WASTE STREAM 9D39 FED Nimonic R1

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.....	~0.8 m^3
Total future arisings:		0 m^3
Total waste volume:		0.8 m^3

Comment on volumes: There could be up to about 130,000 springs in the vault.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.1	Arisings (upper)	x
	Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE Nimonic springs are incorporated into Magnox fuel element top fittings and are removed during fuel element desplittering.

PHYSICAL CHARACTERISTICS

General description:	Springs are about 33 mm long, 10 mm in diameter and weigh about 5 g. There are no large items present in the waste which may require special handling.
Physical components (%vol):	Nimonic springs (~100 vol%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m^3):	~0.82
Comment on density:	-

CHEMICAL COMPOSITION

General description and components (%wt):	Nimonic (~100%).
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Tritium will probably be present as surface contamination, possibly as water but perhaps as other inorganic or organic compounds. C-14: Carbon 14 is likely to be present in the form of graphite contamination. Cl-36: Chlorine 36 will probably be present in the form of graphite contamination. Se-79: The selenium content is insignificant. Tc-99: The chemical form of technetium has not been determined. Ra: Radium isotope content is insignificant. Th: The thorium isotope content is insignificant. U: Chemical form of uranium isotopes has not been determined but may be uranium oxides. Np: The chemical form of neptunium has not been determined. Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
Metals and alloys (%wt):	Bulk metal items are not present in the waste.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....			
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....			

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Copper	0	
Lead	0	
Magnox/Magnesium	0	
Nickel	~100.0	Present as Nimonic alloy (type 80A).
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	0	
Other metals	0	

Organics (%wt): Organics may be present in trace quantities. No halogenated plastics or rubbers present.

	(%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.

	(%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			

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Asbestos	0
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	P
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): None of the inorganic anions in the table is expected to be present at greater than trace concentration.

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

Materials of interest for waste acceptance criteria: There are no materials identified in the waste likely to represent a fire or other non-radiological hazard.

	(%wt)	Type(s) and comment
Combustible metals	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		
Corrosive materials	0	
Pyrophoric materials	0	
Generating toxic gases	0	
Reacting with water	0	
Higher activity particles		
Soluble solids as bulk chemical compounds		

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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.....		

Complexing agents (%wt): Yes

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

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Potential for the waste to contain discrete items: Yes. Springs are DIs by definition

PACKAGING AND CONDITIONING

Conditioning method: -

Plant Name: -

Location: Hinkley Point A Site

Plant startup date: 2019

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

Target start date for packaging this stream: 2020

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	0.05	0.316	16

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: -

Opportunities for alternative disposal routing: -

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

RADIOACTIVITY

Source: Nimonic springs originally incorporated into Magnox fuel element top end fittings and removed during fuel element desplittering. There will be activation products in the Nimonic and contamination by fission products and actinides.

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'.

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Measurement of radioactivities:	Induced activity has been calculated and fission product and actinide contamination levels have been based upon measurements of the activity of Magnox samples.
Other information:	The Nimonic springs are expected to be of high activity.

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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	5.07E-02	C C 2			Gd 153		8		
Be 10		8			Ho 163	3.99E-08	C C 2		
C 14	2.46E-01	C C 2			Ho 166m	5.24E-05	C C 2		
Na 22		8			Tm 170		8		
Al 26	1.81E-04	C C 2			Tm 171	1.64E-08	C C 2		
Cl 36	3.99E-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	3.32E-07	C C 2			Pt 193		8		
Mn 53		8			Tl 204	9.01E-06	C C 2		
Mn 54	7.29E-09	C C 2			Pb 205		8		
Fe 55	5.63E-02	C C 2			Pb 210		8		
Co 60	3.41E+01	C C 2			Bi 208		8		
Ni 59	8.38E+00	C C 2			Bi 210m		8		
Ni 63	8.03E+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	1.96E-03	C C 2			Th 227		8		
Zr 93	2.1E-05	C C 2			Th 228	3.12E-08	C C 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	2.06E-04	C C 2			Th 232		8		
Nb 94	2.36E-06	C C 2			Th 234	<5.63E-07	C 3		
Mo 93	2.48E-07	C C 2			Pa 231		8		
Tc 97		8			Pa 233	2.17E-06	C C 2		
Tc 99	5.58E-08	C C 2			U 232	3.66E-08	C C 2		
Ru 106	2.95E-09	C C 2			U 233	1.34E-08	C C 2		
Pd 107		8			U 234	5.02E-07	C C 2		
Ag 108m	3.30E-06	C C 2			U 235	1.13E-08	C C 2		
Ag 110m		8			U 236	6.07E-08	C C 2		
Cd 109		8			U 238	5.63E-07	C C 2		
Cd 113m	3.43E-03	C C 2			Np 237	2.17E-06	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m	6.5E-06	C C 2			Pu 238	1.23E-04	C C 2		
Sn 123		8			Pu 239	1.74E-04	C C 2		
Sn 126		8			Pu 240	1.78E-04	C C 2		
Sb 125	7.91E-08	C C 2			Pu 241	2.30E-03	C C 2		
Sb 126		8			Pu 242	3.22E-07	C C 2		
Te 125m	1.98E-08	C C 2			Am 241	1.05E-03	C C 2		
Te 127m		8			Am 242m		8		
I 129	6.18E-07	C C 2			Am 243		8		
Cs 134	1.10E-07	C C 2			Cm 242		8		
Cs 135		8			Cm 243	8.84E-07	C C 2		
Cs 137	4.74E-04	C C 2			Cm 244	7.69E-06	C C 2		
Ba 133	1.33E-06	C C 2			Cm 245		8		
La 137	3.57E-09	C C 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	4.93E-07	C C 2			Cf 250		8		
Pm 147	7.92E-07	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	8.27E-07	C C 2			Other a				
Eu 152	3.61E-06	C C 2			Other b/g				
Eu 154	1.04E-05	C C 2			**Total a**	**1.54E-03**	**C C 2**	**0**	
Eu 155	6.77E-07	C C 2			**Total b/g**	**8.46E+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