

Magnox South ILW – Vacuum Drying

Magnox South and Magnox North operate the Magnox type power stations in the UK. During the operation of these power stations, a significant number of wet wastes have been accumulated. Previously the UK baseline for treatment of these wastes, which include sludges of various kinds and organic and inorganic ion exchange materials, was to encapsulate them in a cement matrix within standard sized containers.

In order to accelerate and reduce the cost of the waste retrieval and packaging for disposal and decommissioning of the storage facilities, it is desirable to explore options which require less initial capital expenditure, result in fewer packages for final disposal and less accumulation of secondary wastes following processing.

For more than eighteen months, Magnox have been assessing the suitability of Ductile Cast Iron Containers (DCICs) for interim storage and transport of all ILW streams that will be generated during preparations for Care and Maintenance. ILW would be stored, without an immobilising matrix, in a DCIC which would be sealed (i.e. without a vent). For wet wastes, it is necessary to remove residual water to minimise gas generation from radiolysis and metal corrosion. It is current practice in Germany to achieve this by bulk dewatering followed by application of a vacuum drying system.

Magnox are seeking support from the supply chain to design and perform simple experiments on simulant Magnox waste streams to determine dryness levels that can be achieved through bulk dewatering followed by the application of a vacuum to the waste in a sealed container.

NSG provided a full vacuum rated box with the same internal dimensions (1300 mm x 1700 mm x 1300

mm high) as an actual product box, fabricated from mild steel with a painted finish. The box had a bolted top and bottom and two diagonally opposite vertical flanges to afford full break down of the box to aid sampling and simulant recovery.



Figure 1

The product box was equipped with fork lift pockets in the base and lifting points on all faces to aid handling. It was provided with a flanged nozzle for evacuation and a connection port for a pressure gauge.

Where possible, simulant materials were weighed prior to them being placed inside the product box.

The box was filled with approximately 2.5 m³ of waste simulant by either pumping fluidised waste or by other handling methods if deemed appropriate to the waste form.

Once the simulant had settled the supernate liquor was decanted and weighed.

After completion of decanting, the box was sealed and the vacuum applied to the box to lower the boiling temperature of any liquor remaining within the simulant.

Heaters and insulation jackets were available as necessary to raise the temperature of the box to assist the process of separation. If the contents of the box were allowed to freeze then the moisture removal would have stopped abruptly.



Figure 2

NSG proposed to stand the box on a platform weigh scale to record weight loss during the water recovery process. At the end of the water recovery period the box was vented back up to atmospheric pressure then opened such that samples could be taken for moisture analysis in NSG's laboratory.

The Vacuum drying worked as a process both on water and on the simulant sludge provided for the trial. The final product in the trial was dried to better than 99% and was a friable monolith exhibiting edge and body shrinkage cracking as can be seen in figure 2 with an estimated 'bulk' volume of 0.7 m³, leaving room in the Product Box for refilling to obtain an acceptable waste packaging density.