

Sellafield Fuel Handling Plant Pondwater update

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Introduction

The increased level of beta activity in the Sellafield Fuel Handling Plant (FHP) pondwater has been an issue of interest to NuSAC since 2001, when a sub group was set up to look into the issues. A BNFL paper was presented to the November 2002 meeting (NuSAC[2002]24), with updates presented in late 2003 (NuSAC(03)P10) and late 2004 (NuSAC(04)P10).

This paper provides an update to September 2005.

Background

A number of factors arising in the late 1990's resulted in a spiral of deteriorating conditions and performance within the Fuel Handling Plant at Sellafield.

A series of improvement initiatives commenced in 2001 to address these problems. The initiatives focused on:

- Restoring throughput capability
- Re-establishing effective fuel storage conditions in FHP
- Reducing stocks of corroded fuel in FHP

It was recognised that these initiatives had to be delivered against a background of:

- Controlling radioactive discharges with best practicable means (BPM)
- Controlling radiation dose uptake as low as reasonably practicable (ALARP)

By late 2004 the underlying issues had been identified and addressed. Since late 2004 FHP's prime focus has been on delivering and consolidating the identified remediation activities.

Update for 2004 – 5: Fuel Handling Plant

The successful year reported for 2003/4 was consolidated and built upon during 2004/5 with a further series of notable achievements:

- 1008tes of Magnox fuel reprocessed. Appendix 1 illustrates total reprocessing throughput.
- 145tes of corroded fuel was reprocessed. This has reduced the remaining stock to 342tes from the initial peak of 610tes. FHP pond stock is illustrated in Appendix 2.
- The fuel container reullaging campaign was completed. All fuel skips in FHP are now held in securely ullaged containers.
- There has been a continuing reduction in FHP pondwater activity. (Appendix 3)
- Quantification of fuel corrosion enabled the sludge transfer factor from FHP to SIXEP to be improved and endorsed by Euratom. This will contribute to the avoidance of significant inventory differences in the Sellafield nuclear materials accountancy procedures.
- A good fuel: corroded fuel blending regime was strengthened to enable demonstrable compliance with the conditions for acceptance for the swarf waste stream to the Magnox Encapsulation Plant.
- Programmes were progressed to improve the fuel washing process in FHP Sub Ponds to minimise the corrosion product transfer to the decanners.
- An improved and effective empty skip decontamination and sentencing process was developed and implemented within FHP. This has minimised activity release at Reactor Stations caused by activity transfer on skips, while allowing the continued supply of clean skips as required by the Magnox Operating Programme.
- The dose rates within the pond hall have fallen in line with the decrease in pond water activity, and are currently at the lowest level since early 2000. This reduction in dose rates has been accompanied by a reduction in dose uptake by pond hall operators. Both collective and average doses have reduced since 2003 and current predictions for 2005 are continuing this trend with the lowest dose uptake since 2001.
- FHP has implemented its COSC (Continued Operations Safety Case) enabling previously out-of-specification longer stored fuels to be processed.
- The BPM assessment completed in 2004 has been implemented in FHP with a number of items of equipment being designated as Environmental Safety Mechanisms.

Development programmes are continuing to deliver further improvements in a range of areas. For example, the reduction in FHP pondwater activity although marked has recently levelled off, and work is in progress to identify and reduce the source. This work is focusing on quantifying the relative contributions from pond floor debris, the skips and containers stored within the pond and from the pond structure. It is reassuring to note that the “age” of the remaining contamination in FHP pondwater (as determined by the Cs137:134 ratio) is increasing at least in line with calendar progression indicating that the re-establishment of as-designed fuel storage conditions is proving effective at preventing any Magnox corrosion of new fuel deliveries.

Prior to the commencement of the major Reprocessing Plant outage in April 2005, FHP's fuel stocks stood at 342tes corroded and 436tes non-corroded fuel. The application of a rigorous First in First Out strategy for FHP fuel receipts had capped the non-corroded fuel stock at a maximum 262days FHP storage time. The total pond stock has increased during the 2005 Reprocessing Plant biennial planned outage, and will reduce following restart in October 2005.

Update for 2004 – 5: SIXEP and Discharges

The increased throughput of corroded fuel presented a further increase in the level of alpha and beta activity challenge to the Site Ion Exchange Effluent Plant (SIXEP), leading to a continuation of the previously observed SIXEP alpha and beta discharges. This was concurrent with the implementation of the revised Sellafield discharge limits (SALDAR 2) in October 2004.

This presented a significant challenge to SIXEP, and ion-exchange bed life has been affected, with bed changes typically taking place every 70 days (75 days in 2003/4). However, increased understanding of the many factors affecting SIXEP performance, derived from the ongoing programme of investigation and development work, has been used to maintain the overall level of discharges close to their 2003/4 values.

A significant proportion of the current investigation and development work is focused on Strontium-90 and Antimony-125. Sr90 discharges have been close to the SALDAR2 limit and the Sb125 discharges have been above the initially proposed (but deferred) site limit. For the latter radio-isotope a detailed review of potential abatement technologies did not identify any suitable processes.

Other developments have included:

- Ion-exchange pre-treatment to further improve decontamination factors is being progressed to a full scale plant trial
- The standby storage tanks for used sand/clinoptilolite have been recommissioned
- Sludge arisings have been monitored and remain within expected levels. Progress on provision of increased capacity, utilising existing assets, is in line with requirements.

SIXEP also supports broader site operations. There has been ongoing dialogue with Site Remediation personnel charged with delivering the Site clean up and retrieval programmes, and work to implement the trial discharges required to underpin future effluent management strategies is being actively pursued.

SIXEP discharge trends are illustrated in Appendix 4.

Look Ahead

The early NuSAC papers identified that corroded fuel processing must be tackled in an optimised way, taking care to restrict discharges to acceptable levels. The considerable progress made during the period to late 2004 has been further consolidated during 2005. There is increased confidence in the viability of delivering the proposed strategy of removing the corroded fuel at throughputs of 100+tes/year, within the constraints of acceptable discharge levels, pondwater activity and plant capability. However, it should be noted that the remaining corroded fuel inventory is continuing to age and become more difficult to process. The identified improvement tasks will continue to be vigorously progressed, with the increased technical, engineering and manufacturing resources maintained.

This strategy is likely to lead to discharges similar to current levels for several years to come.

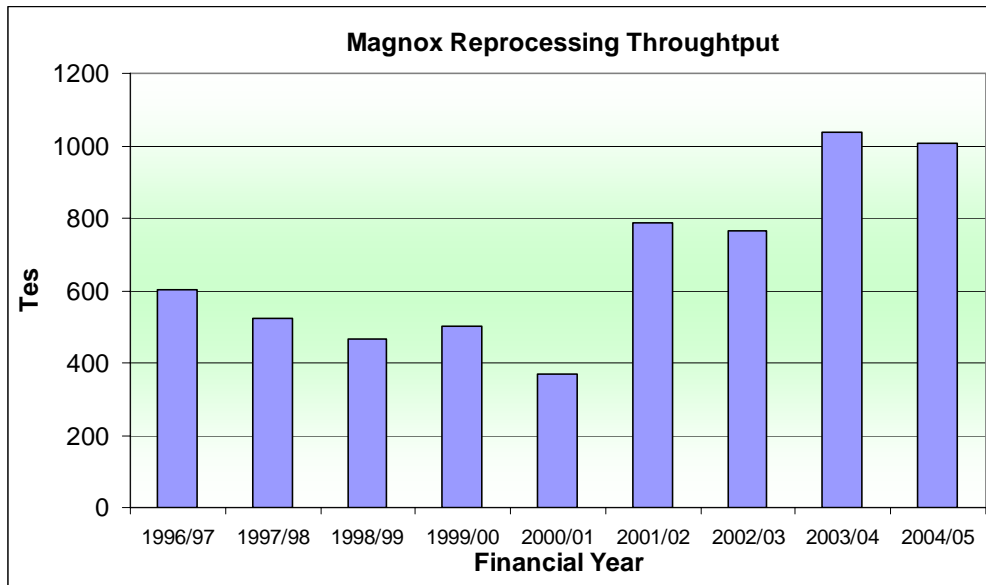
Conclusions

- 1 Magnox Reprocessing throughput has recovered from the low levels of the late 1990's, and new deliveries of fuel are being processed without delay.
- 2 Considerable progress has been made to demonstrate the required sustained capability to remove the FHP corroded fuel stock at a rate of 100+ tes/year.
- 3 FHP pondwater activity has been controlled while addressing the root cause of the activity source. Workforce dose uptake has been controlled.
- 4 SIXEP discharges have been controlled, and are predicted to continue at a similar level for several years. The activity challenge to SIXEP from Magnox Reprocessing and Site Remediation will need to be kept under review.
- 5 The improvement programme presented previously to NuSAC has contributed significantly to this improved situation, and further potential improvements are being assessed.

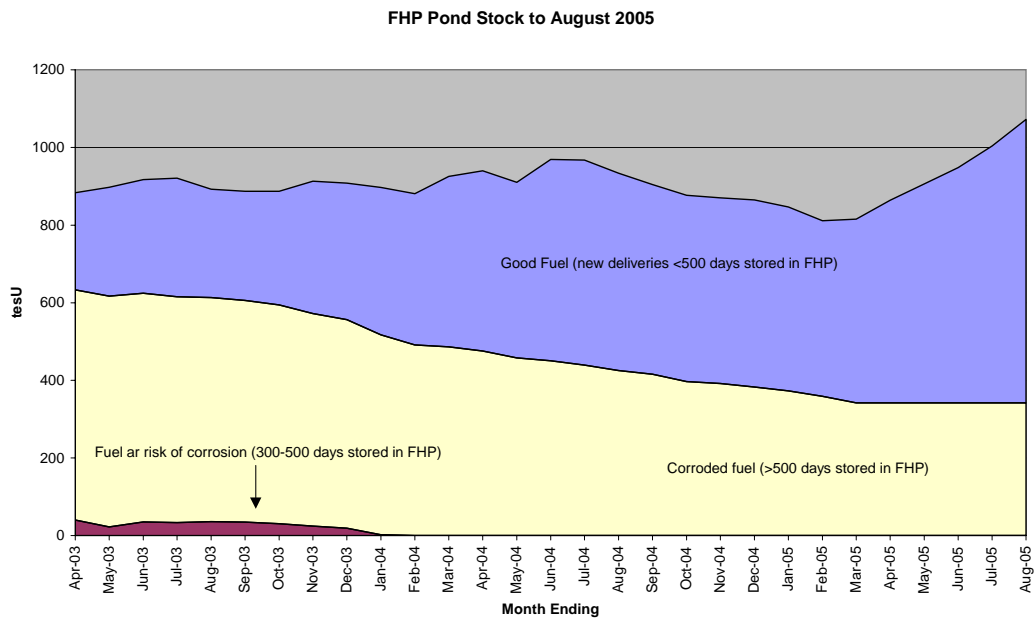
Recommendations

- 1 It is recommended that NuSAC note the progress made, the strategy to process the remaining corroded fuel as quickly as practicable within the plant and discharge limit constraints, the commitment to strive for further improvements, and the likelihood of the continued discharge pattern.

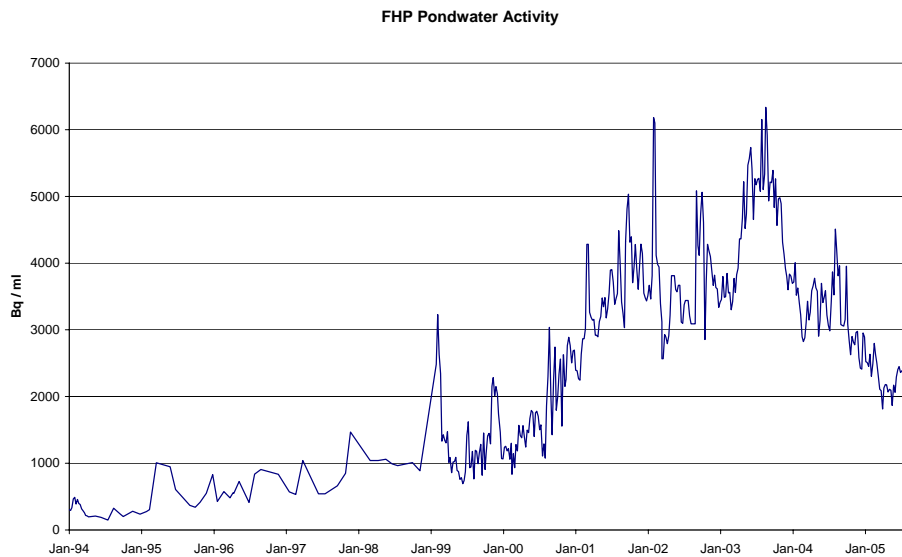
Appendix 1



Appendix 2



Appendix 3



Appendix 4

