WASTE STREAM 9E320 Miscellaneous Metals (Reactor) ILW

SITE Oldbury

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2096 - 31.3.2101.....	0.1 m³
Total future arisings:		0.1 m³
Total waste volume:		0.1 m³

Comment on volumes: Waste arisings are assumed to occur at a uniform rate over 5 years Final Site Clearance is assumed to commence in 2091. Volumes and radioactivity have been calculated for 85 years after reactor shutdown.

Uncertainty factors on volumes:

Stock (upper):	x	Arisings (upper)	x 1.2
Stock (lower):	x	Arisings (lower)	x 0.8

WASTE SOURCE A variety of miscellaneous metallic wastes resulting from reactor dismantling.

PHYSICAL CHARACTERISTICS

General description: Reactor components including channel gas outlet thermocouples, core thermocouples and thermocouple insulation.

Physical components (%wt): Thermocouple metals 40%, thermocouple insulation 60%

Sealed sources: -

Bulk density (t/m³): ~1.4

Comment on density: The density is of the waste as cut for packaging.

CHEMICAL COMPOSITION

General description and components (%wt): Chromel (20%wt), alumel (20%wt) and magnesium oxide (60%wt).

Chemical state: Neutral

Chemical form of radionuclides:
H-3: The tritium content is insignificant.
C-14: The carbon 14 content is insignificant.
Cl-36: The chlorine 36 will be incorporated in the metal.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: The radium content is insignificant.
Th: The thorium content is insignificant.
U: The uranium content is insignificant.
Np: The neptunium content is insignificant.
Pu: The plutonium content is insignificant.

Metals and alloys (%wt): Items will have been cut for packaging in a standard ILW container.

Stainless steel.....	NE	There may be some stainless steel as the thermocouple sheath.
Other ferrous metals.....	0	
Iron.....		
Aluminium.....	0	
Beryllium.....	0	
Cobalt.....		
Copper.....	0	
Lead.....	0	
Magnox/Magnesium.....	0	
Nickel.....	40.0	Chromel (NiCr) (20%wt) and

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			Alumel (NiAl) (20%wt) will be present.
	Titanium		
	Uranium		
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals		
Organics (%wt):	None expected. No halogenated plastics or rubbers will be present.		
	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):	Some graphite dust may be associated with reactor materials.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	60.0	MgO is also expected to be present as thermocouple insulation (60%)
	Graphite	TR	
	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):	Trace quantities of chloride may be present.
	Fluoride..... 0
	Chloride..... TR
	Iodide..... 0
	Cyanide..... 0
	Carbonate..... 0
	Nitrate..... 0
	Nitrite..... 0
	Phosphate..... 0
	Sulphate..... 0
	Sulphide..... 0
Materials of interest for waste acceptance criteria:	No materials likely to pose a fire or other non-radiological hazard have been identified.
	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):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... TR

PACKAGING AND CONDITIONING

Conditioning method:	The waste is not expected to be supercompacted. The treatment envisaged is the placement of the waste in baskets followed by encapsulation.
Plant Name:	None
Location:	Oldbury Power Station
Plant startup date:	About 2096
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	2096
Throughput for this stream (m^3/y incoming waste):	<0.1
Other information:	The processing strategy has not yet been determined.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
4m box (no shielding)	100.0	16.2	18.9	< 1

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Likely container type comment:	The 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:	Not yet determined No significant variability is expected.
Other information on containers:	The container material is expected to be stainless steel.
Likely conditioning matrix:	Blast Furnace Slag / Ordinary Portland Cement
Other information:	The waste is assumed to be encapsulated.
Conditioned density (t/m³):	~3.0
Conditioned density comment:	The conditioned waste density assumes that the waste will be encapsulated.
Other information on conditioning:	The waste will be in baskets placed in the waste packages. Baskets of different Final Site Clearance ILW wastes may be in the same waste package. The encapsulation matrix is likely to be BFS/OPC and the density of the conditioned waste product would be about 3 t/m3. The volume of this stream is small and will not fill one box. Data have been presented as if the waste will be placed in a container with other ILW.
Opportunities for alternative disposal routing:	

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Activation of the metals and impurities.
Uncertainty:	The values quoted were derived by calculation from available material specification and are indicative of the activities that are expected. The major source of uncertainty is the impurity levels.
Definition of total alpha and total beta/gamma:	Total beta/gamma is defined as the sum of the listed activities of all nuclides other than alpha emitters. All alpha emitter activities are insignificant.
Measurement of radioactivities:	The specific activities have been estimated using a neutron activation calculation.
Other information:	The activities quoted are those at 85 years after reactor shutdown. There may be some contamination by Cs137.

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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				8	Gd 153				8
Be 10				8	Ho 163				8
C 14				8	Ho 166m				8
Na 22				8	Tm 170				8
Al 26			5E-04	C C 2	Tm 171				8
Cl 36			1.95E-02	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			7.62E-02	C C 2	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55			5.05E-09	C C 2	Pb 210				8
Co 60			3.08E-02	C C 2	Bi 208				8
Ni 59			2.06E+01	C C 2	Bi 210m				8
Ni 63			1.67E+03	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				8	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				8	Th 234				8
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238				8
Sn 123				8	Pu 239				8
Sn 126				8	Pu 240				8
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241				8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				6	Cm 244				8
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	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152				8	Other b/g				C C 2
Eu 154				8	**Total a**	**0**		**0**	
Eu 155				8	**Total b/g**	**0**		**1.69E+03**	**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