

**Nuclear Safety Advisory Committee**  
**Meeting of RG2 with Windscale Pile 1 Decommissioning Project Team-**  
**29/09/2005**

Bill Heafield (RG2 convenor) and Andrew Clarke (RG1) met Tony Milburn (Pile 1 Project Manager) and Steve Balmforth (Area Technical Officer) to receive an update on the progress with the Pile 1 decommissioning project. (Pile 1 was the source of the Windscale fire in October 1957). Peter Mann (Head of Windscale Site) welcomed us and joined us for a round up session.

We were well received by our hosts. The discussions were open and they were able to address all our questions with confidence.

We first received an overview of the decommissioning project and plans for the future. We visited the pilecap, where there is an excellent visual presentation based on construction photographs and recent non-intrusive inspections of fuel channels.

The current status is as follows:

- 13Te (out of an original 180 Te) of fuel remain in the core. The fuel removed (several years ago) has either been reprocessed or is stored in either the Piles Fuel Pond or the Magnox Decanning and Fuel Storage Facility. Once removed from the Windscale site, it becomes a BNG, rather than a UKAEA responsibility.
- The water ducts (equivalent to a modern pond) are capped off and empty. All fuel elements and other debris out of, or hanging off, the reactor discharge face, were removed as part of an earlier project.

The current project scope is to remove the remaining fuel and isotopes from the core. The core and bioshield will then be put, and left, in an “inherently safe” state until final decommissioning. *Note however, that the UKAEA and NDA are considering whether to adopt an accelerated programme (for the final decommissioning of the core). If they did this, an alternative approach might be to remove graphite in parallel with the fuel (i.e. starting at the top and working down.)* With the current approach, fuel removal is planned to start in 2008 and will take 4 years. The “inherently safe” state is planned to be reached by the end of the 2015/16 fiscal year and to be held in this state until 2040 – the date assumed for a repository to be available.

We also learned that the Pile 1 chimney (the chimneys have characterised the Sellafield sky line for 50 years) is outside the UKAEA Licensed Site and is BNG’s responsibility to decommission. The Pile 2 chimney was removed prior to 1/4/2005 and we were told that there was an original intent to effect the early removal the Pile 1 chimney (which is heavily contaminated). There appears to be some doubt now as to whether this work will be an early funding priority of NDA. The implication for UKAEA is that their safety case has to address the hazard if the chimney were to fall on Pile 1.

Key points of interest to NuSAC are as follows:

- Inspections have shown that there was NOT a graphite fire: damage to graphite, caused by severely overheated fuel assemblies, was localised.
- A new Operational Safety Case (i.e. the case for the facility in its current state) was formally presented to NII within the last week. It has demonstrated, inter alia, that there is no possibility of criticality in the core, nor of a Uranium Hydride propagated incident. The importance of these findings is that there is no longer a possibility of an off-site release in an accident (so the emergency arrangements can be downgraded accordingly) and that decommissioning work can be undertaken without the need for inerting. This case prepares the ground for the Decommissioning Safety Case. The attached Technical Update (at Annex A), prepared for NuSAC by UKAEA in Feb 2005 is still valid. Note however, that NII took 5 months to clear the assessment referred to in the second paragraph of the update.
- The project appeared to us to be well managed; general housekeeping was very good and there was clear evidence of a good safety culture (notices, unusual event reporting forms, adherence to procedures etc)
- There were some concerns, following the NII audit at Dounreay, about who is the informed customer. These concerns have been satisfactorily resolved; UKAEA is clearly the “controlling mind” and provides staff who meet the “informed customer” requirement
- UKAEA clarified their position on contract strategy and Design Authority (they will retain this key role), but their contract strategy for the future remains fluid.
- One issue raised with us related to the operation of the NDA, NII, Licensee triangle. They have an ongoing example whereby NII insist that a piece of work is done and NDA say there is no money to do it. UKAEA are left as “piggy in the middle”

In the round up session, we enquired when it would be sensible for NuSAC to receive a further update on progress. This will depend on progress with the fuel removal development work. Peter Mann did indicate that UKAEA would, in any event, be preparing papers to mark the 50<sup>th</sup> anniversary of the fire in October 2007. He will consider whether UKAEA would like NuSAC to consider some of this material in advance. The July 2007 meeting would be the last opportunity.

W Heafield / A Clarke  
30/9/2005

## WINDSCALE PILE-1 DECOMMISSIONING

### Technical Update for NuSAC

Feb 2005

#### Summary

Research and Development work into a uranium hydride initiated whole core fire and a criticality excursion has shown that these are not the dangers once presumed. The new safety case based on this work is nearing completion.

Non intrusive inspection in the outer inspection holes (so-called foil holes) had showed them to be empty and clear. A safety case was sent to the NII in December 2004 justifying the first intrusive inspection since the “don’t touch the core” policy came into force many years ago. The NII is assessing this to see if they can issue a licence instrument to proceed. This first intrusion will be a major milestone and will pave the way for the further intrusive inspection needed to verify the recently developed theory about the contents and hazards of the fire affected zone.

The R&D work gave grounds for optimism that the overall hazard category of the plant could be reduced thus simplifying future processes for approval of safety and environmental permissions. It also indicated that the dismantling work could be performed in air thus making the design and implementation of the equipment simpler and cheaper. Some details of the technical assessments follow.

#### Uranium Hydride

Thermal modelling work has shown that if the uranium rods are at ambient temperature (below 70 C) then the hydride reaction will not propagate to cause a uranium fire or a core fire. This holds true even under the most extreme conditions including a seismic event. This work has passed through the peer review stage and is with the NII for their assessment.

#### Criticality

Previous measurement work has demonstrated that the core is sub-critical. Mathematical modelling has now shown that under all credible accident scenarios reconfiguration of the core and its contents into a critical assembly is not possible. This work has been included in an updated Criticality Safety Assessment (CSA) which forms part of the safety case. The CSA and its associated peer review have been provided to the NSC, for information, in advance of formal submission of the Operational Safety Case (OSC), which will incorporate the CSA aspect.

#### Graphite Dust Explosion

There is evidence in the literature that under certain extreme conditions reactor graphite dust can be made to explode. The Pile 1 project has completed research at

Leeds University which has concluded that although the conditions can be recreated in the laboratory they will not exist in the reactor and the dust explosion hazard can be discounted. As an added precaution the production of fine dusts during dismantling operations will be closely controlled.

Some members of NuSAC may be aware that recent attempts to burn GLEEP graphite (block form) in a high temperature incinerator succeeded only in making it hot.

### **Hazard Category**

A further implication of the R&D work is that the plant no longer poses any significant off-site hazard, and can be down graded to UKAEA's Category 2 (hazard on-site and to workers).

### **DECOMMISSIONING SCHEME DEVELOPMENT**

The engineering work to develop decommissioning concepts and schemes has continued in parallel with the R&D work. This is in accordance with the Corporate Design Process which requires Concepts to be derived which will be developed into Scheme Designs followed by Detailed Designs.

Concept work has been completed and the R&D work has enabled the list of viable concepts to be shortened as the need to control the global fire and criticality hazards has been removed.

Viable schemes for removing the fuel and isotopes using proven technology and taking advantage of existing design features of the reactor (e.g. the charge hoist and the associated shielded charge well) are on the drawing board and are currently some 3 months ahead of programme. These schemes also cater for the subsequent removal of the graphite core.

Parallel work by a joint team formed from UKAEA, CH2MHill and a U.S. based remote handling company, SA Robotics, is yielding viable schemes for acceleration of the project. They are of particular relevance to the removal of the graphite core and subsequent removal of the concrete core box, bioshield and associated air and water ducts ending in a brownfield site. Development of this work will continue with the intent that when demonstrated as sufficiently robust it will be amalgamated into the Baseline and Workplan.

### **CONCLUSIONS**

The early promise of demonstrating reduced hazards has come to fruition and the project has benefited accordingly. Much of the uncertainty has now been removed. Subject to final approval of the Operational Safety Case the safety issues which remain are principally dose control and industrial safety on the plant and in the building.

A H Milburn & N J Holloway  
Feb 2005

