

WASTE STREAM	9E27	FED Magnox
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SITE Oldbury

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025			
Future arisings:	= 97.9			
Total future arisings:	0.0			
Total waste volume:	97.9			

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: -

Additional information on quantities: Future arisings are zero because the vault is full. Fuel element spiders have not been accumulated on site in significant numbers since the commissioning of a new desplitting machine in 1983.

Uncertainty factors on volumes:

Stock (upper):	x 1.20	Arisings (upper):	x -
Stock (lower):	x 0.80	Arisings (lower):	x -

WASTE SOURCE The source of the waste is the removal of splitters from polyzonal fuel elements prior to dispatch of the elements to Sellafield.

PHYSICAL CHARACTERISTICS

General description: The waste consists of activated Magnox metal and swarf which is contaminated by fission products and actinides. Individual components may weigh up to about 100 g and be approx. 2 mm x 25 mm x (75-900) mm. Some Nimonic springs will also be present (see waste stream 9E43). There are no large items in the waste which will require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 0.32

Comment on density: Density has been calculated using number of splitters in the vault multiplied by mass of an individual splitter to give waste stream mass divided by waste stream volume calculated from height of waste in vault and internal vault capacity.

CHEMICAL COMPOSITION

General description and components (%wt): Magnox metal (>99.5% wt including impurities). Activation of trace components within the Magnox. Fission product and actinide contamination. It is anticipated that the waste will include some fuel element top end fittings which will incorporate highly active Nimonic springs (waste stream 9E43) together with some zirconium alloy.

Chemical state: Neutral

Sheet metal proportion / thickness: No bulk metal items present.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 0	-	
Iron.....	-	-	
Aluminium.....	P	-	
Beryllium.....	TR	Magnox with impurities which may include beryllium.	
Cobalt.....	-	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	> 99.5	Will consist predominantly of Magnox alloy ZR55. includes 0.55% zirconium and 0.5% aluminium. Magnox with impurities which may include beryllium.	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	P	Some zirconium as alloy in the Magnox and as a 'free' metal.	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	There are no halogenated plastics or rubbers present.	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0	There are no halogenated plastics or rubbers present.	
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):

	(%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.....	TR	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	NE	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%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:

	(%wt)	Type(s) and comment
Combustible metals.....	> 99.5	-
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.....	> 99.5	-
Higher activity particles.....	-	-
Soluble solids as bulk chemical compounds.....	-	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	0	-
Benzene.....		-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....		-
Phenol.....		-
Styrene.....		-
Tri-butyl phosphate.....		-
Other organophosphates.....		-
Vinyl chloride.....		-
Arsenic.....		-
Barium.....		-
Boron.....		-
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....		-
Caesium.....		-
Selenium.....		-
Chromium.....		-
Molybdenum.....		-
Thallium.....		-
Tin.....		-
Vanadium.....		-
Mercury compounds.....		-
Others.....		-

Complexing agents (%wt):

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

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction Decay storage Low force compaction Supercompaction (HFC) Incineration Drying/dewatering/liquid separation Tie down/fixatives/strippable coating/painting application Decontamination Metal treatment Recycling / reuse Thermal treatment, including vitrification Encapsulation Polymer encapsulation Other physical treatment Other chemical treatment Containerisation Treatment not yet determined None	Off-site	= 100.0

Comments on planned treatments:

-

Conditioning method:

-

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	100.0	14.4	18.3	7	-

Range in container waste loading: -

Other information on packaging and conditioning:

-

Conditioned density (t/m³):

-

Conditioned density comment:

-

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	= 100.0	0.32	
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
LLWR	GDF	-	AMBER	Baseline position is LLW disposal but this is under threat - under investigation still

RADIOACTIVITY

Source:	The source of the waste is the removal of splitters from fuel 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.
Uncertainty:	The values quoted are indicative of the activities that might be expected. Although the gross beta/gamma activity in the FED material is LLW, this waste stream is not discrete. The FED material is intimately mixed with highly active Nimonic Springs.
Measurement of radioactivities:	Values were derived from measurements.
Chemical form of radionuclides:	H-3: Tritium is expected to be present as surface contamination, possibly as water, or perhaps in the form of other inorganic or organic compounds. C-14: Carbon 14 will 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. I-129: - Ra: Radium isotope content is insignificant. Th: Thorium isotope content is insignificant. U: Chemical form of U isotopes has not been determined but may be oxides. Np: The neptunium content is insignificant. Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

WASTE STREAM 9E27 FED Magnox									
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	1.04E-02	C C 2			Gd 153		8		
Be 10		8			Ho 163	1.49E-08	C C 2		
C 14	3.32E-04	C C 2			Ho 166m	2.72E-07	C C 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.86E-05	C C 2			Lu 174		8		
Ar 39	2.42E-08	C C 2			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41	1.44E-07	C C 2			Pt 193		8		
Mn 53		8			Tl 204	6.90E-07	C C 2		
Mn 54		8			Pb 205		8		
Fe 55	4.70E-07	C C 2			Pb 210		8		
Co 60	3.85E-05	C C 2			Bi 208		8		
Ni 59	1.10E-05	C C 2			Bi 210m		8		
Ni 63	1.07E-03	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	4.83E-05	C C 2			Th 227		8		
Zr 93	1.12E-05	C C 2			Th 228		8		
Nb 91	1.57E-09	C C 2			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	1.76E-05	C C 2			Th 232		8		
Nb 94	1.17E-06	C C 2			Th 234		8		
Mo 93	1.57E-07	C C 2			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	2.11E-08	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234		8		
Ag 108m	2.83E-06	C C 2			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m	9.49E-05	C C 2			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m	2.83E-07	C C 2			Pu 238	4.21E-06	C C 2		
Sn 123		8			Pu 239	6.17E-06	C C 2		
Sn 126		8			Pu 240	7.75E-06	C C 2		
Sb 125	1.23E-09	C C 2			Pu 241	1.28E-04	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	8.59E-06	C C 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134		8			Cm 242		8		
Cs 135		8			Cm 243	2.25E-09	C C 2		
Cs 137	2.62E-05	C C 2			Cm 244	4.61E-08	C C 2		
Ba 133	9.46E-07	C C 2			Cm 245		8		
La 137	1.45E-09	C C 2			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145	1.05E-07	C C 2			Cf 250		8		
Pm 147	3.75E-08	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	1.15E-05	C C 2			Unsp a				
Eu 152	4.37E-08	C C 2			Unsp b/g				
Eu 154	5.81E-07	C C 2			Total a	2.68E-05	*	0	*
Eu 155	6.03E-07	C C 2			Total b/g	1.22E-02	*	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 the 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
* Total calculated from the 114 declared radionuclides