

<b>WASTE STREAM</b>	<b>2F14</b>	<b>AGR Pond Furniture (Containers, Skips, Racks)</b>
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**SITE** Sellafield  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Sellafield Limited  
**WASTE TYPE** LLW  
 Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	0 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2028.....	0 m <sup>3</sup>
	1.4.2028 - 31.3.2029.....	93.5 m <sup>3</sup>
	1.4.2029 - 31.3.2030.....	93.5 m <sup>3</sup>
	1.4.2030 - 31.3.2031.....	146.8 m <sup>3</sup>
	1.4.2031 - 31.3.2032.....	163.0 m <sup>3</sup>
	1.4.2032 - 31.3.2033.....	163.1 m <sup>3</sup>
	1.4.2033 - 31.3.2034.....	163.0 m <sup>3</sup>
	1.4.2034 - 31.3.2035.....	163.1 m <sup>3</sup>
	1.4.2035 - 31.3.2036.....	146.8 m <sup>3</sup>
	1.4.2036 - 31.3.2037.....	1205.0 m <sup>3</sup>
	1.4.2037 - 31.3.2038.....	1188.6 m <sup>3</sup>
	1.4.2038 - 31.3.2039.....	1156.1 m <sup>3</sup>
	1.4.2039 - 31.3.2040.....	351.5 m <sup>3</sup>
	1.4.2040 - 31.3.2090.....	0 m <sup>3</sup>
	1.4.2090 - 31.3.2091.....	720.0 m <sup>3</sup>
	1.4.2091 - 31.3.2092.....	720.0 m <sup>3</sup>
	1.4.2092 - 31.3.2093.....	720.0 m <sup>3</sup>
	1.4.2093 - 31.3.2094.....	720.0 m <sup>3</sup>
	1.4.2094 - 31.3.2095.....	720.0 m <sup>3</sup>
	1.4.2095 - 31.3.2096.....	720.0 m <sup>3</sup>
	1.4.2096 - 31.3.2097.....	720.0 m <sup>3</sup>
	1.4.2097 - 31.3.2098.....	720.0 m <sup>3</sup>
Total future arisings:		10794.0 m <sup>3</sup>
Total waste volume:		10794.0 m <sup>3</sup>

Comment on volumes: Arisings are a function of furniture removal as part of POCO activities and to support long-term storage requirements. Volume is the envelope volume of containers with skips inside, plus envelope volume of 63e racks that are being installed in TR&S. Number of 63e racks to be installed is subject to confirmation, but is assumed to be 720 as an upper estimate. Lower arisings factor does not account for fewer 63e racks.

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

**WASTE SOURCE** Wastes arise from wet-storing AGR fuel elements in FGOFSP, FHP, AGRSP, and TR&S storage ponds.

**PHYSICAL CHARACTERISTICS**

General description: There are three specific cohorts: AGR skips and containers held within AGRSP, FHP, FGOFSP, and TR&S; AGR storage containers stored in FGOFSP; and 63e racks that are to be installed in TR&S to replace existing AGR skips and containers. All waste items are large (e.g. skips: ~2.1m<sup>3</sup>, containers: ~3.6m<sup>3</sup>, 63e racks: ~10.3m<sup>3</sup>) and heavy (skips: ~1.2t; containers: ~2.1t, 63e racks: 7.8t). The waste will not be generated until after 2028.

Physical components (%vol): Containers/skips (45.5%), 63e racks (53.4%), pond frames (1.1%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.93

Comment on density: The density is a weighted average based on the existing container/skip volumes (based on envelope volume), AGR storage rack envelope volume and 63e rack envelope volume.

**CHEMICAL COMPOSITION**

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General description and components (%wt):      Stainless steel (87.1%), concrete (6.4%), boronated stainless steel (6.4%), mild steel (0.1%).

Chemical state:      Neutral

Chemical form of radionuclides:      C-14: Carbonaceous residue transferred from AGR fuel  
 Cl-36: Carbonaceous residue transferred from AGR fuel

Metals and alloys (%wt):      All sheet metal approx 1/4 inch thickness.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	87.1	304L.	
Other ferrous metals.....	~0.10		
Iron.....	~0		
Aluminium.....	P		
Beryllium.....	~0		
Cobalt.....	~0		
Copper.....	~0		
Lead.....	~0		
Magnox/Magnesium.....	~0		
Nickel.....	~0		
Titanium.....	~0		
Uranium.....	~0		
Zinc.....	~0		
Zircaloy/Zirconium.....	~0		
Other metals.....	6.4	Steel content in boronated stainless steel.	

Organics (%wt):      The waste contains no organic materials.

	(%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		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	0		
Oil or grease .....	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		

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Other organics..... 0

Other materials (%wt): The skips may contain trace amounts of carbonaceous deposits, mostly graphite.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	TR		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	6.4		
Sand.....	0		
Glass/Ceramics.....	0		
Graphite.....	~0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): The listed anions are unlikely to be present.

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

Materials of interest for waste acceptance criteria: The recombimer material constitutes a very small proportion of the waste stream.

	(%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	

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Putrescible wastes.....	0
Non-putrescible wastes.....	0
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Higher activity particles.....	0
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants: Catalytic recombiners (Pt/Pd) are present in 170 AGR skips. The weight is negligible compared with the weight of the skips.

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	0	
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....	0	
Boron (non-Boral).....	0.04	Boron content in boronated stainless steel
Cadmium.....	0	
Caesium.....	0	
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	0	
Vanadium.....	0	
Mercury compounds.....	0	
Others.....	0	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	

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EEE Type 5..... 0

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	0	
Other organic complexants.....	0	
Total complexing agents.....	0	

Potential for the waste to contain discrete items: No. Waste will likely either be decontaminated via metallic recycling to out-of-scope levels, or size reduced to sheet metal sections. Not judged as a Discrete Item.

**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None		90.0
		10.0

Comment on planned treatments:

Treatment and disposal plans are currently under development. Options being considered include on-site treatment (decontamination & size reduction) & disposal as LLW and consignment to an off-site metals treatment facility For concrete contained within AGR container lids, given mixed media LLW disposal seen as baseline route. However, opportunity for the waste to undergo sort and segregation to route metals for recycling and concrete for size-reduction and disposal as LLW/VLLW/OoS.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	10.0	
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility	90.0	
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

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

**Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):**

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Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known			

**Opportunities for alternative disposal routing:** Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at LLWR	Mixed Management Route	~10.0	N/A	High	For concrete contained within AGR container lids, given mixed media LLW disposal seen as baseline route. However, opportunity for the waste to undergo sort and segregation to route metals for recycling and concrete for size-reduction and disposal as LLW/VLLW/OoS.

**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	10.0	10	108

Other information: -

**Waste Planned for Disposal at the LLW Repository:**

Container voidage: To be determined based on success of decontamination plus waste loading plan development where metal wastes cannot be decontaminated down to out-of-scope levels.

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

Waste consigned for disposal to LLWR in year of generation: Not yet determined.

**Non-Containerised Waste for In-Vault Grouting:**

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

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Other information: -

**RADIOACTIVITY**

Source: The activity is a result of residual pond water contamination and carbonaceous deposits dislodged from the AGR fuel.

Uncertainty: Specific activities are based on measured samples with well defined measurement uncertainty.

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: Radiometric analysis of swabs taken from 4 containers was carried out and the activity measured for each was scaled up to the total surface area of the containers (and skips within). The average activity per container was based on the total for the 4 divided by the volume of the 4 containers.

Other information: -

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3					Gd 153				
Be 10					Ho 163				
C 14				5	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			~7.30E-08	AA 1	Pb 205				
Fe 55					Pb 210				
Co 60			~7.10E-06	AA 1	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239		~3.80E-08	AA 1	
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			~1.20E-07	AA 1	Cm 242				
Cs 135					Cm 243				
Cs 137			~5.50E-06	AA 1	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154			2.30E-08	AA 1	<b>Total a</b>	<b>0</b>	<b>3.80E-08</b>	<b>AA 1</b>	
Eu 155					<b>Total b/g</b>	<b>0</b>	<b>~1.28E-05</b>	<b>AA 1</b>	

**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