WASTE STREAM	2D403	AHF Non-metallic uranium and sources wastes to WEP

SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE ILW

WASTE VOLUMES

		Reported (m^3)
Stocks:	At 1.4.2025	= 0
Future arisings:	1.4.2026 - 31.3.2027	< 0.1
Total future arisings:		**< 0.1**
Total waste volume:		**< 0.1**

OR

Conditioned (m^3)	Packaged (m^3)

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

Comment on arising rates: Currently only a single waste package has been defined and assessed through the LoC process. Derivation of the remaining inventory is an ongoing exercise.

Additional information on quantities: Currently only a single waste package has been defined and assessed through the LoC process. Derivation of the remaining inventory is an ongoing exercise.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 20.00
Stock (lower):	x -	Arisings (lower):	x 1.00

WASTE SOURCE The AHF is used for the storage of an inventory of fuel waste which exists in various physical forms. Additionally, the facility stores non fuel wastes.

All of this material will be loaded into specially designed furniture in waste baskets, and then transferred to the WEP to be packaged into 500 litre drums using cementitious grout, for long-term interim storage in the Encapsulated Product Stores, and eventual disposal in a Geological Disposal Facility.

PHYSICAL CHARACTERISTICS

General description: The single defined package will contain AGR oxide fuel mounts and sub-stacks. The additional wastes include LWR (PWR/BWR/SGHWR), AGR (including WAGR), Fast reactor: e.g. PFR (oxide, carbide), HTGR (UO2, UCO, U/PuO2, ex DFR irradiated carbide samples, cladding, assembly components, core structure samples (graphite/steel, etc), fuel cuttings, mounted fuel/cladding samples, impregnated sections of fuel rod, fuel samples with fittings, wetted fuel, oxidised fuel/claddings, precipitated/solidified fuel-containing material, including filtrate and concentrated solids, insolubles, e.g. noble metal particles, mounted optical and SEM samples, sealed sources not compatible with MBGWS, high fuel content materials from processing, preparation, examination and testing (e.g. grinding and polishing pads, ion exchange materials), HLW waste forms, (e.g. glasses, glass-ceramics, ceramic) including simulant and accelerated ageing samples (e.g. with high Pu, Cm or Am loadings) and material forms generated during PIE/testing, Americium oxide pellets. These wastes will be determined not to be able to be disposed of via the high heat routes.

Changes since waste generated: Air and water based corrosion.

Bulk density (t/m^3): = 4.8

Comment on density: Bulk density is based on the single defined package. Material mass and material volume of the waste stream.

CHEMICAL COMPOSITION

General description and components (%wt): Based on the single package containing AGR mounts and substacks.

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel	= 82.0	316L and AGR cladding	
Other ferrous metals	= 0.07	Mild steel	
Iron		-	
Aluminium		-	
Beryllium		-	
Cobalt		-	
Copper		-	
Lead		-	
Magnox/Magnesium		-	
Nickel		-	
Titanium		-	
Uranium	= 8.0	Uranium oxide	100.0
Zinc		-	
Zircaloy/Zirconium		-	
Other metals		-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics		-	
Paper, cotton		-	
Wood		-	
Halogenated plastics		-	
Total non-halogenated plastics	= 9.9	Epoxy resin	
Condensation polymers		-	
Others		-	
Organic ion exchange materials		-	
Total rubber		-	
Halogenated rubber		-	
Non-halogenated rubber		-	
Hydrocarbons		-	
Oil or grease		-	
Fuel		-	
Asphalt/Tarmac (cont.coal tar)		-	
Asphalt/Tarmac (no coal tar)		-	
Bitumen		-	
Others		-	
Other organics		-	

Other materials (%wt):

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

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

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals		-
Low flash point liquids		-
Explosive materials		-
Phosphorus		-
Hydrides		-
Biological etc. materials		-
Biodegradable materials		-
Putrescible wastes		-
Non-putrescible wastes		-
Corrosive materials		-
Pyrophoric materials		-
Generating toxic gases		-
Reacting with water		-
Higher activity particles		-
Soluble solids as bulk chemical compounds		-

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide		-
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): No

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

Physical components:

	Number	Type(s) and comment
Sources	> 1	Currently unknown
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	On-site	= 100.0

Comments on planned treatments: Encapsulation in WEP for the single defined package. Other non-defined wastes to be determined.

Conditioning method: Encapsulation in grout at Wastes Encapsulation Plant.

Conditioning plants:

Plant Name	Location
Wastes Encapsulation Plant (WEP)	Sellafield

Likely conditioning matrix: None

Further information on the conditioning matrix: 5:1 GGBS:CEM I 0.47 - 0.59 w/s.

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
500 l drum (basket for waste)	100.0	0.03	0.50	1	2026

Range in container waste loading: N/A for single defined drum. Additional wastes are currently unknown.

Other information on packaging and conditioning: -

Conditioned density (t/m^3): = 1.7

Conditioned density comment: Total waste form volume is 502 L with grout density of 1.74 kg/L. Total waste mass of 0.136 t with volume of 0.029m3. 1 drum currently defined.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland) 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	= 100.0		2077

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
GDF	GDF	= 100.0	GREEN	Opportunity to package some of this waste stream with waste stream 2D402 to maximise packing efficiency.

RADIOACTIVITY

Source: Irradiation in AGR reactors for the single defined package.

Uncertainty: Estimate is suitably conservative based on derived fingerprints based on irradiation history and cooling for the single defined package.

Measurement of radioactivities: A bounding consignment average burn-up of 40 GWd/t with a cooling time of 5 years. The weighted average burn-up of groups of mounts varies between 20 GWd/t and 30 GWd/t and the more recent fuels have had burnup in the range 30-40 GWd/t, therefore 40 GWd/t was chosen to be bounding. This provides some margin without being excessively conservative for more recent materials. The majority of these items have a cooling time of >5,000 days, however some will have been prepared more recently and a cooling time of 5 years provides some margin without being excessively conservative for more recent materials.

Chemical form of radionuclides:

H-3: As oxide
C-14: As oxide
Cl-36: As oxide
Se-79: As oxide
Tc-99: As oxide
I-129: As oxide
Ra: As oxide
Th: As oxide
U: As oxide
Np: As oxide
Pu: As oxide

WASTE STREAM **2D403** **AHF Non-metallic uranium and sources wastes to WEP**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3			= 5.67E+00	A A 2	Gd 153			= 1.92E-03	A A 2
Be 10			= 3.81E-06	A A 2	Ho 163				
C 14			= 2.25E-04	A A 2	Ho 166m			= 1.60E-04	A A 2
Na 22					Tm 170			= 2.12E-08	A A 2
Al 26					Tm 171			= 2.01E-03	A A 2
Cl 36			= 7.97E-09	A A 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			= 6.50E-01	A A 2	Pb 205				
Fe 55			= 2.07E+02	A A 2	Pb 210			= 4.87E-10	A A 2
Co 60					Bi 208				
Ni 59			= 3.85E-01	A A 2	Bi 210m				
Ni 63			= 1.33E-06	A A 2	Po 210			= 4.27E-10	A A 2
Zn 65			= 2.34E-06	A A 2	Ra 223			= 2.44E-07	A A 2
Se 79			= 6.08E-03	A A 2	Ra 225			= 6.84E-09	A A 2
Kr 81			= 3.29E-09	A A 2	Ra 226			= 4.57E-09	A A 2
Kr 85			= 1.21E+02	A A 2	Ra 228				
Rb 87			= 3.89E-07	A A 2	Ac 227			= 9.71E-08	A A 2
Sr 90			= 1.19E+03	A A 2	Th 227			= 9.44E-08	A A 2
Zr 93			= 3.30E-02	A A 2	Th 228			= 3.23E-04	A A 2
Nb 91					Th 229			= 6.84E-09	A A 2
Nb 92					Th 230			= 1.91E-06	A A 2
Nb 93m			= 9.29E-03	A A 2	Th 232				
Nb 94			= 2.40E-06	A A 2	Th 234			= 4.42E-03	A A 2
Mo 93					Pa 231			= 5.93E-07	A A 2
Tc 97					Pa 233			= 3.58E-03	A A 2
Tc 99			= 2.47E-01	A A 2	U 232			= 3.97E-04	A A 2
Ru 106			= 1.79E+02	A A 2	U 233			= 2.60E-07	A A 2
Pd 107			= 1.77E-03	A A 2	U 234			= 2.01E-02	A A 2
Ag 108m			= 2.50E-07	A A 2	U 235			= 1.45E-04	A A 2
Ag 110m			= 2.72E-01	A A 2	U 236			= 5.97E-03	A A 2
Cd 109			= 1.45E-06	A A 2	U 238			= 4.42E-03	A A 2
Cd 113m			= 4.38E-01	A A 2	Np 237			= 3.58E-03	A A 2
Sn 119m			= 3.04E-03	A A 2	Pu 236			= 1.36E-03	A A 2
Sn 121m					Pu 238			= 4.38E+01	A A 2
Sn 123			= 1.14E-03	A A 2	Pu 239			= 2.42E+00	A A 2
Sn 126			= 1.34E-02	A A 2	Pu 240			= 8.88E+00	A A 2
Sb 125			= 5.25E+01	A A 2	Pu 241			= 9.33E+02	A A 2
Sb 126			= 1.88E-03	A A 2	Pu 242			= 3.59E-02	A A 2
Te 125m			= 1.28E+01	A A 2	Am 241			= 1.00E+01	A A 2
Te 127m			= 1.24E-03	A A 2	Am 242m			= 5.51E-02	A A 2
I 129			= 5.48E-04	A A 2	Am 243			= 3.09E-01	A A 2
Cs 134			= 3.93E+02	A A 2	Cm 242			= 3.41E-01	A A 2
Cs 135			= 9.03E-03	A A 2	Cm 243			= 2.34E-01	A A 2
Cs 137			= 1.64E+03	A A 2	Cm 244			= 3.52E+01	A A 2
Ba 133			= 8.76E-08	A A 2	Cm 245			= 3.27E-03	A A 2
La 137					Cm 246			= 1.02E-03	A A 2
La 138					Cm 248			= 7.78E-09	A A 2
Ce 144			= 1.22E+02	A A 2	Cf 249			= 5.63E-08	A A 2
Pm 145			= 1.75E-08	A A 2	Cf 250			= 3.63E-07	A A 2
Pm 147			= 6.50E+02	A A 2	Cf 251			= 2.37E-09	A A 2
Sm 147					Cf 252			= 1.98E-07	A A 2
Sm 151			= 3.46E+00	A A 2	Unsp a				
Eu 152			= 4.23E-02	A A 2	Unsp b/g				
Eu 154			= 1.19E+02	A A 2	**Total a**	**0**	*	**1.01E+02**	*
Eu 155			= 2.00E+01	A A 2	**Total b/g**	**0**	*	**5.65E+03**	*

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