WASTE STREAM 9D54 Miscellaneous Activated Components from R2 pond

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

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0.9 m^3
Total future arisings:		0 m^3
Total waste volume:		0.9 m^3

Comment on volumes: There will be no further arisings of this waste steam.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.1	Arisings (upper)	x
	Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE Transfers of miscellaneous activated components from R2 Pond into R2 Wet Vault. RCL dummy fuel elements, absorber bars and RCL cables. The MAC was size reduced for the transfer from the pond to the wet vault.

PHYSICAL CHARACTERISTICS

General description:	122 RCL dummy fuel elements as 244 halves, 10 absorber bars as 20 halves, 41 RCL cables as 576 segments. RCL dummy fuel elements are Magnox fuel cans without uranium used to make up the vacant element positions in the RCL (Replacement Continuous Lead). They were originally 990mm long and the main body has a diameter of 50mm with a maximum diameter of 92mm over the splitter vanes). They were cut in half as part of the transfer operation. The absorber bars are irradiated mild steel tubes with the same dimensions as the RCL elements and a mass of approx. 3.5 kg. They were also cut in half as part of the transfer operation. The appearance of the bar is similar to that of a scaffold tube with lugs attached to the side. A graphite nose cone is attached to one end with a graphite location nose at the other. The RCL cables are approx. 12m long x 10mm diameter stainless steel cables that supported the RCL stringer and included the thermocouple cable. These have been cut into approx. 450mm lengths.
Physical components (%vol):	Magnox metal and mild steel.
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	~0.9
Comment on density:	Preliminary estimate.

CHEMICAL COMPOSITION

General description and components (%wt):	Magnox metal and mild steel.
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Most tritium is expected to be present as surface contamination, possibly as water but perhaps in the form of other inorganic compounds or organic compounds. C-14: Carbon 14 will probably be present as graphite. 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 may be uranium oxides. Np: The chemical form of neptunium has not been determined. Pu: The chemical form of plutonium isotopes may be plutonium oxides.
Metals and alloys (%wt):	Magnox fuel can and dummy hollow mild steel element. RCL cables of stainless steel.

WASTE STREAM 9D54 Miscellaneous Activated Components from R2 pond

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	~~10.0	RCL cables of stainless steel.	
Other ferrous metals	~~30.0	Magnox fuel can and dummy hollow mild steel element.	
Iron			
Aluminium	0		
Beryllium			
Cobalt			
Copper	0		
Lead	0		
Magnox/Magnesium	~~60.0		
Nickel			
Titanium			
Uranium			
Zinc	0		
Zircaloy/Zirconium	TR		
Other metals	0		

Organics (%wt): There may be organics present in trace quantities. Halogenated plastics or rubbers are not expected.

	(%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	TR		

Other materials (%wt): Traces of graphite may be present.

WASTE STREAM 9D54 Miscellaneous Activated Components from R2 pond

	(%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.....	0		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	P		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Traces of magnesium carbonate and magnesium hydroxide are anticipated.

	(%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: Magnox will ignite under appropriate conditions.

	(%wt)	Type(s) and comment
Combustible metals.....	P	
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.....		

WASTE STREAM 9D54 Miscellaneous Activated Components from R2 pond

Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	P
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.....		

WASTE STREAM 9D54 Miscellaneous Activated Components from R2 pond

Complexing agents (%wt):

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

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs (MAC also includes nimonics, known DIs)

PACKAGING AND CONDITIONING

Conditioning method: -

Plant Name: -

Location: Hinkley Point A Site

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: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
500 l RS drum (50mm Pb)	100.0	0.09	0.316	10

Likely container type comment: -

Range in container waste volume: RCL Dummy elements/Absorber bars CF = 2, Cables CF = 10

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

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RADIOACTIVITY

Source:	The waste will have been activated in the reactor and will have contamination by fission products and actinides from reactor and ponds. Activity is likely to be high.
Uncertainty:	The values quoted are preliminary and only indicative of possible values.
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 existing fuel element debris information. Activation of the stainless steel has only been approximated.
Other information:	-

WASTE STREAM 9D54 Miscellaneous Activated Components from R2 pond

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	1.41E-01	C C 2			Gd 153		8		
Be 10	1.63E-06	C C 2			Ho 163		8		
C 14	4.88E-03	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26	<4.07E-06	C 3			Tm 171		8		
Cl 36	1.63E-03	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	<1.63E-04	C 3			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54	2.14E-07	C C 2			Pb 205		8		
Fe 55	<1.60E+00	C 3			Pb 210		8		
Co 60	<1.13E+01	C 3			Bi 208		8		
Ni 59	1.63E+00	C C 2			Bi 210m		8		
Ni 63	1.47E+02	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	2.92E-04	C C 2			Th 227		8		
Zr 93	6.51E-04	C C 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	5.88E-04	C C 2			Th 232		8		
Nb 94		8			Th 234		8		
Mo 93	7.30E-04	C C 2			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	1.63E-04	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m	3.18E-05	C C 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m	<1.15E-03	C 3			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m	<4.68E-03	C 3			Pu 238		8		
Sn 123		8			Pu 239		8		
Sn 126		8			Pu 240	<2.44E-07	C 3		
Sb 125	7.41E-05	C C 2			Pu 241	<2.44E-07	C 3		
Sb 126		8			Pu 242		8		
Te 125m	1.86E-05	C C 2			Am 241		8		
Te 127m		8			Am 242m	<3.36E-08	C 3		
I 129		8			Am 243	<3.36E-08	C 3		
Cs 134	5.28E-08	C C 2			Cm 242		8		
Cs 135		8			Cm 243		8		
Cs 137	4.04E-04	C C 2			Cm 244		8		
Ba 133	<6.10E-04	C 3			Cm 245		8		
La 137	<4.07E-05	C 3			Cm 246	2.52E-07	C C 2		
La 138		8			Cm 248	2.52E-07	C C 2		
Ce 144		8			Cf 249		8		
Pm 145	1.98E-04	C C 2			Cf 250		8		
Pm 147	<3.1E-03	C 3			Cf 251	3.26E-08	C C 2		
Sm 147		8			Cf 252	3.26E-08	C C 2		
Sm 151	7.24E-04	C C 2			Other a	2.44E-07	C C 2		
Eu 152	1.13E-02	C C 2			Other b/g	2.44E-07	C C 2		
Eu 154	9.73E-02	C C 2			**Total a**	**1.32E-03**	**C C 2**	**0**	
Eu 155	9.73E-04	C C 2			**Total b/g**	**1.62E+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