WASTE STREAM 9E44 FED Nimonic

SITE	Oldbury
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.....	<< 0.1 m^3
Total future arisings:		0 m^3
Total waste volume:		<< 0.1 m^3

Comment on volumes: Fuel element spiders (to which Nimonic springs are attached) have not been accumulated on site in significant numbers since the commissioning of a new desplittering machine in 1983. Following this, Fuel elements were then sent to Sellafield with the spiders, containing Nimonic springs, attached.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.2	Arisings (upper)	x
	Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE Nimonic springs from polyzonal Magnox fuel elements.

PHYSICAL CHARACTERISTICS

General description:	Nimonic springs originally incorporated into Magnox fuel element top end fittings and removed during fuel element desplittering. 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):	1.5
Comment on density:	The density given is based on a packing factor of 5 times the displacement volume of the material. (The density will be only 0.4 t/m3 assuming a packing factor of 5 times the cylindrical volume of a spring). The density range is not estimated.

CHEMICAL COMPOSITION

General description and components (%wt):	Activated Nimonic (~100%) which may be contaminated by fission products and actinides.
Chemical state:	Neutral
Chemical form of radionuclides:	H-3: Trace amounts of tritium will be present as surface contamination. C-14: Trace amounts of carbon 14 will be present as graphite. Cl-36: Trace amounts of chlorine 36 will be present in graphite. Se-79: The selenium content is insignificant. Tc-99: The technetium content is insignificant. Ra: Radium isotope content is insignificant. Th: Thorium isotope content is insignificant. U: Trace contamination possibly as uranium metal or uranium oxides. Np: The neptunium content is insignificant. Pu: Trace contamination possibly as plutonium oxides.
Metals and alloys (%wt):	No bulk or sheet metal items present.

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

WASTE STREAM 9E44 FED Nimonic

Cobalt		
Copper	0	
Lead	0	
Magnox/Magnesium	TR	
Nickel	~100.0	100% present as Nimonic alloy (type 80A).
Titanium		
Uranium		
Zinc	0	
Zircaloy/Zirconium	0	
Other metals	0	No "other" metals present.

Organics (%wt): Organics may be present in trace quantities. Halogenated plastics or rubbers are not 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): Some graphite contamination is expected.

	(%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		

WASTE STREAM 9E44 FED Nimonic

Graphite	TR
Desiccants/Catalysts	
Asbestos	0
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	TR
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 concentrations.

	(%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: No materials likely to pose a fire or other non-radiological hazard have been identified.

	(%wt)	Type(s) and comment
Combustible metals	TR	
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	TR	
Higher activity particles		
Soluble solids as bulk chemical compounds		

WASTE STREAM 9E44 FED Nimonic

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	

WASTE STREAM 9E44 FED Nimonic

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

PACKAGING AND CONDITIONING

Conditioning method: Waste streams 9E40, 9E41, 9E42, 9E43 & 9E44 will be packaged together.

Plant Name: -

Location: Oldbury Power Station

Plant startup date: 2023

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

Target start date for packaging this stream: 2023

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

Likely container type comment: There are 115,000 Nimonic springs in total split between waste streams 9E40/41/42/43/44 which will be transferred into Mosaik DCICs. Waste streams 9E40, 9E41, 9E42, 9E43 & 9E44 will be packaged together.

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'.

WASTE STREAM 9E44 FED Nimonic

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. Data taken from M/EF/OLA/EAN/0002/21 and underpinning calculation sheets.
Other information:	The Nimonic springs are expected to be of high activity.

WASTE STREAM 9E44 FED Nimonic

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	2.14E-02	C C 2			Gd 153	7.78E-09	C C 2		
Be 10	7.19E-09	C C 2			Ho 163	1.24E-07	C C 2		
C 14	2.32E-01	C C 2			Ho 166m	2.28E-06	C C 2		
Na 22		8			Tm 170		8		
Al 26	2.69E-08	C C 2			Tm 171	2.82E-05	C C 2		
Cl 36	1.43E-04	C C 2			Lu 174	4.29E-09	C C 2		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n	1.22E-08	C C 2		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53	1.08E-08	C C 2			Tl 204	1.07E-03	C C 2		
Mn 54	4.32E-04	C C 2			Pb 205		8		
Fe 55	1.38E+01	C C 2			Pb 210		8		
Co 60	1.53E+02	C C 2			Bi 208		8		
Ni 59	1.21E+01	C C 2			Bi 210m		8		
Ni 63	1.36E+03	C C 2			Po 210		8		
Zn 65	2.54E-07	C C 2			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85	8.77E-09	C C 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	1.98E-04	C C 2			Th 227		8		
Zr 93	9.24E-05	C C 2			Th 228		8		
Nb 91	1.33E-08	C C 2			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	4.09E-04	C C 2			Th 232		8		
Nb 94	9.63E-06	C C 2			Th 234		8		
Mo 93	1.30E-06	C C 2			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	1.74E-07	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m	4.90E-05	C C 2			U 235		8		
Ag 110m	5.34E-07	C C 2			U 236		8		
Cd 109	1.22E-04	C C 2			U 238		8		
Cd 113m	2.85E-03	C C 2			Np 237		8		
Sn 119m	1.46E-08	C C 2			Pu 236		8		
Sn 121m	3.51E-06	C C 2			Pu 238	1.36E-05	C C 2		
Sn 123		8			Pu 239	1.8E-05	C C 2		
Sn 126		8			Pu 240	2.26E-05	C C 2		
Sb 125	1.53E-05	C C 2			Pu 241	3.83E-04	C C 2		
Sb 126		8			Pu 242		8		
Te 125m	3.82E-06	8			Am 241	5.51E-05	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	6.74E-05	C C 2			Cm 242		8		
Cs 135		8			Cm 243	1.3E-08	C C 2		
Cs 137	2.56E-04	C C 2			Cm 244	3.28E-07	C C 2		
Ba 133	5.42E-05	C C 2			Cm 245		8		
La 137	1.20E-08	C C 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	2.48E-06	C C 2			Cf 250		8		
Pm 147	6.92E-04	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.16E-04	C C 2			Other a				
Eu 152	1.44E-06	C C 2			Other b/g				
Eu 154	1.51E-04	C C 2			**Total a**	**1.10E-04**	**C C 2**	**0**	
Eu 155	3.04E-04	C C 2			**Total b/g**	**1.54E+03**	**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