THE NUCLEAR SAFETY ADVISORY COMMITTEE

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Operational Excellence – a Magnox Perspective

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This paper is in response to a presentation made to NUSAC in 2004 by Sig Berg, then Managing Director, World Association of Nuclear Operators. His presentation was entitled "Operational Excellence".

INTRODUCTION

BNFL has for many years focused on improving the performance of the Magnox fleet of reactors. In some cases the remaining lifetime has not made it cost effective to undertake major interventions. Nevertheless, significant work has resulted in improvements and prevented anticipated failures. The performance improvement initiatives can be categorised into three groups, People, Processes and Plant.

PEOPLE PERFORMANCE IMPROVEMENT

Human Error Reduction

Based on event analysis it is accepted that the majority of events relate to Human Performance. This prompted a series of initiatives to reduce the frequency of human error. A Human Performance Foundation Course, based on the BE material was developed. The key elements being: Operational Conduct, Conservative Decision Making, Communication and Situational Awareness. This was rolled out across the stations starting late 2001. One aspect of the training is to create an environment where personnel are encouraged to share their experience and discuss related problems. These sessions have provided valuable feedback to managers for inclusion into their own improvement plans.

A number of human performance monitoring programmes are currently in use. These include:-Loss Control Reports, Behavioural and Task Observations, plant inspections etc. These provide feedback on the results of the performance improvement initiatives.

Benchmarking

Most sites have embarked on an industry wide benchmarking programme. The best performing power stations and other industrial sites are visited to compare processes and practices and thereby learn from the experience of others. Topics covered include Operator and Maintainer practices, safety culture, leadership etc. Efforts are underway to share the results amongst all Magnox sites.

Safety Culture Assessment and Improvement

The Safety Culture Assessment and Rating Tool (SCART) was developed in-house and adopted in April 2004 as the company approach to assessing and monitoring safety culture across the sites. This is a practical approach which assesses site performance against five areas: Leadership, Learning, Team-working, Communications and Personnel Behaviours and Competencies. The value of this approach comes from a number of sources. Firstly, the involvement in the process can help staff to question the way they do things, and raise awareness of safety culture issues. It is a way of collecting ideas from those on the shop-floor about how the site can improve. It provides the site with information about where they 'rate' on the five areas, along with in-depth information about what is and isn't working well. The information can then be used to help identify appropriate actions to improve their safety culture.

Conduct of Operations and Maintenance

This initiative was implemented to promote professionalism and a commitment to excellence in all activities relating to Operations and Maintenance. Standards were developed with involvement from all stations to define the high level requirements. The Production Manual, the sister document to the Standard expands on the content of the Standard and provides the basis for development of local arrangements. The documents were developed in 2001, with initial implementation, for Operations in Sept 2002 and for Maintenance in March 2003. Roll-out has been a combination of briefing and training packages to raise the awareness on the shop floor, which is the key to the success of the standard. The initiative has resulted in a substantial reduction in Operating Rule breaches.

Implementation is being reviewed via an independent manager from Magnox. and Production Managers and SCE reviews of each others stations. The reviews indicate that there is good progress towards full implementation.

Learning from Experience

A number of activities are currently being pursued to improve the experience feedback processes:

- A review of the general ownership of the process and the relationships between all parties including an understanding of barriers, aids and mutual expectations.
- Improve the Just In Time (JIT) process. All tasks should be prefaced by a pre-job or heightened level of awareness (HLA) brief.
- Improve the Mandatory Assessment process to achieve a more critical examination of issues and more effective remedial intervention.

PROCESS PERFORMANCE IMPROVEMENT

Outage duration and slip

An appropriate methodology (Point A Analysis) was established to review the outage related processes at each station and benchmark them each against each other, and against a common set of WANO baseline criteria. In visiting each station and applying this methodology a picture was developed on where practices are common, where they are different and how they compare to the baseline criteria. This has allowed areas for improvements to be identified and a management view to be developed on where to apply

resources and focus for maximum benefit. It has also allowed good practices to be identified which can be transferred to other stations. Examples of some of the performance areas investigated were, Organisational Structure and Responsibilities, Management Effectiveness, Human Resources, Safety, Teamwork and Communication
Based on the above approach, a number of recommendations were implemented across the sites. This has resulted in reduced outage duration and slip.

PLANT PERFORMANCE IMPROVEMENT

Boiler tube failures

Erosion/corrosion related failures became more frequent as the plant aged, especially at Wylfa. Various projects were launched to reduce tube failures. The water chemistry was improved by alternate chemical dosing and refurbishing the water treatment and condensate polishing plant. Tighter standards of boiler inlet chemistry were introduced. Modifications were implemented to reduce the frequency of leaks, e.g. boiler tube ferruling and turbine condenser tube sleeving.

Transformers

Transformer failure was identified as a frequent cause of lost production. A workshop with international assistance established a number of actions that could be used to better anticipate and prevent failure. Considering that many of the transformers are near the end of their design life, stricter and more sophisticated monitoring was implemented to provide early warning of deterioration.

Fuel Route

Many millions of pounds have been spent refurbishing and replacing fuel handling equipment such as charge machines and hoist units. This has improved the refuelling rate which in turn has allowed the reactors to operate close to their designed power level.

System Engineers

All sites have introduced System Engineering as a means of improving the plant performance. Each Engineer is allocated a number of systems for the development of performance indicators and preventive maintenance and modification programmes. This increased focus and ownership results in an early identification of deteriorating trends and a prompt response.

Engineering Projects and modifications

Dungeness Shield Cooling Air Heaters. A project to improve controllability of RPV temperatures and increase them in low ambient temperatures using electrically powered heater banks.

Cast Iron pipe failures. Proactive replacement of cast iron pipe work following the failure of piping at the BE Heysham site, prevented plant losses and improved nuclear safety. This is also an example of successful cross industry learning.

Turbine replacements to increase output by optimising the turbine steam conditions.

Fuel cycle improvements eg fuel retention schemes, and enriched fuel. These not only save on fuel and reprocessing costs, but have enabled Oldbury to achieve rated output when it used to struggle.

CONTINUOUS IMPROVEMENT

Past and present improvement initiatives have reduced reactor trips, UCLF and human error. The automatic reactor trip rate is now amongst the best in the world. Forced Loss rate is now a business indicator receiving continuous attention. One of the organisational changes to sustain the focus on improvement has created six programmes, driven by the Director EHSQ through Heads of Profession Regulatory Compliance and Assurance and Learning. These address all aspects of safety, learning and culture. This holistic approach is designed to improve the business through better plant and people performance.