SITE Sellafield NNL SITE OWNER **Nuclear Decommissioning Authority WASTE CUSTODIAN** National Nuclear Laboratory LLW **WASTE TYPE** Is the waste subject to Nο Scottish Policy: **WASTE VOLUMES** Reported At 1.4.2022..... Stocks: $0.6 \, \text{m}^{3}$ Total future arisings: $0 \, \text{m}^3$ $0.6 \, \text{m}^3$ Total waste volume: 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 Stock (upper): x 1.0 Arisings (upper) Х volumes: Arisings (lower) Stock (lower): x 1.0 Х **WASTE SOURCE** Failed experimental waste. PHYSICAL CHARACTERISTICS Glass boats, tube furnace, Glass tubes, dreschel bottles, tubing, general purpose (GP) General description: 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 Metal (49%), biodegradable (non-putrescible) 7%, plastics (halogenated) 7%, rubber 7%, components (%wt): others 30%. Chemical state: Neutral Chemical form of Tc-99: Solid - Is encapsulated in the glass or is contamination in the rest of the waste radionuclides: 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.....

	Magnox/Magnesium			
	Nickel			
	Titanium			
	Uranium			
	Zinc			
	Zircaloy/Zirconium			
	Other metals			
Organio	s (%wt): -			
		(%wt)	Type(s) and comment	% of total C14
	Total cellulosics	7.0		activity
	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 m	naterials (%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			

	Moderately friable		
	Highly friable		
	Free aqueous liquids		
	Free non-aqueous liquids		
	Powder/Ash		
Inorganic ani	ons (%wt): -		
		(%wt)	Type(s) and comment
		(70111)	Type(3) and comment
	Fluoride		
	Chloride		
	lodide		
	Cyanide		
	Carbonate		
	Nitrate		
	Nitrite		
	Phosphate		
	Sulphate		
	Sulphide		
Materials of i	nterest for - ance 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 s non hazardo	ubstances / - us pollutants:		
		(%wt)	Type(s) and comment
	Acrylamide	. ,	
	Benzene		
	Chlorinated solvents		

Others	
Others	
Mercury compounds	
Vanadium	
Tin	
Thallium	
Molybdenum	
Chromium	
Selenium	
Selenium	
Caesium	
Cadmium	
Boron (non-Boral)	
Boron (in Boral)	
Boron	
Barium	
Arsenic	
Vinyl chloride	
Other organophosphates	
Tri-butyl phosphate	
Styrene	
Phenol	
Formaldehyde Organometallics	

Potential for the waste to contain discrete items:

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		
Recyling / 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 %				
Disposal Noute	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: N

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

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m³	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 quantitiy 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: -

Moulido		Mean radioactivity, TBq/m³			Mean radioactivity, TBq/m³					
Be 10 C C14 Ho 1868	Nuclide		Bands and	Future		Nuclide		Bands and	Future	
C14 Ho 168m Na 22	H 3					Gd 153				
Na 22	Be 10					Ho 163				
A286 C136 L174 A739 A742 K40 C341 M53 M53 M53 M754 F655 C0 60 C0 60 N163 C2 76 C0 60 N163 C2 76 C3 77 C3 78 C4 84 C7 78	C 14					Ho 166m				
C136						Tm 170				
Ar-99 K 40 K 40 Ca-41 Mn 53 Mn 54 Mn 54 Mn 56 Mn 56 Mn 58 Mn 58 Mn 58 Mn 58 Nn 59 Nn 59 Nn 59 Nn 58 Nn 59 Nn										
Ar 42 K 40 Ca 41 Mn 53 Mn 54 FP 55 Co 60 N 69 N 69 N 693 N 693 N 693 N 694 FP 2010 FR 2023 FR 92 FR 18 K 781 K 781 K 781 K 781 K 785 R 222 FR 88 226 K 781 R 87 S 790 R 227 S 790 R 228 R 208 R	CI 36					Lu 174				
Hit 182	Ar 39					Lu 176				
Pi 193						Hf 178n				
Mn 53						Hf 182				
Mn 54										
Pe 55										
Bi 208	Mn 54					Pb 205				
Ni 59 Ni 63 Zn 65 Se 79 Kr 81 Kr 85 Kr 81 Kr 85 Rh 87 Sr 90 Zr 93 Nb 91 Nb 92 Nb 91 Nb 92 Nb 94 Nb 93 Th 223 Nb 91 Nb 93 Th 223 Tc 97 Tc 99 9.40E-04 AA 3 Ru 106 Pd 107 Ag 108m Ag 110m Cd 113m Sn 12m Sn 119m Sn 121m Sn 126 Sb 125 Sb 126 Pu 238 Sn 126 Sb 126 Pu 240 Sb 125 Sb 126 Pu 241 Cd 137 Cd 13	Fe 55					Pb 210				
Ni 63										
Ra 223										
Se 79 Kr 81 Kr 85 Kr 85 Ra 228 Ra 228 Ra 228 Rb 87 Sr 90 Zr 93 Nb 91 Nb 92 Nb 93m Nb 94 Nb 93 Th 230 Nb 93 Tr 97 Tr 99 Pa 231 Tr 99 Pa 230 Tr 99 Pa 100 Ag 110m Ag 110m Ag 110m Cd 113m Ag 110m Ag 110m Ag 108m Ag 110m Ag 108m Ag 110m Pu 236 Sh 123 Sh 121m Sh 123 Sh 126 Sh 127 Tr 127 Tr 128 Sh 128										
Kr 81 Kr 85 Rb 87 Sr 90 Zr 93 Nb 91 Nb 92 Nb 93 Nb 93 Nb 94 Mo 93 Tc 97 Tc 99 Pd 233 Tc 97 Pd 233 Ru 106 Pd 107 Ag 110m Ag 110m Ag 110m Ag 110m Ag 110m Sh 1238 Sh 125 Sh 125 Sh 126 Sb 125 Sb 126 Sb 125 Sb 126 Te 127m Te 128 Cs 134 Cs 135 Cs 137 Cs 134 Cs 135 Cs 137 Cs 138 Cc 1242 Cs 137 Ba 133 La 137 La 138 Cc 1249 Pm 145 Pm 145 Pm 145 Pm 145 Pm 147 Sm 147 Sm 147 Sm 147 Sm 151 Eu 152 Pm 147 Sm 151 Eu 152 Pu 152 Pm 154 Pu 154 P										
Kr 85 Ra 228 Rb 87 Sr 90 Zr 93 Th 227 Nb 91 Th 228 Nb 92 Th 230 Nb 93m Nb 94 Mb 93 Th 234 Tc 97 Pa 231 Tc 99 9.40E-04 AA 3 Ru 106 Pd 107 Ag 108m U 233 Ag 110m U 234 Ag 110m U 238 Cd 119 U 238 Sh 121m Np 237 Sh 121m Pu 236 Sh 122 Sh 122 Pu 240 Sh 126 Pu 240 Sh 126 Pu 241 Sh 126 Pu 242 Te 127m Am 243 Tl 129 Am 241 Te 127m Am 243 Cs 136 Cm 244 Cs 137 Cm 246 Ca 137 Cm 246 Ca 138 Cm 248 Ce 144 Cm 248 Ch 249 Cm 248 Ch 144 Cm 248 Ch 145 Cm 246 Ca 144 Cm 248 </td <td></td>										
Rb 87 Sr 90 Zr 93 Th 227 Th 227 Th 227 Th 228 Th 229 Th 230 Th 231 Th 232 Th 234 Th 235 Th 236 Th 2	Kr 81					Ra 226				
Sr 90 Zr 93 Nb 91 Nb 92 Nb 92 Nb 94 Nb 94 Nb 93 Tc 97 Re 231 Tc 97 Re 233 Re 4 Re 106 Re 107 Ag 108m Ag 110m Cd 109 Cd 113m Sh 119m Sh 121m Sh 121m Sh 121m Sh 122m Sh 124 Sh 125 Sh 126 Sh 125 Sh 126 Sh 127 Sh 128 Sh 128 Cc 134 Cc 134 Cc 134 Cc 135 Cc 135 Cc 137 Ba 133 La 137 La 138 Cc 134 Cc 144 Pm 145 Pm 147 Pm 145 Pm 147 Sm 151 Eu 152 Eu 152 Fm 147 Sm 151 Eu 152 Fm 151 Eu 152 Fm 151 Eu 152 Fm 151 Eu 152 Cher bo Cher						Ra 228				
Th 228	Rb 87					Ac 227				
Nb 91 Nb 92 Nb 92 Nb 93 Nb 94 Mo 93 Tc 97 Tc 97 Tc 97 Pa 231 Pa 231 Pa 233 Ru 106 Pd 107 Ag 108m Ag 110m Cd 113m Sn 119m Sn 121m Sn 123 Sn 121m Sn 123 Sn 126 Sn 126 Sn 126 Sn 126 Sn 127 Ba 133 La 137 La 138 Cc 134 Cc 134 Cc 134 Cc 134 Cc 134 Cc 137 Ba 133 La 137 La 138 La 137 La 138 Cc 144 Pm 145 Pm 147 Sm 147 Sm 147 Sm 151 Eu 152 Eu 152 Eu 152 Eu 152 Cd 169 Cd 169 Cd 175 Sn 126 Cd 226 Cd 227 Cd 248 Cd 248 Cd 248 Cd 248 Cd 248 Cd 248 Cd 250 Cd 248 Cd 250 Cd 248 Cd 250 Cd 248 Cd 250 Cd 25	Sr 90					Th 227				
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Nb 94 Mo 93 Tc 97 Tc 99 9.40E-04 AA 3 Ru 106 Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Sn 119m Sn 121m Sn 121m Sn 1226 Sb 125 Sb 125 Sb 126 Te 127m Tl 129 Cs 134 Cc 137 Ba 133 La 137 La 137 La 137 La 137 La 138 Cc 144 Pm 145 Pm 147 Pm 145 Pm 147 Sm 151 Eu 152 Eu 154 To 128 To 128 To	Nb 92					Th 230				
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Pd 107 Ag 108m Ag 110m Cd 109 Cd 113m Sn 119m Pu 236 Sn 121m Sn 123 Sn 126 Sb 125 Sb 126 Te 125m Te 127m I 129 Cs 134 Cs 135 Cs 137 Ba 133 La 137 La 138 Ce 144 Pm 145 Pm 145 Pm 147 Sm 151 Em 152 Eu 152 Eu 154 U 234 U 235 U 236 U 238 Np 237 Np 237 Np 236 Np 238 Np 237 Np 238 Np 238 Np 237 Np 240 Np 240 Np 240 Np 240 Np 241 Np 242 Nm 241 Am 241 Am 242 Am 241 Am 242 Cm 243 Cm 244 Cm 243 Cm 244 Cm 245 Cm 244 Cm 245 Cm 246 Cm 246 Cm 248 Cf 249 Cm 248 Cf 250 Cm 248 Cf 250 Cm 248 Cf 250 Cm 147 Cm 147 Cf 250 Cm 148 Cf 250 Cm 149 Cf 250 Cf 251 Cf 251 Cf 252		9.40E-04	AA 3							
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Eu 154 Total a 0 AA 3 0]								
Eu 155 Total b/g 9.40E-04 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 8 Not expected to be present in significant quantity