
Other information on conditioning:	Appropriate plant will be provided at the Station in accordance with Company strategy. Wastes will be in baskets placed in the waste packages. Baskets of different Final Dismantling ILW wastes may be in the same packages. The matrix would be likely to be BFS/OPC. The density of the encapsulated waste would probably be about 3t/m3.
Opportunities for alternative disposal routing:	No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Activation of steel, principally due to Fe55 and Co60.
Uncertainty:	Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.
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:	Estimates are based upon theoretical assessments.
Other information:	-

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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	<1.81E+00	C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-02	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3E-05	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		8			Pb 205		8		
Fe 55	2.02E-01	C C 2			Pb 210		8		
Co 60	6.13E-01	C C 1			Bi 208		8		
Ni 59	4E-02	C C 2			Bi 210m		8		
Ni 63	2.82E+00	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	<4.04E-05	C 3			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94	4E-05	C C 2			Th 234	7E-09	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	<1E-08	C 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	<6.07E-09	C 3		
Ag 108m	3.94E-05	C C 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	<7E-09	C 3		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	<2.79E-06	C 3		
Sn 123		8			Pu 239	<3E-06	C 3		
Sn 126		8			Pu 240	<4.00E-06	C 3		
Sb 125		8			Pu 241	<3.89E-05	C 3		
Sb 126		8			Pu 242	<2E-09	C 3		
Te 125m		8			Am 241	<8.58E-06	C 3		
Te 127m		8			Am 242m	<1.91E-08	C 3		
I 129		8			Am 243	<6.00E-09	C 3		
Cs 134		8			Cm 242	<1.58E-08	C 3		
Cs 135		8			Cm 243	<4.07E-09	C 3		
Cs 137	<5.69E-05	C 3			Cm 244	<4.25E-08	C 3		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	<8.33E-09	C 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<8.39E-07	C 3			Other a				
Eu 152	1.26E-05	C C 2			Other b/g				
Eu 154	9.66E-06	C C 2			**Total a**	**1.85E-05**	**C C 2**	**0**	
Eu 155		8			**Total b/g**	**5.50E+00**	**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