WASTE STREAM 9G48/C Encapsulated Skips and Debris from Fuel Cooling Pond

SITE	Trawsfynydd
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	8.1 m^3	9.8 m^3
Total future arisings:		0 m^3	0 m^3
Total waste volume:		8.1 m^3	9.8 m^3
Number of waste packages in stock:	At 1.4.2022.....	3 package(s)	

Comment on volumes: The debris from the transfer of waste stream 9G17 to 9G16 has been added to this stream. There will be no further arisings of this waste stream. Waste consists of debris contained in pond skips. It was removed during final clearing of the fuel cooling ponds. It has been conditioned in 3m3 boxes.

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 the residual debris after the removal of fuel elements, skips and equipment from the fuel-cooling ponds.

PHYSICAL CHARACTERISTICS

General description: The waste consists of three packages of conditioned pond debris. The packages are stainless steel 3-cubic-metre boxes. The waste is mostly Magnox metal which may be contaminated by fission products and actinides. Some Nimonic springs are present in a shielded pot and there will be a little zirconium with the Magnox. There are also some concrete blocks and small scrap items. Each box also contains a contaminated fuel skip, in which the waste was loaded. A mild steel anti-flotation plate of 20 mm thickness was also included in the encapsulated package. The boxes are standard containers and weigh about 6 tonnes.

Physical components (%vol): Magnox (29%), Mild steel (3%), Grout (68%), Others (<1%) .

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 1.8

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Magnox (6%), Mild steel (14%), Grout (80%), Others (<1%) .

Chemical state: Alkali

Chemical form of radionuclides:
H-3: 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: Carbon 14 will probably be present as graphite.
Cl-36: Chlorine 36 incorporated in the Magnox may be associated with barium impurity (barium chloride), other chlorine 36 may be associated with surface contamination.
Se-79: The selenium content is insignificant.
Tc-99: The technetium content is insignificant.
Ra: Radium isotope content is not significant.
Th: The thorium isotope content is insignificant.
U: Chemical form of uranium isotopes has not been determined but may be uranium oxides.
Np: The neptunium content is insignificant.
Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): The fuel skip is made from mild steel plate 6.5 mm thick. The flotation plate is made of mild steel 20 mm thick.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	0		
Other ferrous metals	~14.0		
Iron			
Aluminium	0		
Beryllium	TR		
Cobalt			
Copper	0		
Lead	0		
Magnox/Magnesium	~6.0		
Nickel			
Titanium			
Uranium			
Zinc	0		
Zircaloy/Zirconium	TR		
Other metals	0	There are no "other" metals.	

Organics (%wt): The grout contains 1 to 1.5% superplasticiser (sulphonated naphthalene formaldehyde). The fuel skip was painted with 9kg Calvinac HR800. There are no halogenated plastics or rubbers present with the waste.

	(%wt)	Type(s) and comment	% of total C14 activity
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	<1.0	Grout contains 1 to 1.5% superplasticiser (sulphonated naphthalene formaldehyde). The fuel skip was painted with 9kg Calvinac HR800	

Other materials (%wt): -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	~80.0	Grout	
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Not fully assessed. There will be aluminates and silicates associated with the grout.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	0	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: The Magnox is encapsulated in grout and so does not constitute a fire hazard.

	(%wt)	Type(s) and comment
Combustible metals.....	~6.0	
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.....		

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Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	~6.0
Higher activity particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / non hazardous pollutants: None expected

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
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.....		

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Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Not yet determined. In & of itself not a DI; waste stream may include DIs (notably any stainless steel components)

PACKAGING AND CONDITIONING

Container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
3m^3 box (round corners)	100.0	2.7	2.7	3

Container type comment: The waste has been conditioned.

Range in container waste volume: There is no significant variability in the volume of waste per container

Other information on containers: The container material is stainless steel.

Conditioned density (t/m^3): 1.8

Conditioned density comment: -

Other information on conditioning: -

RADIOACTIVITY

Source: The source of the waste is mostly splitter debris 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 the main sources of activity. There are 155 small, but highly-activated, Nimonic springs in one package, within a steel pot, one-inch thick. There are a number of other small contaminated scrap items from the pond floor.

Uncertainty: The uncertainties are a combination of systematic and counting errors at the one sigma level.

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: Values were derived from spectrometry measurements, and fingerprinting of debris samples.

Other information: -

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3		6			Gd 153		8		
Be 10		6			Ho 163		8		
C 14		6			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36		6			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		6			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		6			Pb 205		8		
Fe 55		6			Pb 210		8		
Co 60	1.45E-02	C C 1			Bi 208		8		
Ni 59		6			Bi 210m		8		
Ni 63		6			Po 210		8		
Zn 65		6			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		6			Th 227		8		
Zr 93		6			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		6			Th 232		8		
Nb 94		8			Th 234		8		
Mo 93		6			Pa 231		8		
Tc 97		8			Pa 233	7.63E-09	C C 2		
Tc 99		6			U 232		8		
Ru 106		6			U 233		8		
Pd 107		8			U 234		6		
Ag 108m		6			U 235		8		
Ag 110m		8			U 236		6		
Cd 109		8			U 238		6		
Cd 113m		8			Np 237	7.70E-09	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		6			Pu 238		6		
Sn 123		8			Pu 239		6		
Sn 126		8			Pu 240		6		
Sb 125		8			Pu 241		6		
Sb 126		8			Pu 242		6		
Te 125m		8			Am 241	1.96E-03	C C 2		
Te 127m		8			Am 242m		6		
I 129		8			Am 243		6		
Cs 134		6			Cm 242		6		
Cs 135		8			Cm 243		6		
Cs 137	<4.56E-03	C 1			Cm 244		6		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		6			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147		6			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		6			Other a				
Eu 152		6			Other b/g				
Eu 154	2.28E-04	C C 2			**Total a**	**1.96E-03**	**C C 2**	**0**	
Eu 155	1.27E-05	C C 2			**Total b/g**	**1.92E-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