WASTE STREAM	7A23	Operational LLW Requiring Further Assay Through the Recategorization Programme

SITE AWE Aldermaston

SITE OWNER Ministry of Defence

WASTE CUSTODIAN AWE plc

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	40.0 m³
Future arisings -	1.4.2019 - 31.3.2080.....	0 m³
Total future arisings:		0 m³
Total waste volume:		40.0 m³

Comment on volumes: The previous title for this waste stream is now obsolete, hence the change. 80% of the stock from 2016 is envisaged to be LLW after re-assay, hence the reduction in stock since 2016. 80% of the 2016 stock has been moved to waste stream 7A27. Waste arisings have been set at zero as the waste in this category is waste that was unacceptable to the LLWR as it did not meet the 0.1GBq/t Pu limit. Since the limit has been removed it needs re-assaying. Some EU is also present in this category due to the disparity between LLWR acceptance and transport regulations for fissile materials. The forward programme for recategorizing this waste has moved along since the last UK RWI in 2016 was undertaken, although has yet to be implemented. In-situ High Resolution Gamma spectroscopy has been denounced as a possible assay method, due to the waste being too dense, but an argreement within AWE (through the relevant Subject Matter Experts) to employ neutron counting has been sought. Stock estimates are accurate, but the waste needs to be re-assayed (this may result in waste being recategorised into either 7A27 or 7A21).

Uncertainty factors on volumes:

Stock (upper):	x 2.0	Arisings (upper)	x
Stock (lower):	x 0.5	Arisings (lower)	x

WASTE SOURCE Organic and inorganic solids arising from operations with plutonium.

PHYSICAL CHARACTERISTICS

General description: Chemicals, PVC sheeting, tools, graphite, filter material, equipment. Waste is held in fibreboard or polythene inner drums which are placed in metal outer drums.

Physical components (%wt): Other ferrous metals (56.5%), stainless steel (8.6%), aluminium (5.8%), copper (1.8%), lead (0.4%), beryllium (<0.1%), halogenated plastics (13%), non halogenated plastics (4%), rubber (3%), cellulosics (3%), perspex (2%), filters (1%), asbestos (<0.1%), glass (0.2%) and ceramics (<0.1%). The percentage composition breakdown of this waste is not known but has been estimated using waste stream 7A111.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.46

Comment on density: Density calculated from in-stock containers, revised for 2016 RWI.

CHEMICAL COMPOSITION

General description and components (%wt): Other ferrous metals (56.5%), stainless steel (8.6%), aluminium (5.8%), copper (1.8%), lead (0.4%), beryllium (<0.1%), halogenated plastics (13%), non halogenated plastics (4%), rubber (3%), cellulosics (3%), perspex (2%), filters (1%), asbestos (<0.1%), glass (0.2%) and ceramics (<0.1%).

Chemical state: Neutral

Chemical form of radionuclides: U: Oxide form if present.
Pu: Oxide form.

Metals and alloys (%wt): Sheet metal of approximately 4mm in thickness will be present arising from glove boxes and sheet metal arising from ductwork maybe as high as 6mm. The average thickness of a box 'base plate' is approximately 25mm.

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	Stainless steel	8.6	
	Other ferrous metals	56.5	
	Iron		
	Aluminium	5.8	
	Beryllium	<0.10	
	Cobalt		
	Copper	1.8	
	Lead	0.40	
	Magnox/Magnesium		
	Nickel		
	Titanium		
	Uranium	NE	Present as a contaminant only.
	Zinc		
	Zircaloy/Zirconium		
	Other metals		
Organics (%wt):	-		
	Total cellulosics	3.8	
	Paper, cotton	3.2	
	Wood	0.60	
	Halogenated plastics	13.2	PVC.
	Total non-halogenated plastics	6.3	Perspex.
	Condensation polymers	6.3	
	Others		
	Organic ion exchange materials		
	Total rubber	3.1	
	Halogenated rubber	3.1	Neoprene.
	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):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs		
	Soil		
	Brick/Stone/Rubble		
	Cementitious material		
	Sand		
	Glass/Ceramics	0.30	

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	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....	<0.10	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		
Inorganic anions (%wt):	-		
	Fluoride.....		
	Chloride.....		
	Iodide.....		
	Cyanide.....		
	Carbonate.....		
	Nitrate.....		
	Nitrite.....		
	Phosphate.....		
	Sulphate.....		
	Sulphide.....		
Materials of interest for waste acceptance criteria:	-		
	Combustible metals.....	0	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	P	
	Putrescible wastes.....	0	
	Non-putrescible wastes.....	P	Paper, cotton and wood.
	Corrosive materials.....	NE	
	Pyrophoric materials.....	0	
	Generating toxic gases.....	0	
	Reacting with water.....	0	
	Active particles.....	0	
	Soluble solids as bulk chemical compounds.....	0	
Hazardous substances / non hazardous pollutants:	The waste contains lead (0.4%wt), asbestos (<0.1%wt) and beryllium (0.1%).		
	Acrylamide.....	0	
	Benzene.....	0	
	Chlorinated solvents.....	0	

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	Formaldehyde	0	
	Organometallics	0	
	Phenol	0	
	Styrene	0	
	Tri-butyl phosphate	0	
	Other organophosphates	0	
	Vinyl chloride	P	PVC is present.
	Arsenic	0	
	Barium	0	
	Boron	0	
	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		
	EEE Type 2		
	EEE Type 3		
	EEE Type 4		
	EEE Type 5		
Complexing agents (%wt):	Yes		
	EDTA		
	DPTA		
	NTA		
	Polycarboxylic acids	TR	
	Other organic complexants	TR	Complexing agents are likely to be present because of their use as decontaminants
	Total complexing agents	TR	

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)	Off-site	~60.0
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		~40.0

Comment on planned treatments: 40% of waste will not be acceptable for supercompaction because of high fissile content.

Disposal Routes:

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~100.0
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	
Expected to be consigned as Out of Scope	
Expected to be recycled / reused	
Disposal route not known	

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

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	~100.0	~12	4
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: Where acceptable wastes will be supercompacted, therefore voidage will be minimised, but currently high fissile drums (i.e. EU contaminated wastes) are not acceptable for supercompaction, so they will be loaded directly.

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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:	No. Waste needs to be re-assayed to confirm suitability for disposal at the LLWR.
Potential for the waste to contain discrete items:	No - drums containing discrete items will not be disposed as LLW.

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:	60% Pu contaminated, 40% enriched uranium contaminated.
Uncertainty:	Gross alpha and gross beta/gamma activities are accurate, radionuclide breakdown has been estimated using a combination of fingerprints.
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:	Typically these wastes were assayed using PNCC (Pu drums), which (at the time) was not configured to distinguish between HAW and LLW or LRGS (HEU drums).
Other information:	Some of this waste will go as ILW, at which point it will be transferred to waste stream 7A21.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3		6			Gd 153				
Be 10		6			Ho 163				
C 14		6			Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36		6			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		6			Pb 210				
Co 60	2.20E-09	C C 2			Bi 208				
Ni 59					Bi 210m				
Ni 63		6			Po 210				
Zn 65		6			Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226		6		
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		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		6			U 232	1.03E-09	C C 2		
Ru 106		6			U 233		6		
Pd 107					U 234	1.11E-04	C C 2		
Ag 108m					U 235	3.56E-06	C C 2		
Ag 110m		6			U 236	4.60E-07	C C 2		
Cd 109					U 238	1.89E-07	C C 2		
Cd 113m					Np 237		6		
Sn 119m					Pu 236		6		
Sn 121m					Pu 238	7.76E-06	C C 2		
Sn 123					Pu 239	2.62E-04	C C 2		
Sn 126					Pu 240	6.00E-05	C C 2		
Sb 125		6			Pu 241	2.71E-05	C C 2		
Sb 126					Pu 242	7.21E-09	C C 2		
Te 125m					Am 241	8.22E-05	C C 2		
Te 127m					Am 242m				
I 129		6			Am 243				
Cs 134		6			Cm 242				
Cs 135					Cm 243				
Cs 137	1.04E-07	C C 2			Cm 244				
Ba 133		6			Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144		6			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**	**5.27E-04**	**C C 2**	**0**	
Eu 155					**Total b/g**	**2.72E-05**	**C C 2**	**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