WASTE STREAM 9G39 Miscellaneous Activated Components

SITE	Trawsfynydd
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Magnox Limited
WASTE TYPE	ILW; SPD3

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	21.0 m³
Total future arisings:		0 m³
Total waste volume:		21.0 m³

Comment on volumes: There will be no further arisings. This waste will be retained on site as at present to Final Dismantling. The station ceased generation on 20/07/1993. Defuelling was completed on 31/08/1995.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.2	Arisings (upper)	x
	Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE Redundant or defective components removed from the reactor core or pile cap.

PHYSICAL CHARACTERISTICS

General description:	Redundant or defective components such as control rods and fuel charge chutes removed from the reactor or pile cap. The possibility of large items which may need special handling is not assessed.
Physical components (%vol):	Control rods, fuel charge chutes and other items; volume breakdown is to be assessed.
Sealed sources:	-
Bulk density (t/m³):	~1
Comment on density:	The assumption of 1 t/m3 as the average bulk density may be subject to revision.

CHEMICAL COMPOSITION

General description and components (%wt): Principally irradiated steel components (~90%) removed from the reactor.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: The chemical form of tritium has not been determined.
C-14: The chemical form of carbon 14 has not beeen determined but may be present as graphite.
Cl-36: The chemical form of chlorine 36 has not been determined.
Se-79: The selenium content is insignificant.
Tc-99: The chemical form of technetium has not been determined.
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
Np: The neptunium content is insignificant.
Pu: The chemical form of plutonium isotopes has not been determined but may be present as plutonium oxides.

Metals and alloys (%wt): -

Stainless steel.....	P	Grade BS970 EN58
Other ferrous metals.....	~90.0	Boron steel other mild steel grades likely present.
Iron.....		
Aluminium.....	NE	
Beryllium.....	NE	
Cobalt.....	<0.25	Greatest measured value from the various components.
Copper.....	NE	
Lead.....	NE	

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	Magnox/Magnesium	0	
	Nickel		
	Titanium		
	Uranium		
	Zinc	NE	
	Zircaloy/Zirconium	NE	
	Other metals	TR	Silver and niobium.
Organics (%wt):	To be further assessed.		
	Total cellulosics	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		
	Oil or grease		
	Fuel		
	Asphalt/Tarmac (cont.coal tar)		
	Asphalt/Tarmac (no coal tar)		
	Bitumen		
	Others		
	Other organics	NE	
Other materials (%wt):	Expect some graphite dust.		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand		
	Glass/Ceramics	NE	
	Graphite	NE	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	

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Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): Not fully assessed.

Fluoride.....	NE
Chloride.....	NE
Iodide.....	NE
Cyanide.....	0
Carbonate.....	NE
Nitrate.....	NE
Nitrite.....	NE
Phosphate.....	NE
Sulphate.....	NE
Sulphide.....	NE

Materials of interest for waste acceptance criteria: No materials likely to pose a fire or other non-radiological hazard have been identified.

Combustible metals.....	0
Low flash point liquids.....	0
Explosive materials.....	0
Phosphorus.....	0
Hydrides.....	0
Biological etc. materials.....	0
Biodegradable materials.....	
Putrescible wastes.....	0
Non-putrescible wastes.....	
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Active particles.....	
Soluble solids as bulk chemical compounds.....	

Hazardous substances / non hazardous pollutants: -

Acrylamide.....	
Benzene.....	
Chlorinated solvents.....	
Formaldehyde.....	
Organometallics.....	
Phenol.....	
Styrene.....	
Tri-butyl phosphate.....	
Other organophosphates.....	
Vinyl chloride.....	

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	Arsenic.....		
	Barium.....		
	Boron.....		
	Cadmium.....		
	Caesium.....		
	Selenium.....		
	Chromium.....		
	Molybdenum.....	<0.60	Greatest measured value from the various components.
	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):	No		
	EDTA.....		
	DPTA.....		
	NTA.....		
	Polycarboxylic acids……		
	Other organic complexants.....		
	Total complexing agents.....	0	

PACKAGING AND CONDITIONING

Conditioning method:	The waste is not expected to be supercompacted. It will be placed in baskets in the waste packages and is assumed to be encapsulated.
Plant Name:	None
Location:	Trawsfynydd Decommissioning Site
Plant startup date:	2074
Total capacity (m^3/y incoming waste):	~5000.0
Target start date for packaging this stream:	2074
Throughput for this stream (m^3/y incoming waste):	~2.1
Other information:	The current proposal is that the waste in tubes accessed from Pile Cap will remain as currently stored until Reactor Demolition. All of that waste will be processed during that conditioning campaign.

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Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
4m box (no shielding)	100.0	16.2	18.9	2

Likely container type comment:	Container choice may be influenced by Transport Regulations at the time of Final Site Clearance. The waste in 4m boxes is assumed to be in baskets in the waste package so the occupied volume in the package is greater than the original waste volume.
Range in container waste volume:	Not yet determined. No significant variability is expected.
Other information on containers:	The container material is expected to be stainless steel.
Likely conditioning matrix:	Blast Furnace Slag / Ordinary Portland Cement
Other information:	The waste in 4m boxes is assumed to be encapsulated.
Conditioned density (t/m^3):	~1.8
Conditioned density comment:	The density of the unencapsulated waste in 4m boxes is asssumed to be 3.0 t/m3.
Other information on conditioning:	The waste in 4m boxes will be in baskets placed in the waste packages. Baskets of different Final Dismantling ILW wastes may be in the same waste package. The conditioning matrix is likely to be BFS/OPC and the conditioned waste density about 3 t/m3.
Opportunities for alternative disposal routing:	No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source:	Irradiated components removed from the reactor. Absorber bars and control rods are likely to be components of high activity, the majority of their activity coming from activation products.
Uncertainty:	Specific activity is a function of operating history. The values quoted are indicative of the activities that might be expected.
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:	Estimates are based upon theoretical assessments.
Other information:	-

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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	<1.81E+00	D 3			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	2.00E-02	C D 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	3E-05	C C 2			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		
K 40		8			Hf 182		8		
Ca 41		8			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		8			Pb 205		8		
Fe 55	2.02E-01	C D 2			Pb 210		8		
Co 60	6.13E-01	C D 2			Bi 208		8		
Ni 59	4E-02	C D 2			Bi 210m		8		
Ni 63	2.82E+00	C D 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	<4.04E-05	D 3			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m		8			Th 232		8		
Nb 94	4E-05	C D 2			Th 234	<7E-09	D 3		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	<1E-08	D 3			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	<6.07E-09	D 3		
Ag 108m	<3.94E-05	D 3			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	<7E-09	D 3		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	<2.79E-06	D 3		
Sn 123		8			Pu 239	<3E-06	D 3		
Sn 126		8			Pu 240	<4.00E-06	D 3		
Sb 125		8			Pu 241	<1.30E-04	D 3		
Sb 126		8			Pu 242	<2E-09	D 3		
Te 125m		8			Am 241	<1.21E-05	D 3		
Te 127m		8			Am 242m	<1.91E-08	D 3		
I 129		8			Am 243	<6.00E-09	D 3		
Cs 134		8			Cm 242	<1.58E-08	D 3		
Cs 135		8			Cm 243	<4.07E-09	D 3		
Cs 137	<5.69E-05	D 3			Cm 244	<3.55E-08	D 3		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	<8.33E-09	D 3			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	<8.39E-07	D 3			Other a				
Eu 152	1.26E-05	C D 2			Other b/g				
Eu 154	9.66E-06	C D 2			**Total a**	**2.20E-05**	**C D 2**	**0**	
Eu 155		8			**Total b/g**	**5.50E+00**	**C D 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