RE: APPLICATION FOR APPROVAL TO DISPOSE OF RADIOACTIVE WASTE FROM HER MAJESTY'S NAVAL BASE (HMNB) CLYDE (REF NBC 02/04/02)

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On 4th July 2019, the FSA Radiological Risk Assessment Team was tasked with estimating the effective dose to the public via the food chain as a consequence of radioactive discharges from Her Majesty's Naval Base (HMNB) Clyde and providing a conclusion about the safety of the newly applied for limits.

FSA risk assessment background

HMNB Clyde have made an application for approval to dispose of radioactive waste. Solid waste is predominantly transferred to the low-level waste repository near Drigg, Cumbria by an external contractor, with a small quantity being retained onsite. A new onsite facility for treatment of both solid and liquid waste material, the nuclear support hub (NSH), will process all receipts prior to discharge or disposal.

Under the new application, liquid waste, which represents the vast majority of the applied for discharge limits (approximately 99.5%) is primarily composed of tritium (500 GBq), with much smaller contributions from Co-60, C-14, other non-alpha emitting radionuclides (excluding tritium, Co-60 and C-14) and all alpha emitting radionuclides. Gaseous discharges from the NSH, representing the other 0.5% of applied for discharges, comprise tritium, C-14 and noble gases. The applied for limits are significantly lower than the present limits (about half).

FSA risk assessors use and maintain models that can estimate the impact of radiological discharge into the environment and estimate the impact, of radionuclides from the food chain, on human health for the United Kingdom. The key risk assessment models used in assessing the safety of new limits for radioactive discharges at HMNB Clyde are the RAD Aqueous and Aerial Dose Assessment screening spreadsheets, which have been designed and maintained for at least 20 years and used for radiological risk assessments undertaken by the FSA since its founding.

Risk assessment for a representative person using requested new radionuclide limits

The risk assessment exposures have been calculated using the aerial and aqueous spreadsheets. The input values used in the aqueous and aerial assessments are detailed in the respective spreadsheets and were taken from various documents supplied by HMNB Clyde.

Having considered the aqueous and aerial routes for emission of radionuclide discharges to the environment under the new proposed limits, we have estimated an

effective dose, to the representative person, from a food aspect (farmer) of 0.2 µSv/year, significantly below the exposure level that would require model refinement, of 20 µSv/year[1], associated with a one-in-one million risk of death.

We have made several conservative assumptions in reaching this estimate, including:

1) assuming a sewer flow-rate of 100 m^3/day (although reducing this to 1 m^3/day did not affect the estimated effective dose);
2) modelling the non-alpha emitting particles as Cs-137;
3) modelling alpha emitting particles as Po-210; and
4) considering the final destination, Gare Loch, as a 'large river' ('flow rate 'of 10 m^3/second).

We have, however, disregarded potential leaching from the small proportion of the solid waste retained on site as there are no data on which to provide an estimate of potential effective dose from leachate. Furthermore, the historic emissions of gaseous and liquid tritium represent a small fraction of the permitted limits, so this risk is not considered sufficiently significant to warrant further investigations.

Baseline results

Both variability and uncertainty are considered in the model. Variability is addressed by ensuring that the upper limits for discharges are always used, with any variability therefore being below this limit and therefore not significant. Uncertainty of discharges and calculated doses are addressed by using conservative values and by refining the values used in the models, if the final exposure value is close to the risk guidance level, respectively. In the latter instance, we request further data to enable greater accuracy.

Verification of results

As part of quality assurance other members of the radiological risk assessment team have reperformed the calculations, in each instance using the applied for limits as the most conservative estimate. The initial assumptions and justifications have been evaluated (and amended if necessary), and the final results are checked to ensure they are consistent with those expected from the source terms.

Conclusions and recommendations

Based on the nature and activity levels of the proposed discharges, the estimated effective dose of 0.2 µSv/year to the representative person is 100-fold below the 20 µSv/year threshold optimisation dose associated with a one-in-one million risk of death. Therefore, we do not believe that the applied for limits of radioactive discharges represent a significant risk to human health via the food chain.

References

1. Environment Agency, *et al.* (2012) Principles for the assessment of prospective public doses arising from authorised discharges of radioactive waste to the environment.