

WASTE STREAM	2P07	NNL Tc-99 lab waste
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SITE Sellafield NNL

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN National Nuclear Laboratory

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

Stocks:	At 1.4.2022.....	Reported 0.6 m ³
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Total future arisings:		0 m ³
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Total waste volume:		0.6 m ³
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Comment on volumes: This is a known defined volume of waste arising from previous work. No further similar waste is planned to be generated. This is a known volume of waste and no further waste will be generated. So uncertainty factors are 1.

Uncertainty factors on volumes:	Stock (upper):	x 1.0	Arisings (upper)	x
	Stock (lower):	x 1.0	Arisings (lower)	x

WASTE SOURCE Failed experimental waste.

PHYSICAL CHARACTERISTICS

General description: Glass boats, tube furnace, Glass tubes, dreschel bottles, tubing, general purpose (GP) gloves, aprons, sleeves, nitrile gloves, Kimtex wipes, Rad wipes, plastic vials, pipettes, test tubes, Sisal paper. No changes to the waste.

Physical components (%wt): Metal (49%), biodegradable (non-putrescible) 7%, plastics (halogenated) 7%, rubber 7%, others 30%. Others is 8 x Tc-99 loaded glass boats in PVC bags in a paint tin, and 1 x bag of broken up, contaminated glass lab items in a plastic bag in paint tin, the furnace (WEEE) and the ceramic fibre board (insulation) element of the furnace.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.2

Comment on density: There is 0.11 tonne in 0.6 m3. However not all items have been weighed and volume is estimated so the final figure is approximate.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (49%), biodegradable (non-putrescible) 7%, plastics (halogenated) 7%, rubber 7%, others 30%.

Chemical state: Neutral

Chemical form of radionuclides: Tc-99: Solid - Is encapsulated in the glass or is contamination in the rest of the waste

Metals and alloys (%wt): There is no sheet metal. There are metal containers typically 1mm thick. There are also the steel drums which will contain the waste, typically 1 mm thick. The furnace is a bulk item, ~30kg, H 550mm x W 310mm x D 750 mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....	49.0		
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			

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Magnox/Magnesium.....
 Nickel.....
 Titanium.....
 Uranium.....
 Zinc.....
 Zircaloy/Zirconium.....
 Other metals.....

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	7.0		
Paper, cotton.....	7.0		
Wood.....			
Halogenated plastics	7.0		
Total non-halogenated plastics.....			
Condensation polymers.....			
Others.....			
Organic ion exchange materials....			
Total rubber.....	7.0		
Halogenated rubber	7.0		
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.....	30.0		
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....			
Non/low friable.....			

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Moderately friable.....

Highly friable.....

Free aqueous liquids.....

Free non-aqueous liquids.....

Powder/Ash.....

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.....

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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..... 1.0
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

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

Potential for the waste to contain discrete items: Yes. The furnace is considered a discrete item.

TREATMENT, PACKAGING AND DISPOSAL

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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	Off-site	100.0

Comment on planned treatments:

The waste will not be treated. It will be sent direct to LLWR for disposal

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	<0.01

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:

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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: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: The waste will not be compacted as it is deemed to be BAT to send the waste direct to LLWR. Therefore there will be some voidage within the 3 x 200 litre drums that will contain the waste. Estimates 60% voidage.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCH. Inventory information is consistent with the current WCH. The WCH is yet to be approved but is anticipated to be approved shortly so there should not be any significant difference.

Waste consigned for disposal to LLWR in year of generation: No. The waste was generated in 2013.

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: A failed experiment using a known quantity of Tc-99 led to the generation of the waste.

Uncertainty: There are no uncertainties, there is a known activity of Tc-99 in a known quantity of waste.

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: A known amount of activity was provided for the experiment.

Other information: -

WASTE STREAM

2P07

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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					Gd 153				
Be 10					Ho 163				
C 14					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					Pb 210				
Co 60					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	9.40E-04	AA 3			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				
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					Cm 242				
Cs 135					Cm 243				
Cs 137					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	0	AA 3	0	
Eu 155					Total b/g	9.40E-04	AA 3	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