

WASTE STREAM	2A30	Waste Oils
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SITE Calder Hall
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.....	~10.0m ³
Future arisings -	1.4.2022 - 31.3.2023.....	0 m ³
	1.4.2023 - 31.3.2024.....	~0 m ³
	1.4.2024 - 31.3.2025.....	~0 m ³
	1.4.2025 - 31.3.2035.....	~5.0 m ³
Total future arisings:		5.0 m ³
Total waste volume:		15.0 m ³

Comment on volumes: Arisings are as a result of characterising oils remaining on the Calder Hall site after operations ceased. Although no future arisings are anticipated, more arisings may occur as decommissioning progresses and building contents are characterised. The main tanks on the site were cleared but a small quantity of oil may reside within the system and low lying pipework. A figure of approximately 5 m³ has been taken as remaining within the systems. Removal of the remaining blower oil is not currently however specific clearance of the Reactor 4 blower houses is being assessed and the date may be accelerated accelerating some of the future arisings. Still some uncertainty over exact volumes as no measuring devices fitted to storage tanks. Volumes are best estimate, probably accurate to 10%.

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

WASTE SOURCE Calder Hall blower lubricating oil from within controlled areas and active areas.

PHYSICAL CHARACTERISTICS

General description: The waste originates as several types of lubricating oil, some containing water and cleaning solvent. No items require special handling. Water will be separated and disposed of via SETP.

Physical components (%vol): Oil (99%), solvent (<1%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.9

Comment on density: A value of 0.9 t/m³ has been assumed.

CHEMICAL COMPOSITION

General description and components (%wt): Oil (99%), solvent (<1%).

Chemical state: -

Chemical form of radionuclides: H-3: As H₂O.
 C-14: As oil.

Metals and alloys (%wt): -

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

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Cobalt.....	0
Copper.....	TR
Lead.....	TR
Magnox/Magnesium.....	NE
Nickel.....	
Titanium.....	
Uranium.....	NE
Zinc.....	TR
Zircaloy/Zirconium.....	NE
Other metals.....	0

Organics (%wt): The waste is oil and solvent. None present.

	(%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.....	NE		
Oil or grease	NE	Oil quantified under "Free non-aqueous liquids".	
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		

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.....			
Graphite.....	0		

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Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	~99.0
Powder/Ash.....	0

Inorganic anions (%wt): Chlorides, sulphates, phosphates and sulphides will be present at trace levels (<0.01%). Others may also be present in trace amounts.

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

Materials of interest for waste acceptance criteria: Oil is a flammable material and is controlled by COSHH regulations.

	(%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: Present at low concentrations (<0.001%) as additives. Oils (99%), solvents (<1%).

	(%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.....		
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.....	TR	Trace levels of organic complexing agents will be present as oil additives and stabilisers or as organic degradation products.
Total complexing agents.....	TR	

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Potential for the waste to contain discrete items: No.

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		100.0

Comment on planned treatments:

It is expected that waste oil will be incinerated. Any water will be separated off and disposed of via SETP.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
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	100.0	0.90

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):

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: No

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

Waste Packaging for Disposal: (Not applicable to this waste stream)

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Container	Stream volume %	Waste loading m ³	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			

Other information: It is expected that waste oil will be incinerated. It will not be disposed of to the LLWR.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: The main sources of activity are fission and activation products.

Uncertainty: The uncertainty has been derived from the accuracy of the analysis results for the sample with the highest specific activity. All other samples have low specific activity by comparison.

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: The specific activity data has been derived from a weighted average of the reported analytical results detailed in the characterisation documents for each of the waste oil storage locations.

Other information: The only possible source of activity after burning is ash. Ash volumes will be negligible and activity levels are expected to be very low.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	~1.21E-05	AA 1	~1.21E-05	AA 1	Gd 153				
Be 10					Ho 163				
C 14	~3.14E-08	AA 1	~3.14E-08	AA 1	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					Pb 205				
Fe 55	~1.09E-07	AA 1	~1.09E-07	AA 1	Pb 210				
Co 60	~5.77E-08	AA 1	~5.77E-08	AA 1	Bi 208				
Ni 59					Bi 210m				
Ni 63	~3.01E-07	AA 1	~3.01E-07	AA 1	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		6		6	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		6		6
Ag 108m					U 235		6		6
Ag 110m					U 236		6		6
Cd 109					U 238		6		6
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241	~6.65E-10	AA 1	~6.65E-10	AA 1
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	~7.95E-08	AA 1	~7.95E-08	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					Total a	~6.65E-10	AA 1	~6.65E-10	AA 1
Eu 155					Total b/g	~1.27E-05	AA 1	~1.27E-05	AA 1

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