WASTE STREAM 3N04 Desiccants and Catalysts

SITE	Hinkley Point B
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	200.9 m³
Future arisings -	1.4.2019 - 31.3.2021.....	24.0 m³
	1.4.2021 - 31.3.2023.....	0 m³
	1.4.2023 - 31.3.2024.....	28.8 m³
Total future arisings:		52.8 m³
Total waste volume:		253.7 m³

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.25	Arisings (upper)	x 1.5
	Stock (lower):	x 0.75	Arisings (lower)	x 0.5

WASTE SOURCE Exhausted desiccants and catalysts that have been used for the drying and recombination of carbon dioxide reactor coolant. Small amounts of steel and ceramic balls and charcoal.

PHYSICAL CHARACTERISTICS

General description: Some residual moisture may be associated with the desiccant. There will also be ceramic and steel shielding balls and charcoal. There are no large items in the waste which may require special handling.

Physical components (%vol): Desiccant (Silica Gel), Catalyst (pellets of platinum on alumina), Charcoal, Ceramic balls, Mild Steel balls. About 95% of volume is desiccant. No other components anticipated.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Silica gel, very small quantities of charcoal, cylindrical pellets of platinum on alumina (catalyst), and ceramic and steel balls. Desiccant (silica gel) (~92%), catalyst (platinum on alumina) (~2%), ceramic balls (1%), mild steel balls (~3%), charcoal (~2%). No other materials anticipated. Some residual moisture may be associated with the desiccant.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Tritiated water absorbed onto desiccant.
C-14: May be present as Graphite contamination
Cl-36: Not Assessed
Se-79: Not Expected to be significant
Tc-99: Not Expected to be significant
I-129: Not Expected to be significant
Ra: Not Expected to be significant
Th: Not Expected to be significant
U: Not Expected to be significant
Np: Not Expected to be significant
Pu: Not Expected to be significant

Metals and alloys (%wt): -

Stainless steel.....	0
Other ferrous metals.....	~3.0
Iron.....	0
Aluminium.....	0
Beryllium.....	0
Cobalt.....	0
Copper.....	0

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	Lead	0	
	Magnox/Magnesium	0	
	Nickel	0	
	Titanium	0	
	Uranium	0	
	Zinc	0	
	Zircaloy/Zirconium	0	
	Other metals	NE	Platinum on alumina
Organics (%wt):	Inspection and sampling shows no gross organic items.		
	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	0	
	Oil or grease	0	
	Fuel	0	
	Asphalt/Tarmac (cont.coal tar)	0	
	Asphalt/Tarmac (no coal tar)	0	
	Bitumen	0	
	Others	0	
	Other organics	2.0	Charcoal
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	0	
	Brick/Stone/Rubble	0	
	Cementitious material	0	
	Sand	0	
	Glass/Ceramics	1.0	
	Graphite	0	
	Desiccants/Catalysts	94.0	
	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):	None of the listed inorganic anions are expected to be present at greater than trace concentrations.	
	Fluoride..... TR	
	Chloride..... TR	
	Iodide..... TR	
	Cyanide..... 0	
	Carbonate..... TR	
	Nitrate..... TR	
	Nitrite..... NE	
	Phosphate..... TR	
	Sulphate..... TR	
	Sulphide..... TR	
Materials of interest for waste acceptance criteria:	Carbon fines (<1%wt) filtered by desiccant are a spontaneous combustion hazard at >150 degrees C. in air.	
	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..... 0	
	Corrosive materials..... 0	
	Pyrophoric materials..... 0	
	Generating toxic gases..... 0	
	Reacting with water..... 0	
	Active particles..... 0	Not expected
	Soluble solids as bulk chemical compounds..... 0	
Hazardous substances / non hazardous pollutants:	-	
	Acrylamide..... NE	
	Benzene..... NE	
	Chlorinated solvents..... NE	
	Formaldehyde..... NE	
	Organometallics..... NE	
	Phenol..... NE	
	Styrene..... NE	
	Tri-butyl phosphate..... NE	
	Other organophosphates..... NE	

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	Vinyl chloride	NE	
	Arsenic	NE	
	Barium	NE	
	Boron	NE	
	Cadmium	NE	
	Caesium	NE	
	Selenium	NE	
	Chromium	NE	
	Molybdenum	NE	
	Thallium	NE	
	Tin	NE	
	Vanadium	NE	
	Mercury compounds	NE	
	Others	NE	
	Electronic Electrical Equipment (EEE)		
	EEE Type 1	0	
	EEE Type 2	0	
	EEE Type 3	0	
	EEE Type 4	0	
	EEE Type 5	0	
Complexing agents (%wt):	Not yet determined		
	EDTA	NE	
	DPTA	NE	
	NTA	NE	
	Polycarboxylic acids	NE	
	Other organic complexants	NE	Expect only trace quantities, if any.
	Total complexing agents	NE	

LAW TREATMENT, PACKAGING AND DISPOSAL

Waste that is currently ILW: This waste is ILW at the time of arising. The waste is stored temporarily to allow decay of short lived radionucliides, following this, the desiccant is transferred to Winfrith for decontamination to LLW. Waste will be despatched when activity levels permit treatment to LLW levels.

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Planned on-site / off-site treatments(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification	Off-site	100.0
Decontamination	Off-site	100.0
Metal treatment		
Size reduction		
Decay storage	On-site	100.0
Recyling / reuse		
Other / various		
None		

Comment on planned treatments: The waste will be decay stored and then decontaminated to LLW and encapsulated.

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	~11.99	22
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: A conditioning factor of approximately 1.23 assumed

Waste Consigned to the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): The waste does not meet the LLWR's Waste Acceptance Criteria (WAC).

	Does not meet WAC until desiccant is washed and decontaminated.
Waste consigned for disposal to LLWR in year of generation:	No. Waste is ILW when generated and needs decontaminating to LLW.
Potential for the waste to contain discrete items:	No

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:	Contamination by tritium and activation products will be the main sources of activity.
Uncertainty:	Present estimates are indicative of the activities that are 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:	Theoretical assessment and limited sampling.
Other information:	Other beta/gamma nuclides of arisings and stocks (in TBq/m^3) include Co58 (1E-7, <4E-11), Zr95 (5E-7, <1E-10); Nb95 (9E-7, <2E-12); Ta182 (3E-7, <1E-9) and Fe59 (<2E-6, <4E-11). Tritium was shown to be the only significant radionuclide in vault samples taken in 1986.

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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	6E-02	C C 2	1E-01	C C 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	<5E-05	C 3	<5E-05	C 3	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36	1E-04	C C 2	1E-04	C C 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	<5E-09	C 3	<2E-07	C 3	Pb 205				
Fe 55		6		6	Pb 210		8		8
Co 60	<8E-08	C 3	<3E-07	C 3	Bi 208				
Ni 59		6		6	Bi 210m				
Ni 63		6		6	Po 210		8		8
Zn 65	<1E-09	C 3	<9E-08	C 3	Ra 223				
Se 79		8		8	Ra 225				
Kr 81					Ra 226		8		8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		8		8	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229		8		8
Nb 92					Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234				
Mo 93		8		8	Pa 231		8		8
Tc 97					Pa 233				
Tc 99		8		8	U 232				
Ru 106	<6E-09	C 3	<2E-07	C 3	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m		8		8	U 235		8		8
Ag 110m	<9E-10	C 3	<7E-08	C 3	U 236		8		8
Cd 109					U 238		8		8
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238		8		8
Sn 123					Pu 239		8		8
Sn 126		8		8	Pu 240		8		8
Sb 125	4E-09	C C 2	3E-08	C C 2	Pu 241		8		8
Sb 126					Pu 242		8		8
Te 125m					Am 241	<5E-09	C 3	<5E-09	C 3
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	<2E-09	C 3	<2E-08	C 3	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	<3E-07	C 3	<4E-07	C 3	Cm 244		8		8
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	<2E-09	C 3	<1E-07	C 3	Cf 249				
Pm 145					Cf 250				
Pm 147		8		8	Cf 251				
Sm 147					Cf 252				
Sm 151		8		8	Other a		8		8
Eu 152		8		8	Other b/g	<1E-09	C 3	<4E-06	C 3
Eu 154	<5E-09	C 3	<1E-08	C 3	**Total a**	**<5E-09**	**C 3**	**<5E-09**	**C 3**
Eu 155	<3E-09	C 3	<8E-09	C 3	**Total b/g**	**6.02E-02**	**C C 2**	**1.00E-01**	**C C 2**

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