WASTE STREAM 9C24 FED Magnox (Lugs)

SITE Dungeness A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2016.....	1.8 m³
Total future arisings:		0 m³
Total waste volume:		1.8 m³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

WASTE SOURCE FED found inside fuel skips in R1 & R2 ponds.The waste consists of Magnox metal, swarf and sludge which may be contaminated by fission products and actinides. Components may weigh up to about 10g and be approximately 4 mm x 15 mm x 100 mm. It is anticipated that there will be a few fuel element Nimonic springs associated with the waste. There are no large items in the waste which will require special handling.

PHYSICAL CHARACTERISTICS

General description:	FED Magnox
Physical components (%vol):	Magnox, magnesium hydroxide and magnesium carbonate will be present (>99.9% wt). A few Nimonic springs (<0.1% wt) and fuel element top end fittings are also anticipated and there will be very small quantities of zirconium alloy (<0.1% wt) in these fuel element top end fittings.
Sealed sources:	-
Bulk density (t/m³):	0.7
Comment on density:	The bulk density of .7 t/m3 assumes a packing factor of 2.5 times the displacement volume of the material

CHEMICAL COMPOSITION

General description and components (%wt):	Magnox metal, magnesium carbonate and magnesium hydroxide. Activation of trace components within the Magnox (>99% wt in total including impurities). Fission product and actinide contamination. It is anticipated that the waste volume will include a small fraction of fuel element top end fittings which will incorporate highly active Nimonic springs together with some zirconium alloy.
Chemical state:	-
Chemical form of radionuclides:	H-3: The tritium is expected to be present as surface contamination, possibly as water, but perhaps in the form of other inorganic or organic compounds. C-14: The carbon-14 will probably be present as graphite. Tc-99: The chemical form of technetium has not been determined. Ra: Chemical form of Uranium isotopes has not been determined but may be oxides. Np: The chemical form of neptunium has not been determined. Pu: Chemical form of plutonium isotopes has not been determined but may be oxides.
Metals and alloys (%wt):	Magnox metal incorporating impurities which may include beryllium. Chromium and nickel will be constituents of the Nimonic. Some zirconium. The waste is lugs, which will be typically 4 mm by 15 mm by 100 mm.
	Stainless steel.....
	Other ferrous metals.....
	Aluminium.....
	Beryllium.....
	Cobalt.....
	Copper.....
	Lead.....

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	Magnox/Magnesium	>99.0
	Nickel	
	Titanium	
	Uranium	
	Zinc	
	Zircaloy/Zirconium	
	Other metals	
Organics (%wt):	-	
	Total cellulosics	
	Paper, cotton	
	Wood	
	Halogenated plastics	
	Total non-halogenated plastics	
	Condensation polymers	
	Others	
	Organic ion exchange materials	
	Total rubber	
	Halogenated rubber	
	Non-halogenated rubber	
	Other organics	
Other materials (%wt):	-	
	Inorganic ion exchange materials.	
	Inorganic sludges and flocs	
	Soil	
	Brick/Stone/Rubble	
	Cementitious material	0
	Sand	0
	Glass/Ceramics	
	Graphite	
	Desiccants/Catalysts	
	Asbestos	
	Chrysotile	
	Amosite	
	Crocidolite	
	Free aqueous liquids	
	Free non-aqueous liquids	
	Powder/Ash	
Inorganic anions (%wt):	-	

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	Fluoride.....		
	Chloride.....		
	Iodide.....		
	Cyanide.....		
	Carbonate.....		
	Nitrate.....		
	Nitrite.....		
	Phosphate.....		
	Sulphate.....		
	Sulphide.....		
Materials of interest for waste acceptance criteria:	-		
	Combustible metals.....	Yes	>99%
	Low flash point liquids.....		
	Explosive materials.....		
	Phosphorus.....		
	Hydrides.....		
	Biological etc. materials.....		
	Biodegradable materials.....		
	Putrescible wastes.....		
	Non-putrescible wastes.....		
	Corrosive materials.....		
	Pyrophoric materials.....		
	Generating toxic gases.....		
	Reacting with water.....	Yes	>99%
	Active particles.....		
	Soluble soilds as bulk chemical compounds.....		
Hazardous substances / non hazardous pollutants:	-		
	Vinyl chloride.....		
	Tri-butyl phosphate.....		
	Phenol.....		
	Benzene.....		
	Arsenic.....		
	Boron.....		
	Cadmium.....		
	Selenium.....		
	Chromium.....		
	Molybdenum.....		
	Tin.....		
	Vanadium.....		
	Others.....		

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Complexing agents (%wt):

Aminopolycarboxylic acids.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents.....

PACKAGING AND CONDITIONING

Conditioning method: The FED will be dissolved in the dissolution plant and the remaining sludge will be packaged with 9C17

Plant Name: Dungeness A Magnox Dissolution Plant

Location: Dungeness A Station

Plant startup date: 1988

Total capacity (m^3/y incoming waste): 25.0

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): 23.0

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: The assumed process is dissolution.

Opportunities for alternative disposal routing: No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source: Totals shown on table of radionuclide activities are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma.'

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Uncertainty:	The source of the waste is the removal of lugs from fuel elements prior to dispatch of the elements to Sellafield. Activation of trace nuclides in the Magnox and contamination by fission products and actinides will be main sources of activity.
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 values quoted are indicative of the activities that might be expected. Specific activity is a function of Station operation history.
Other information:	The activity estimates make no allowance for any Nimonic springs or zirconium alloy in top end fittings. The resulting average activities in the waste are thought to lie within the uncertainties associated with the average activities of the Magnox.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2016	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2016	Bands and Code	Future arisings	Bands and Code
H 3	3.62E-03	C C 2			Gd 153		8		
Be 10	3E-07	C C 2			Ho 163		8		
C 14	3E-04	C C 2			Ho 166m		8		
Na 22					Tm 170		8		
Al 26	7E-05	C C 2			Tm 171		8		
Cl 36	3E-04	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n				
K 40		8			Hf 182		8		
Ca 41	<5E-05	C 3			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54	5.43E-09	C C 2			Pb 205		8		
Fe 55	1.02E-03	C C 2			Pb 210		8		
Co 60	<3.06E-03	C 3			Bi 208		8		
Ni 59	4E-05	C C 2			Bi 210m		8		
Ni 63	4.69E-03	C C 2			Po 210		8		
Zn 65	8.01E-09	C C 2			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	5.64E-05	C C 2			Th 227		8		
Zr 93	9E-08	C C 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	4.17E-08	C C 2			Th 232		8		
Nb 94		8			Th 234	7E-08	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	7.18E-09	C C 2		
Tc 99	2E-08	C C 2			U 232		8		
Ru 106	1.03E-09	C C 2			U 233		8		
Pd 107		8			U 234	5.07E-08	C C 2		
Ag 108m	7.88E-06	C C 2			U 235	1E-09	C C 2		
Ag 110m	1.09E-10	C C 2			U 236	8.01E-09	C C 2		
Cd 109	<2.91E-09	C 3			U 238	7E-08	C C 2		
Cd 113m		8			Np 237	7.18E-09	C C 2		
Sn 119m	<2.94E-09	C 3			Pu 236		8		
Sn 121m	<5.36E-04	C 3			Pu 238	2.8E-05	C C 2		
Sn 123		8			Pu 239	3E-05	C C 2		
Sn 126		8			Pu 240	3E-05	C C 2		
Sb 125	2.09E-05	C C 2			Pu 241	1.3E-03	C C 2		
Sb 126		8			Pu 242	2E-08	C C 2		
Te 125m	5.22E-06	C C 2			Am 241	7.25E-05	C C 2		
Te 127m		8			Am 242m	1.91E-07	C C 2		
I 129		8			Am 243	5.99E-08	C C 2		
Cs 134	4.88E-08	C C 2			Cm 242	1.58E-07	C C 2		
Cs 135		8			Cm 243	5.69E-08	C C 2		
Cs 137	1.63E-04	C C 2			Cm 244	5.67E-07	C C 2		
Ba 133	<1.11E-04	C 3			Cm 245		8		
La 137	<1E-05	C 3			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	<1.85E-03	C 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.87E-07	C C 2			Other a				
Eu 152	1.89E-09	C C 2			Other b/g				
Eu 154	2.9E-07	C C 2			**Total a**	**1.62E-04**	**C C 2**	**0**	
Eu 155	1.1E-07	C C 2			**Total b/g**	**1.72E-02**	**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