Our Ref.: HNB20645N

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Keith Hammond
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27th March 2015

Dear Mr Hammond

Please find enclosed a response to your letter reference RS/NUC/HUNTB dated 28th January 2015 which asked for further information on our application to vary the Authorisation granted under the RSA.

I trust that the enclosed document answers your questions, however should you have any further enquiries please get in touch.

Yours sincerely

Colin Weir
Station Director

Enc.
HNB/RSA/VARIATION/2013/1 - Supplementary information to support variation request to Hunterston B Power Station's RSA Certificate.

cc Document Centre

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Nuclear Generation Limited

Hunterston B

Supplementary information to support variation request to Hunterston B Power Station's RSA Certificate.

Originated by:	George Thomson Environmental Safety Engineer	Date: March 2015
Reviewed by:	Andrew Taylor Environmental Safety Group Head	Date: March 2015
Reviewed by:	John Morrison Technical & Safety Support Manager	Date: March 2015

1 Purpose

The purpose of this additional letter of clarification is to provide further details on:-

- Which higher activity wastes are intended for disposal at which facility;
- Details regarding arrangements that are, or would be, in place to demonstrate the selected waste management option is BPM;
- How the selected waste management options meet the aims and principles of Scotland's Higher Activity Waste Policy
- Physical quantities, radionuclide content, activity per radionuclide and anticipated frequencies of transfer of waste to each identified disposal site.
- Detailed description of radioactive waste types that may be transferred to Hunterston from other EDF sites
- Details regarding storage arrangements for the radioactive wastes transferred from each Station
- Onward disposal arrangements for each identified waste type and time on site for each waste type transferred to Hunterston
- Decision making process and BPM arrangements for waste transfers to Hunterston.

2 HAW Types, disposal routes, frequency and specific activity

The precise volume of higher activity solid radioactive waste produced during the forthcoming years at Hunterston will depend on the future management of the two AGRs.
The volume & activity estimates provided within this submission is based on a review of the performance of the station during the last 3 years and consideration of current stored volumes on site.
Based on the previously named reviews, the waste arisings for Hunteston would not be expected to increase significantly as the plant ages.
Six Higher Activity Waste streams (HAW) have been considered in this submission. It is envisaged these HAW will be transferred off-site to the destinations listed within table 3.2 of HNB/RSA/VARIATION/2013, where it can be treated to produce a final waste form that is categorised as LLW.

For completeness, desiccant has been included despite being authorised under the existing permit.

Disposal routes selected for the aforementioned waste streams are based on current use – if in the future a named disposal site developed a new process/technique that became the BAT for a particular named waste stream then Hunterston would endeavour to pursue such a route.

Additionally, Hunterston would not want to be constrained should an equivalent disposal site became operational that was geographically closer and/or financially more cost effective for disposal of a particular named HAW stream.

Table 1: HAW Types

WASTE DESCRIPTION	DETAILED COMMENTS
Generic ILW Oils & Sludge's	Active waste oil arisings are assayed and may contain the full spectrum of activity found in liquid waste treated in the liquid waste processing facilities. The activity in the oil is caused by activity uptake from the reactor coolant. There are also tritiated oil arisings that occur within the tritiated water storage tanks that serve the desiccant driers. The processing of active effluent at AGR stations produces waste in the form of sludges. Predominantly sludges arise from the backwashing of sand filters in the AETP and Pond Water Treatment Plant but other processes cause sludge arisings such as the oil bound sludges generated from gas circulator maintenance and the AETP oil separators. Oil-bound sludges can arise as well as non-oily sludges accumulated in process plant sump bottoms and tanks. A significant fraction of the contamination present in sludges is short lived radionuclides e.g. Fe-55, Cr-51, Co-60, S-35, Mn-54 and Ca-45 and as such storage in settling tanks allows for a significant reduction in sludge activity. Also present in sludges may be Zn-65, Cs-137 and Cs-134 particulate. It is likely the majority of the sludges generated at Hunterston during operational life will be LLW however there is the potential for generating HAW sludges if a particular process vessel required to be cleaned/emptied earlier than anticipated. Currently within this category, Hunterston have generated tritiated oils associated with oil recovered from the TWST system and sludges from the AETP and GCWS. If other ILW oils do arise, the specific activity may be different depending on the origin of the oil. This may require a different disposal strategy depending on the doserate/radiochemical properties of the oil.
Generic Metallic Solid HAW Waste e.g. Bypass gas plant (BPGP) inlet/blowdown filters & Other filters (Not shredded/compacted)	As the plant ages, specific plant components may require replacement that may in itself be HAW, or through size reduction create HAW components. Hunterston has a Gas/Water heat exchanger, some diverter valves, and three Post Dryer Filters which fall into the category of Metallic Solid HAW, however it is anticipated that the activity level will have decayed to LAW within the operating life of the LLWR. These items are therefore stored on site pending acceptance for disposal by LLWR. The BPGP is responsible for conditioning and drying the rector coolant. In future years, the activity of the filters may increase and may require disposal individually as HAW.

WASTE DESCRIPTION	DETAILED COMMENTS
Generic Solid HAW Waste: Drummed Waste	Drummed solid HAW waste consists of general waste materials, secondary wastes and redundant items. Occasionally the overall radioactive content of a shredded & compacted drum may exceed 4 GBq/te of alpha or 12 GBq/te of beta/gamma activity. These waste drums have historically been produced from vacuum cleaner bags and shredded filters e.g. vessel air extract HEPA filters. i.e. low mass/volume, high concentration of activity generally created as a result of concentrating the LLW waste stream. The inclusion of this waste stream assumes that:- No application of LLWR discrete item limits if being disposed to LLWR. No averaging activity over a consignment container e.g. averaging over a full IP2 FHISO package. No onsite decay used to allow HAW drum to decay to LAW.
Ion Exchange Resin	Ion exchange resins are a solid organic material usually in the form of beads that are used to treat a variety of effluents. These resin beads are usually contained in steel tanks through which the water passes, the resins work by adsorbing soluble ions from the liquids that are passed over them and as a result reduce the soluble activity in the water. At Hunterston, radioactive ion-exchange resins arise mainly from pond water treatment in the Pond Water Treatment Plant, but ion-exchange resins also arise from liquid effluent treatment in the AETP. The resins are used for the removal of soluble radioactive species from the liquids processed. Spent resin is discharged from IX plant when exhausted and transferred to storage vessels. It is expected that PWTP resins will be HAW and AETP resins will be LLW. For purpose of consideration in this submission, pond water ion exchange resin will be considered. The principal contaminants present are Ba133, Co60, Cs134, Cs137 and Mn54. These are typical fission and activation products that may be found in liquid treatment systems from which the resin has been extracted. Other isotopes may be present.

WASTE DESCRIPTION	DETAILED COMMENTS
Catalyst	The AGR reactor gas bypass plant contains recombination units for recombining oxygen with any CO which has formed within the CO2 reactor coolant gas. The unit also converts gaseous species of hydrogen to water, thereby removing tritiated water vapour moisture from the coolant. The catalyst is in the form of granular alumina / platinum catalyst, the platinum having been deposited onto an alumina base granule (0.3% by weight). Once the material ceases to fulfil its function and there is a risk of oxygen breaking through to the reactor, the catalyst is replaced and the spent catalyst becomes a waste product. Radionuclide concentrations associated with these wastes are expected to be low except for tritium and S-35. The level of tritium in the waste will determine whether it is treated as ILW or LLW. **For the purpose of this submission, the same specific activity values have been used for both desiccant and catalyst.** It is currently the baseline strategy for catalyst to be processed and packaged using the same washing process as desiccant waste, however, recent trials conducted on catalyst samples have shown the washing process to be less effective at removing activity.
Desiccant	Radionuclide concentrations are low except tritium and S-35. However, radioactive decay of S-35 (half life 87 days) means that the specific activity is low in wastes which have been stored for more than 3 years. The level of tritium chemically bonded in the waste determines whether it is to be treated as LLW or ILW. In order to remove water vapour from the AGR gas coolant the gas by-pass stream is passed through towers containing beads of silica gel based desiccant. A component of the water vapour that is absorbed into the desiccant is tritiated. The tritium originates mainly as a tertiary fission product, with a possible additional contribution from the activation of lithium impurities. Desiccant may contain both ceramic and steel balls which are used to retain the desiccant within the towers. The effectiveness of the desiccant decreases over time as a result of the temperature cycling resulting from regeneration cycles; it is therefore replaced periodically during statutory outages. The determination of desiccant life, and decision as to which planned outage the in-service batch will last until, is made by assessing the frequency of desiccant regeneration cycles. Batches can be changed after anything between a few years to over 10 years. Before being finally discharged from the reactor driers, desiccant is heated as for regeneration to ensure the activity loading is minimised.

The data presented in the following Tables represents the volume and activity of waste to be transferred from Hunterston site utilising the different preferred disposal options.

Table 2: HAW Volumes, Specific Activity & Rate of Arising

		Specific Activity (MBq/g)								
Waste Stream	**Current Volume (m^3)**	**H-3**	**Carbon - 14**	**Phosphorous-32 and Sulphur-35**	**Beta and Weak Gamma Emitters (P33, Cl36, Ca45, Cr51, Fe55, Ni63, Sr90, Cd109, I129, Pm147)**	**Medium Gamma Emitters (Co57, Zn65, Se75, Sr85, Rb86, Zr95, Ru103, Ru106, Ba133, Cs137, Hg203)**	**Strong Gamma Emitters (Na22, Sc46, Mn54, Fe59, Co56, Co58, Co60, Ag110m, Sb124, Cs134, Eu152, Eu154)**	**Other isotopes not listed (excl. alpha)**	**Alpha emitters**	**Future Arisings (m3/year)**
ILW Oils & Sludges	7.4	3.00	0.00100	0.002	NIL	0.0000003	0.0000004	NIL	NIL	0.3
Bypass Gas Plant Inlet Filter/Blow down Filters & Compone mts	3.95	0.00	0.001	0.08	0.05	0.003	0.01	~NIL	0.001	1 Filter every 3 years
Ion Exchange Resin	23.7					0.0562	0.3668		0.00025	N/A
Catalyst	30	0.20	0.00003		~NIL	~NIL	~NIL	4.30714E-05	~NIL	N/A
Solid Drummed Waste (no onsite decay period applied)	0	0.002	0.0002	0.00001	0.01500	0.0000739	0.0039364		0.000055	1
Desiccant	0	0.20	0.00003	~NIL	~NIL	~NIL	~NIL	4.30714E-05	~NIL	None for disposal

Table 3: Requested disposal sites in variation request

Incinerator, Hythe, UK	1
Metal Treatment Facility, Lilyhall, UK	2
Waste Treatment & processing site, Winfrith , UK	3
Incinerator, Elsemere Port, UK	4
Incinerator, Slough, UK	5
Incinerator, Dessel, Belgium	6
Metal treatment facility, Krefeld, Germany	7
Incinerator &Metal Treatment Facility, Nykoping, Sweden	8
Incinerator & Metal treatment facility, Tennessee, USA	9
Other UK incinerators	10
Other overseas incinerators and metal treatment plants	11
Any UK and overseas radioactive treatment facilities which become available at a future date.	12

Table 4: Preferred & Secondary disposal routes for identified waste types

Waste Stream	Preferred Route	Secondary Routes	Not currently explored/BAT
ILW Oil: Tritiated Oil	1	None currently identified	4, 5, 6, 8, 9, (10, 11, 12)
ILW Sludges	3	None currently Identified	3, 12
Generic Metallic Solid HAW Waste e.g. Bypass gas plant (BPGP) inlet/blowdown filters & Components (Not shredded/compacted & no onsite HAW > LAW decay)	2	3	7, 8, 9, (11, 12)
Ion Exchange Resin	3	None currently identified	1, 4, 5, 6, 8, 9, (10, 11, 12)
Catalyst	3	None currently identified	1, 4, 5, 6, 8, 9, (10, 11, 12)
Solid Drummed Waste (no onsite decay period applied or application of discrete item limits)	3	None currently identified	(12)
Desiccant	3	None currently identified	1, 4, 8, 9, (10, 11, 12)

3 Demonstration of BPM

With respect to demonstrating that our arrangements are BPM, or would be, Hunterston will comply with the company specification "Providing a framework for Sustainable Approach to Waste Management (SAWM)" (reference 1) for all waste streams not currently covered by an existing BPM strategy.

The disposal of Tritiated Oils is covered by an existing BPM strategy (reference 2) which determines incineration as the preferred option. The treatment & disposal of this waste stream will utilise the existing framework contract with the operator of the Hythe incinerator.

Likewise with desiccant disposal – an existing BPM strategy (reference 3) and framework contract is utilised for desiccant treatment and disposal.

4 Requirements of Scotland's Higher Activity Waste Policy

The aim of the SAWM framework (reference 1) – "to ensure that wastes are managed safely and in a sustainable way taking into account long – term environmental considerations at an early stage rather that at the time of transfer from a site or disposal. In simple terms, this means doing the right thing at the right time in the right way". This is broadly comparative to the aim of the Higher Activity Waste Policy.

With respect to the Waste Hierarchy and the Proximity Principle:-
Waste hierarchy: The current Station radwaste management practices for preventing/minimising generation of LLW apply equally to HAW. For example, improved control of reactor gas conditions ensures the life of desiccant can be maximised up to the region of 15 years. This is approximately twice as long as originally anticipated. Unfortunately there is limited scope to reuse potential HAW items – particularly those included in this submission. Therefore it is imperative that Hunterston select the correct treatment facility which results in the lowest aggregated environmental impact whilst meeting the principles of the HAW Policy. This is controlled via the BPM process detailed within reference 1 and for some HAW waste streams, such as tritiated oil, they already have an underpinning BPEO strategy.

Proximity Principle: Currently there are no available treatment facilities (or disposal facilities for LLW) at a regional level for HAW. The waste management options named in table 3 above apply to both UK and international facilities. Currently Hunterston do not make use of any international facility. The geographical aspect of the proximity principle will be applied if and when competing treatment facilities with similar waste acceptance criteria come on line in different geographical locations.

5 Transfer of waste from other EDF sites to Hunterston

Due to the geographical location of Hunterston and the locations of the currently available disposal sites it is not envisaged Hunterston will be receiving radioactive waste during the current operational lifespan from other EDF sites for the purpose of interim storage, loading of containers or onward transfer.
If however this option was exercised, the physical characteristics of waste transferred could encompass the full suite of wastes that Hunterston are currently (and potentially in future) permitted to transfer for treatment and/or disposal.
Currently Hunterston consign on average $55m^3$ of LLW for treatment/disposal per year with a significant proportion going for incineration at the Hythe site. It is therefore reasonable to assume that only a small proportion of any sites waste would be suitable for transfer to other EDF sites for the purposes mentioned above. Hunterston estimate such a volume to be less than $10m^3$ per year at a maximum frequency of 2

road transfers (in accordance with The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009) from other EDF sites.
The activity breakdown for other EDF sites waste are available from reference 4 which detail EDF Station LLW radioactive waste fingerprints.

Storage arrangements for any radioactive waste transferred to Hunterston will be controlled as per current practices as detailed in the Station Radioactive Waste Management Safety Case (reference 5). Approximate dwell time of such waste on the Hunterston site will depend on the waste stream in question but an average dwell time of up to 30 days before onward transfer should be assumed with a maximum dwell time of 6 months. This would be considered as part of any BPM assessment generated if required as a result of the SAWM frame work (reference 1).

6 References

Reference 1	Definition, Review and Optimisation of Radioactive Waste Management Strategies: Providing a Framework for Sustainable Approach to Waste Management (SAWM)	BEG/SPEC/SHE/ENVI/038
Reference 2	Strategic Review of Options for the Management of Tritiated Oil and Particulate at AGR Sites,	ERO/REP/0031/GEN
Reference 3	Best Practicable Environmental Option Study for the Management of Spent AGR Desiccant	ENL/REP/0055/AGR/08
Reference 4	EDF Waste Fingerprints	BEG/FORM/SHE/ENVI/013
Reference 5	Hunterston B Radioactive Waste Safety Case	E/REP/RADT/0013/HNB/02