PLANT EVALUATION USED TO HELP PREPARE SELLAFIELD B29 AND B30 PONDS FOR SAFE AND EFFECTIVE DECOMMISSIONING

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Fig. 1 Image of B30 facility

ABSTRACT

This paper describes how a "peer review" style process was used in a unique way, utilising a combined contractor and plant staff team to conduct an "assisted" self-evaluation on Sellafield B29 and B30 plants. It was used as part of a process of establishing a culture, which allows modern nuclear operational management techniques to be developed and then treated as the norm when the plants resume their decommissioning operations in the near future.

INTRODUCTION

Many nuclear facilities around the world, which were key to early industry developments, have been left in various states of care and maintenance. Decommissioning of these facilities is now being progressed, many being in the very early stages although a few have already completed the process.

In general, initial decommissioning activities on these early nuclear facilities were and are, operational in nature, involving the removal of active materials and wastes. However in most cases the necessary skills have been lost to the facility since personnel have moved on or retired. Also the available processes and procedures are typically those developed when the plant last "operated" in a formal sense and hence by definition do not align with current best practice. More importantly these "legacy" documents tend to support an operational and safety culture which whilst acceptable in the early days of the nuclear industry are not acceptable today.

In addition, although the plants have been "looked after", often this is in a minimalistic sense sufficient to ensure nuclear safety is maintained but not sufficient to prepare them for a return to "operation".

In summary, these plants do not have an existing material condition, the appropriate processes, satisfactory documentation, disciplined operations, or the embedded safety culture to ensure minor consequence or event free decommissioning operations can take place with a high degree of probability for success.

The Sellafield Ponds B29 and B30 are such facilities.

SELLAFIELD B29 AND B30 PLANT DESCRIPTION

Fuel Cooling and Storage Pond B29

Built and commissioned between 1948 and 1952 the B29 pond provided the storage and cooling facility for irradiated fuel and isotopes from the two Windscale pile reactors, themselves built to provide nuclear material for military purposes. The pond was linked via submerged water ducts to the back of each reactor, where fuel and isotopes were discharged into skips for transfer to the pond. Following a cooling period, the fuel was then decanned within B29 prior to reprocessing in another facility on the site. During the fire in Pile 1 in 1957, the west sections of the B29 ponds were used for the accumulation of debris from the fire fighting efforts. Following the shutdown of the Windscale Piles after the fire, B29 continued to be used for some decanning operations (although these were transferred to B30 plant in 1962), the storage of miscellaneous Intermediate Level Waste (ILW) and some fuel, until 1970 when the plant was left in a dormant state

The pond contents are known to consist of 196 skips, approximately 10 tonnes of fuel, 20 tonnes of general debris and 450 cubic metres of sludge.

Significant refurbishment of the facility commenced in the mid-1980's with the replacement of the main crane (skip handler) and followed in later years by infrastructure improvements (ventilation, radiometrics, fire protection, building fabric). The water ducts were permanently isolated from the pond in 1990 with seismically qualified structures.

Magnox Fuel Storage Pond and Decanning Facility B30

The Magnox Storage and Decanning Facility, B30, was built and commissioned between 1959 and 1962 as part of the UK's expanding nuclear programme. Its role was to receive and store irradiated fuel from Magnox reactors, and to remove the fuel cladding prior to the fuel being reprocessed. The plant operated for over 30 years with the final fuel being received into the facility in 1992. During its operational life, B30 received and processed over 25,000 tonnes of magnox fuel, for subsequent reprocessing in the adjacent B205 reprocessing plant.

Since 1992 the plant has been in the Post Operational Clean Out (POCO) phase of decommissioning. Well over half of the radioactive inventory of the plant at the time of closure has been safely removed. The quantities of nuclear inventory currently within the plant are approximately 350 tonnes of fuel debris, 1000 cubic metres of ILW and 1200 cubic metres of sludge.

Some asset restoration activities have been achieved since POCO began in 1992, including a significant reduction in contamination levels, new ventilation systems installed and new building cranes installed.

Decommissioning Strategy

The overall aim of both the B29 and B30 decommissioning projects is one of hazard reduction and mitigation of the continued cost of operational and maintenance activities. In the medium to long term this can only be achieved through the removal of the radioactive inventory from the plants.
However, in the short term the plant activities are focussed on risk reduction activities, such as developing and deploying improved contingency plans to deal with a loss of containment from the ponds. In addition, significant asset restoration and upgrade is being planned and implemented to support future waste retrieval operations.

The management structure to support these activities is focussed in two specific areas:

- Firstly to maintain compliance with the Nuclear Site Licence granted by the Nuclear Installations Inspectorate (NII), part of the organisation is dedicated to the Control and Supervision of operations within these legacy plants. This group provides the safe stewardship of the nuclear inventory, maintenance of the safety cases and maintenance of the essential safety features required of a nuclear plant.

- Secondly, to prepare the plants for future waste retrieval activities, dedicated project teams with significant supply chain involvement have been established. These teams, totalling several hundred people, provide dedicated design, construction and commissioning expertise to enable remediation of these legacy plants.

The Approach

Plant evaluations have been used in nuclear power plants over many years to continuously improve safety, performance and influence culture change. Originating in the nuclear power industry at the Institute of Nuclear Power Operations (INPO) in the USA but now adopted by the World Association of Nuclear Operators (WANO) world wide, plant evaluation techniques have been developed and deployed leading to operational excellence and a reduction in license reportable events.

The process is not an audit but rather a "bottom up" performance based approach starting with actual observations of activities and events, management actions and procedures and inappropriate plant conditions. These facts, data and sources of information are then analysed systematically to establish the root causes of inappropriate behaviours, actions and conditions leading to the identification of fundamental overall problems. The fundamental overall problems are characterised against long established Performance Objectives and Criteria in order to identify and develop "Areas for Improvement" (AFI's) in a stylised written form.

Performance Objectives and Criteria (P.O's & C's) originally developed by INPO and WANO for use on nuclear power plants define those observable characteristics and behaviours which typify excellence in operational performance. They cover all aspects of the operation and management of nuclear safety and reliability for a nuclear power plant. BNFL as members of WANO have access to these P.O's & C's but modified them, with the concurrence of the WANO Paris Centre, to be applicable to a non-reactor nuclear facility. It was these modified P.O's & C's that were used for this particular exercise on B29 and B30.

Although plant evaluations do identify things a plant does well their focus is on things, which can be done better as captured by AFI's. Hence by definition evaluation reports appear "critical" of plant performance and of the management teams, being dominated by indications of things, which are less than optimum, and how improvements might be effected.

Notwithstanding this the Sellafield B29 and B30 plant management team decided to try an evaluation approach on these specific irradiated fuel and material storage ponds, which were scheduled to resume decommissioning, even though they accepted up front that the process could be "painful". Many Areas for Improvement (AFI's) were expected all of which would need to be actioned if benefit were to be gained.

This understanding, acceptance, openness and willingness to communicate the position to all of the plant staff at all levels was key to the ultimate success of the project.

Further, essential features of the success of the approach were the openness of all the plant staff and more importantly the management team's acceptance of the need to drive towards continuous improvement evidenced by their enthusiastic adoption of the Areas for Improvement into an action plan for the business.

The actual process used was an "adapted evaluation" styled to suit the plant, recognising it was in "care and maintenance" but also recognising the potential hazards. Key to the success was the development of this tailored approach to deliver 'fit for purpose' AFI's aimed at delivering event free, effective decommissioning and which the team felt would be beneficial for future operations.

The evaluation team of 13 comprised eight personnel from Atkins Nuclear and five personnel from BNFL had a total of 227 years of nuclear experience. Although led by Atkins this combined BNFL / Atkins group, was a significant feature and contributed to the success. In particular the inclusion of a senior manager from the plant as part of the team ensured the work of the group progressed safely and that findings were factually correct. The routine meetings held between the team members and the plant staff during which facts and developed findings were extensively discussed further reinforced this factor. Utilising the meetings in this way ensures the process is a "no – surprises" approach when the ultimate AFI's are presented.

During the six days of actual evaluation activity on site the team wrote individual plant based facts on 523 "white cards" during a systematic plant inspection. These facts covered, predominantly but not exclusively, deviations from good standards of housekeeping and material condition. Additionally 83 observation reports were written each containing a number of discrete facts. Combining and analysing the facts derived from the "white cards" and the observations resulted in the identification of 26 Areas for Improvement (AFI's). The relatively high number of white cards and observations written by the team during a comparatively short period on site is in no small measure due to the high degree of co-operation and help received from all the plant staff at all levels. This attitude among plant staff is typically a strong indicator that the plant has the characteristics and desire to improve.

AFI's varied from housekeeping improvements to proposing changes to organisational arrangements leading to more visible management involvement. All AFI's included observed facts, which contributed to the finding. Examples of the types of issues covered by the AFI's and the resulting management corrective actions are included below.

Evaluation benefits in the context of modern safety and environmental standards

Perhaps above all industries, the nuclear industry has been subject to the highest standards of safety management and regulation during its lifetime. Many of the techniques for risk assessment and in particular probabilistic risk assessment have their roots in the nuclear industry. Through the 1970s and 80s, the application of these techniques grew and matured until a significant amount of emphasis was placed on numerical assessment. More recent thinking is that, in conjunction with probabilistic assessment, the safety of plant should be assessed on more deterministic grounds. The evaluation tool used provided a very good basis for such an assessment, by considering plant safety from the ‘as is’ state.

During the same period and at the same time as thinking on safety assessment was changing, the amount of environmental legislation worldwide grew significantly. Most of the basic principles of environmental management, however, go hand in hand with good safety management. For example, the principles of eliminate, reduce and mitigate hazards work equally well for safety as they do environmental hazards. Therefore, although the WANO tool does not specifically include compliance with environmental legislation, the technique easily accommodated the most significant environmental aspects of the plant.

After the initial visits to the plant and following discussions with the facility, it was quickly realized that the approach to be taken by the evaluation team needed to be modified to reflect the age and condition of the facility. Account was taken for the fact that the plant was old, contained large quantities of radioactive material and that removal of the primary hazards would take significant amounts of time and resource.

Especially in the areas of radiological protection, the need to maximise the amount of useful work for the dose incurred was recognised. Improved dose control could lead not only to fewer incidents and accidents but also more useful work being done per unit of dose incurred. A number of the areas for improvement focused on this particular aspect.

The other key focus of the evaluation developed from the simple principle of making some ‘quick wins’ to improve safety in the immediate term. These included improved housekeeping and the elimination of obsolete and obsolescent signs. These are discussed in more detail below.

Having a number of ‘quick wins’ was important for a number of reasons. Firstly, it demonstrated that the evaluation tool could be applied to this type of plant. Secondly, it was important to show that the standards applied to this plant should be no different to other plants. The questions were raised about the acceptance of certain practices are discussed below.

The AFI’s therefore took into account improvements, which could be achieved, in the short term, whilst recognising that a true decrease in primary hazard would be the subject of longer-term plans. The AFIs were therefore geared to better safety and environmental performance, including most significantly, lower dose to personnel.

By showing that short-term improvements could be made with potentially minimal cost, it was also hoped that the facility could improve its relationships with stakeholders, especially the regulators.

Finally, as well as improving safety and environmental performance, it is recognised that high performing plant are also high commercial performers. In the context of this facility, this could lead to a reduction in the overall cost of the decommissioning and clean up programme.

Examples of types of issues for B29 / B30 and the plant management response

In discussing the output from any evaluation reports it is important to emphasise two key features related to Areas for Improvement:

- Firstly the number of AFI's is NOT an indicator of the plant's performance (very high performance plants can have a lot of AFI's). Rather it is the scope and significance of the AFI's, which characterise the plant (high performing plants do not have broad scope and significant AFI's). In the B29 / B30 report several of the AFI's could be categorised as broad scope (that is applying to several areas of the plant or several management functions) and significant (in that they apply to things which have happened and which have or could influence nuclear safety).

- Secondly from any set of observation based facts several sets of AFI's could be drafted. It is the skill of the evaluation team based on the experience of the members and the specific circumstances of the plant, its age, history, management culture, and staff attitude (and other characteristics) as appreciated by the team during the evaluation period which determine the actual set selected. For example given the facts collected on B29 / B30 it would have been possible to identify a Safety Culture AFI. However the lack of immediacy of the nuclear safety threat (compared to a reactor where it is immediate) and the lack of defensive attitude (towards the AFI's) displayed by the whole management team mitigated against this.

The evaluation team covered Management and Organisation, Operations, Maintenance, Engineering, Health Physics, Emergency Arrangements, Training, Chemistry and Operating Experience and AFI's were developed in all areas. These AFI's ranged from technical detail to strategy and organisational issues although they could be characterised under ten broad headings, which proved valuable in focussing the action plans derived to positively respond to the observed shortfalls in performance. The ten broad headings were:

- Standards
- Communications
- Learning from Experience
- Industrial Safety
- Radiological Control (dose and contamination)
- Plant Control and Status Monitoring
- Plant Drawing and Record Configuration
- Segregation, Storage and Handling of Waste
- Effective Maintenance
- Emergency Arrangements

Although in this paper it is not the intent to cover all ten issues. Neither is it the intent to prioritise the issues since all are important and prioritisation is a matter for the plant manager and the management team. However certain topics will be discussed in more detail since these are the ones, which when addressed, will have a significant benefit.

Standards

Based both on the "white cards" and the observations it became clear that there was a standards issue throughout the plant at all levels in the organisation. In many respects the standards established at the time the plants last operated prevailed, whereas on higher performing plants standards had improved significantly. This lead to an "acceptance" culture where personnel accepted standards that were less than optimum. Senior managers walking by the problem perhaps not even recognising it frequently condoned this less than acceptable performance.

A contributory factor was the fact that personnel had not been exposed to what was possible even at older plants. Hence there was no clear and consistent message about what standards should be adopted. This particular issue was clearly indicated by the number of "white cards" which highlighted aspects of poor housekeeping, plant labelling deficiencies, less than acceptable maintenance practices and problems with dose and contamination control. In each case the plant was not unsafe nor were there compliance issues overall although the team considered that operational performance was not being optimised.

At the time of the evaluation, several of the plant managers, including the senior manager were relatively new in post, having moved to these decommissioning plants from other areas. The benefit of refreshing the organisation with individuals who have been exposed to higher plant standards is now bearing fruit with a measurable improvement in standards as evidenced by the quantitative building inspections.

In December 2002, a re-launch of the "Standards & Expectations for the Sellafield Site" was made.
These 11 standards describe in plain language the standards that are expected of all who work at Sellafield. These standards have been enthusiastically adopted by the teams within B29 and B30, and are visibly employed on a daily basis.

Communications

Related very much to the standards issue was the degree to which the management team were visible on the plant.

Establishing appropriate standards, communicating them and regularly reinforcing them by senior managers being more visible at the point of work is a key feature of the plants action plan to respond to the AFI's. In support of this a new and more formalised cascade briefing system has been established to ensure managers and team leaders consistently brief all staff on the current plant issues and respond in a timely manner to staff's concerns.

The number and frequency of plant inspections has been increased with an appropriate degree of formalisation to encourage completion. Senior managers from these and other plants at Sellafield regularly inspect both B29 and B30, providing both qualitative and quantitative feedback to the plant management. Joint management and shop floor inspections are also conducted to an agreed schedule.

Learning from Experience

A "Learning from Experience" process has been established "Sellafield-wide" but by comparison with high performing plants where this type of process forms a key feature of day to day activity at all levels. At B29 and B30 plants (similar to the majority of the site) it is not yet fully mature. As a result the evaluation team found examples of repeat events and events which had not been fully or appropriately analysed in order to establish the available learning. Also there was not consistent evidence that operating experience was sort prior to commencing activities which as a result the potential for repeat events was greater than ideal.

Although there was limited evidence of learning from other plants on the Sellafield site, in the wider context the concept of learning from the experience of others was not well embedded in the organisation. An example of this was very limited use of benchmarking to learn from what others do well and emulate it. This feature was considered to be a direct contributor to the inappropriate standards, which existed in a number of areas.

Significant improvement has been made in this area, with a well coordinated daily, weekly and monthly feedback process at all levels in the organisation from shop floor to senior management. The feedback process takes relevant learning from both within the organisation and external sources and implements appropriate actions to mitigate potential hazards. The feedback process within the business unit within which B29 and B30 reside has been assessed as best practise at Sellafield by one of the Sites regulators.

Radiological Control

On Dose Control there was evidence that on significant (high profile) jobs ALARP processes were well embraced. However this important aspect of dose control was not so well established for routine operations with the potential consequence that personnel could receive more dose than was warranted by the planned activities.

A number of improvements are currently being implemented on plant such as the introduction of Local ALARP Review Levels (LARLs) for all worker groups to prompt regular reviews of worker dose against plant specified action levels. This will ensure routine tasks, which give rise to radiation exposure, are reviewed. In addition, a review of contamination control procedures and area classification is being conducted in line with the relevant statutory procedures and best practise.

Plant Control & Status Monitoring

Examination of the plant configuration control processes in place identified opportunities for available improvements in material condition that would improve plant and personnel safety and chemical sampling operations were observed which did not adequately represent the overall pond conditions being monitored. Corrections to both of these areas are part of the action plan, which will also contribute to reducing repeat events on the plant.

A significant review against conduct of operations standards has been undertaken resulting in improved operator rounds, operator aids, and plant configuration control processes.

Effective Maintenance

The Work Management systems in use promoted reactive rather than proactive maintenance resulting in the ineffective use of maintenance personnel and in some cases the allocation of personnel to tasks without ensuring that they were appropriately trained or had the necessary experience.

A complete overhaul of the maintenance philosophy within the plants is underway, borne out of this peer review and events within the plant. Formal training and appointment of Persons Organising Work and those supervising the maintenance is now a key feature of the maintenance regime. Improvements to the working patterns of maintenance personnel are also being implemented to achieve the goal of reduced reactive maintenance.

CONCLUSIONS

The WANO style plant evaluation process "works" and is entirely appropriate for use on decommissioning reactor and non-reactor facilities.

Applying the plant evaluation approach to a pre- decommissioning plant has the potential to give confidence that the decommissioning "operational" activity will be conducted in a safe and event free manner.

Adapting the evaluation approach to B29 and B30 has produced many lessons learned as to how this process could be repeated on other similar facilities. Specifically a joint contractor/plant team enables a unique way of evaluating a plant preparing for decommissioning in that it combines knowledge of the plant, knowledge of the process and a commercial aspect. Optimising this balance ensures appropriate AFI's are developed duly recognising the current plant conditions and thereby gaining ownership from he plant leading to a high degree of enthusiasm to correct issues found in a timely way.