The findings of NII's assessment of the UKAEA's Site-Wide Periodic Safety Review for Harwell

August 2005

Contents

1. Executive Summary
2. Introduction
3. Purpose of site-wide PSR
4. Submission of Harwell SWPSR
5. NII Assessment
6. Summary of NII's Findings
7. Conclusions
8. Detailed Findings
9. References

1. Executive Summary

All nuclear licensees are required periodically to carry out a systematic review and reassessment of safety cases as a condition of their site licences, and they need to satisfy NII that the safety of their sites remains adequate until the next review. This exercise is termed the 'Periodic Safety Review' (PSR). This report gives the results of NII's assessment of UKAEA's Site-Wide PSR submission in respect of its nuclear licensed site at Harwell (reference 1).

The PSR process for a site like Harwell is required to be carried out at two levels, normally at least once every 10 years. Firstly at the facility level a PSR is designed to ensure that a thorough and comprehensive review is made of the whole plant safety case. Secondly at the site level a PSR is designed to ensure that site wide considerations, including Safety Management Systems and any interactions between facilities, are fully reviewed. This 'site wide' review is referred to as the 'Site–Wide PSR' (SWPSR).

The Harwell SWPSR represents the first time this second level 'Site-Wide' type of exercise has been undertaken by UKAEA under the current guidance produced by NII. The approach and format for the SWPSR document was agreed between NII and UKAEA early in the SWPSR process. The aim of the format is to provide the most appropriate way of addressing the requirements for SWPSRs taking into account the individual facility safety case PSRs. The format includes site issues, procedures and management processes as well as reviews of individual facilities safety cases in a holistic overview of the entire site.

The document was submitted by UKAEA to the agreed timescale and has been assessed, with site inspection as appropriate, by NII inspectors encompassing a wide range of specialist disciplines.

NII is satisfied that the UKAEA has completed a detailed scrutiny, at the site wide level, of safety at Harwell, has an acceptable rolling programme of facility level PSRs, and put in place improvements to the plant, which the licensee identified as part of its review. The overall outcome of the licensee's review, together with the programmes of additional modifications and inspections which have been put in

place, indicates that UKAEA believes it can continue to operate facilities on the Harwell site safely for the time being.

Nevertheless, NII has also identified the need for some further work, and programmes for this have been agreed with UKAEA. Subject to the satisfactory completion of this work, and continuing satisfactory results from the routine monitoring and demonstrations of safety required under the nuclear site licensing arrangements, we are confident that UKAEA can continue to operate the Harwell site safely at least until the end of 2013, at which time a further site wide PSR will be required.

2. Introduction

Currently UKAEA owns the Harwell “estate” near the village of Harwell in the Vale of the White Horse District of Oxfordshire, some 640 acres in size. Approximately 290 acres are enclosed within the site perimeter fence, known as ‘The Harwell Site’.

Harwell was a nuclear research centre that included a number of experimental and materials testing reactors and associated facilities, some of which have already been decommissioned. The reactors that remain are two materials test reactors (DIDO and PLUTO) and a pile reactor (BEPO). All of these reactors were shut down some time ago, and have undergone some decommissioning. Other significant facilities on the Harwell site include research and development laboratories and post irradiation and examination facilities (which are still in operation), operational accelerators (Helios 1, 2 & 3) and various facilities for the treatment and storage of radioactive waste. Since the submission of the SWPSR, the Tandem Generator has been shut down.

UKAEA intends to develop the Harwell site by decommissioning and remediation of the nuclear facilities with the long-term objective of turning the site into a de-licensed science and technology business park. Significant decommissioning and remediation work has already been completed on the Nuclear Licensed Site and ancillary reactor buildings, along with a number of other nuclear facilities used for handling radioactive materials, have been decommissioned and either demolished or converted to other uses. This programme of decommissioning and remediation is intended to continue until the remaining buildings have been decommissioned so that the land can be de-licensed and released for general use.

The intention is that by around the year 2020 the licensed site will consist of a storage area for radioactive waste and three small buildings containing the remains of the redundant reactors. These will be kept in a programme of care and maintenance pending decommissioning. Therefore the main focus of the current activities on site is to do with the cleaning out and safe storage of radioactive materials from the nuclear facilities pending their decommissioning and dismantling. Few of the facilities can now give rise to accident situations that result in a major offsite release of radioactive material and the chance that such a scenario will be realised will continue to reduce as the decommissioning programme continues. UKAEA need to carry out this decommissioning whilst maintaining its focus on the safe handling and storage of radioactive materials.

The main legislation governing the safety of nuclear installations in the UK is the Health and Safety at Work etc Act 1974 (HSWA 74) (reference 2) and the associated

relevant statutory provisions of the Nuclear Installations Act 1965 (as amended) (reference 3). Under the Nuclear Installations Act 1965 (as amended)[NIA 65], no site may be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence has been granted by the Health and Safety Executive (HSE). The HM Nuclear Installations Inspectorate (NII) is that part of the HSE that is responsible for administering this licensing function and enforcing NIA 65 and HSWA 74 on nuclear licensed sites.

UKAEA were originally excluded from the provisions of the NIA 65. However the law was changed and, having come within the provisions of the Act, HSE granted the UKAEA nuclear site licence number 44 in respect of its Harwell site in 1990.

NIA 65 provides HSE with powers to attach conditions to the licence, and the HSWA 74 provides the regulatory powers to enforce these conditions. One of the standard licence conditions (reference 4), number 15, requires that adequate arrangements are made and implemented by UKAEA for the periodic and systematic review and reassessment of safety cases.

3. Purpose of site-wide Periodic Safety Review (SWPSR)

As individual nuclear facilities mature, modifications are made and ageing effects take place. Some components may become obsolescent and plant operating instructions may be changed as a result of experience. During all this time the safety case for each nuclear facility must remain valid, and individual changes are required to be incorporated into the safety case as appropriate.

The PSR process for a site like Harwell is required to be carried out at two levels, normally at least once every ten years. Firstly at the facility level a PSR is designed to ensure that a thorough and comprehensive review is made of the whole plant safety case. For multi-plant sites such as Harwell it is not feasable to carry out the PSR for all plants at the same time, so a rolling programme for such reviews is used. These reviews complement the normal day-to-day operational monitoring of safety, which is further underpinned by thorough inspections and assessment of the condition of plants during normal maintenance and testing. Secondly at the site level a PSR is designed to ensure that site wide considerations, including Safety Management Systems and any interactions between facilities, are fully reviewed.

The objectives of facility level PSRs are:

1) Review the individual plant safety cases and confirm that they are adequate.

2) Compare against current standards for new plant, evaluate any differences and implement any reasonably practicable improvements to enhance plant safety.

3) Identify any ageing process that may limit the life of plant.

4) Revalidate the individual safety cases until the next PSR, subject to the outcome of routine monitoring by the licensee and regulation by NII.

NII expects the PSRs to confirm that the plant safety case will remain valid until the time of the next review, which is normally set at ten years. However, even when a

PSR may conclude that a facility safety justification is adequate for a further ten years, this will be dependent upon continuing satisfactory results from routine inspections and adequate maintenance. Should any safety related factor emerge in the interim period which may throw doubt on the continuing validity of the safety cases, NII would require the licensee to resolve the matter to NII's satisfaction.

In response to the requirements of Licence Condition 15, UKAEA Safety and Assurance Division, in conjunction with other UKAEA sites and operational divisions, has adopted a general policy that:

1) Each UKAEA licensed site will be the subject of a SWPSR once every ten years.

2) The overall programme of SWPSRs will be agreed with NII as will the detailed scope and arrangements for individual site PSR's.

3) Safety Cases for individual facilities and operations will continue to be subject to individual review. The results of the individual reviews will be included in the SWPSR as appropriate.

4) The SWPSR will highlight the need / provision of site wide justifications such as services, decommissioning and other strategies.

4. Submission of Harwell SWPSR

The Harwell SWPSR was submitted on time by UKAEA and represents the first in the programme of four such submissions that will include Windscale, Winfrith and Dounreay. It was presented as a suite of documents comprising a top-tier summary document and corrective action plan, supported by four 'support files' which detail: -

1) Facility and Services Descriptions

2) Operational Reviews

3) Summary of Facility Safety Cases

4) Safety Management Systems Reviews

The overall conclusion of the licensee's review was that there are no major shortfalls in safety that prevent continued operation of the site for the immediate future.

UKAEA made 46 recommendations itself as a result of the PSR review process. These were incorporated along with the NII assessment findings into an agreed forward improvement plan running over the next two years.

5. NII Assessment

A team of NII inspectors was formed including specialists in civil and structural engineering, fault studies, radiological waste and decommissioning, chemical process

technology, maintenance, human factors, mechanical engineering, radiological protection and criticality. The team then reviewed the document against NII guidance (reference 5), IAEA International Standards for PSR reviews (reference 6) and current good industry practice. A series of site visits was undertaken as part of the assessment.

Given the approach and format agreed for the submission, the objectives of the assessment were defined as follows:

1) To review the production of the Harwell SWPSR and determine if the approach and format represents a suitable procedure for undertaking site-wide periodic safety assessments of UKAEA sites in line with NII guidance (Reference 7).

2) To assess whether the scope and content of the SWPSR is suitable and sufficient to satisfy the requirements for Health and Safety review under licence condition 15 of the site licence.

3) To assess the adequacy of the identification of site-wide shortfalls against modern standards and associated improvement programmes in respect of those specialist areas and / or specific technical issues selected for assessment.

6. Summary of NII's Findings

6.1 Overview

NII is satisfied that the UKAEA has completed a review of safety at its Harwell nuclear site, at the site wide level, of suitable scope to satisfy the requirements under Site Licence condition 15. The assessment reached the following conclusions: -

1) The assessment, which included several site visits, did not identify any major shortfalls in the overall management of safety.

2) The overall strategy of decommissioning and remediation was appropriate for the site.

3) The shut down and progress in decommissioning of the nuclear reactors had considerably reduced the nuclear risks from the site.

4) The remaining nuclear risk is expected to reduce as the site decommissioning programme progresses.

The overall outcome of the licensee's review, together with the programmes of additional modifications and inspections that have been put in place, help to build confidence in the ability of UKAEA to continue to operate facilities on the Harwell site safely for the time being.

The NII assessment team has also identified the need for some further work. Subject to the satisfactory completion of this work, including the achievement of an acceptable forward rolling programme of facility level PSRs, and continuing satisfactory results from the routine monitoring and demonstrations of safety required under the nuclear site licensing arrangements, we are confident that the Harwell site can continue to operate safely at least until the end of 2013, at which time a further site wide PSR will be required.

Following this assessment UKAEA's and NII's intentions are to develop the SWPSR process and submission to provide an integrated system for management of the facility and site safety cases. This system should meet the objectives of providing sufficient flexibility to accommodate the changes that will occur on the Harwell Site whilst maintaining satisfactory and efficient compliance with regulatory requirements.

The NII assessment team's findings also included three groups of more specific findings. The first group relates to the production of facility safety cases and the SWPSR documentation style and presentation. The second group relates to the Safety Management System arrangements. The third relates to the physical plant and facilities.

NII's process for the assessment of PSRs provides for it to result in an agreed two year forward improvement programme. Therefore the recommendations from the UKAEA reviews and NII assessment have been integrated into a two year forward action programme in order to close out the SWPSR for Harwell.

6.2 Safety Cases

It was known and accepted that the programme for producing Nuclear Facility Modern Standards Safety Cases (MSSCs) was not complete at the time of the submission and would require substantial effort on the part of UKAEA to complete. It quickly became clear that this had affected the ability of the submission to meet its objectives, particularly in the justification of a further ten year period of operation. The main finding of the assessment was that it was necessary to establish a programme for the completion of the nuclear facilities safety cases and also to establish a rolling programme for safety case submissions that will form the basis of subsequent PSR review programmes.

The style and presentation of the Harwell SWPSR was necessarily at a high generic level with related information spread between the various volumes. As the programme of Modern Standard Safety Cases (MSSCs) was incomplete with a number of the significant nuclear facilities outstanding, many of the statements made in the submission could not be supported by a reasoned argument based on a critical analysis of available factual information and data against modern standards. Some statements were made which ended in references to other documents with no reference to factual recorded data or statistics. Therefore the assessment team found the SWPSR a complicated document that needed a lot of assessment effort and several site visits to verify.

The considered opinion of the assessment team was that, ideally, future SWPSR submissions should only be submitted once the programme of facility safety case production or periodic safety review had been completed.

During the assessment there were several discussions regarding the limitations of the SWPSR process and format. Consideration of the sheer number and magnitude of changes that are likely to occur on the site over the next ten years and the need for a flexible and efficient documentation system to cope with the changes led to the suggestion of the submission being developed into a ‘top tier’ site wide safety case. This would present the current scope and content of the SWPSR submission in a safety case format.

This was seen as having a number of benefits, which are: -

1) The Site Wide Safety Case allows the site wide interfaces between the individual nuclear facilities to be captured in a top tier safety case which allows greater flexibility of the Safety Case document system to respond to the decommissioning and demolishing of existing nuclear facilities.

2) Subsequent SWPSR submissions will be based on a safety case document that will lend itself more efficiently to the regulatory review process.

3) One common process can be used to perform individual facility and site wide safety case periodic safety reviews.

4) It will allow the information and recommendations from a number of different requirements such as Quinquennial Review of the strategy for decommissioning nuclear sites, Licence Condition 36 (reference 4) staffing baseline reviews, Lifecycle Baseline (LCBL) and Near Term Work Plan (NTWP) review, emergency response and site wide safety management issues to be gathered conveniently in one place.

No site wide ALARP study was included in the SWPSR to demonstrate that risks had been reduced to as low as reasonably practicable, and the calculations of site wide risk were not conclusive. The incomplete programme of individual facility MSSCs simply did not provide a consistent basis for the ALARP study nor a compatible suite of risk figures for the calculation of site risk. However, we have accepted that the radiological risk posed by the site with the reactors shutdown and in decommissioning was small. Therefore as part of the forward improvement plan and once the individual facility MSSCs are in place, UKAEA will complete a Site-Wide ALARP study and recalculate the overall site risk and include them in the Site Wide Safety Case document.

The facilities at Harwell are now of an age where the degradation of the concrete structures must be considered seriously. In particular High Alumina Cement (HAC), which has been used in several of the facilities roof panels, ages over time causing the quality and strength of the cement to degrade. Therefore the inspection and maintenance regime needs to take this ageing effect into account. The current safety justification for the HAC roof panels was found to be at the limit of its period of validity and in need of review. UKAEA agreed to develop and present a new safety justification for the next ten years or the lifetime of the facility if this is shorter.

6.3 Safety Management System

The arrangements for the organisation and training of staff, the production of site and facility operating procedures and the production of safety documentation such as safety cases is known generically as the 'Safety Management System' (SMS). It is important that these arrangements are kept under control and the safety documents up to date.

UKAEA have procedures for monitoring, review and audit of their daily operations, which is a legal requirement both under the Site Licence Conditions and general Health and Safety Legislation. Unfortunately the SWPSR document did not provide enough evidence to demonstrate that the monitoring review and audit arrangements applied by UKAEA were satisfactory. Therefore, UKAEA need to revisit their arrangements for monitoring, review and audit to verify that;

1) Sufficient factual data is being collected from the daily operations for UKAEA to be able to justify why its management of safety is considered satisfactory.

2) The recommendations arising from reviews and audits are properly closed out to an auditable standard.

3) Any trends in key safety performance indicators can be picked up and monitored.

4) Safety documentation and plant operating procedures are kept up to date and any changes to them are properly implemented.

The assessment team noted a number of specific instances with regard to the effectiveness of the relevant UKAEA interfaces with their specialist contractors. UKAEA have been working corporately on the issue of control of contractors since it featured in the findings of the Dounreay Audit in 1998 (reference 8), and many improvements have already been made. Considerable work has been expended in providing an Intelligent Customer base within UKAEA and appropriate in-house expertise in the control of contractors and project management. However the findings of the assessment team indicate that UKAEA still need to improve their control over contractor and subcontractor quality control and develop its Corporate and Site competency and safety management systems accordingly.

There were no details in the SWPSR document regarding arrangements for Human Factors, which is seen as a significant omission. However, UKAEA is already aware of this issue and is actively engaged in addressing the provision of Human Factors resource.

During the close out of the Dounreay Audit in 1998 UKAEA agreed to produce upgraded procedures for radiological protection and implement them across all of the UKAEA sites. The implementation plan for the revised radiological protection standards for Harwell was outstanding at the time of the assessment. This is an important area to be cleared to give confidence in the continued safe operation of the site. NII would expect to see these standards reflected in the MSSCs for the plants as they are produced. UKAEA need to develop and implement a programme to reformat

the radiological protection standards as corporate procedures and integrate them into the production of the MSSCs

The SWPSR submission was comprised from the results of a series of reviews across the site and facilities, which in the main, concentrated on their current situation and status. However it is also necessary for UKAEA to provide information about any threats to continued operation arising from aging effects in the current submission. Therefore, UKAEA are to produce a report summarising the individual facility reviews suitable for inclusion in the site wide safety case document regarding the likely effects of ageing on the Facilities and Operations.

The assessment of the process adopted by UKAEA for Engineering Substantiation (ES) found that ES adds significant value to the MSSCs and will be of benefit to the Site Wide Safety Case development. However, a number of topics within the process could be improved. UKAEA need to ensure that the facilities are compared against equipment that would be fitted in new build facilities to realise the full potential of the process rather than just comparing the existing equipment against Modern Standards. Additionally the collection, prioritisation and categorisation of shortfalls needs demonstrate how the ALARP process has been applied and how the role of Engineering Good Practice has been given suitable emphasis.

6.4 Facilities and Processes

UKAEA has developed a strategy for the site based on progressive decommissioning of the site's redundant nuclear facilities and demolishing redundant buildings. In order to achieve this objective Harwell have recognised that existing legacy waste on the site is not in suitable storage facilities nor packed sufficiently securely to be suitable for very long term storage.

Therefore arrangements have been developed to recover the stored waste and check its condition prior to repacking it in improved containers and placing in new storage facilities. Overall the proposals outlined represent a suitable overall strategy for the eventual achievement of site delicensing.

The NII assessors suggested that the existing arrangements could usefully be developed, particularly in the areas of non-intrusive and intrusive sampling of existing stored waste and early conditioning of Intermediate Level Waste (ILW). An apparent dependence of the Harwell Radiological Waste management strategy on the availability of a NIREX disposal facility, particularly for Contact Handleable ILW was noted.

There are a number of operations across the site requiring Radioactive Materials Transport. In general these are accomplished using old equipment that would not meet modern standards. Some decommissioning operations and transport operations will finish in a relatively short time whilst others will continue into the foreseeable future. Site wide arrangements for re-useable containers for radioactive materials were found to differ from those in use at facility level and it was considered that this could lead to inconsistencies in safety case and maintenance standards. UKAEA

Harwell has initiated a programme of improvement and/or replacement of RAM transport flasks and reviewing RAM transport operations. This work is being monitored as part of the site inspection activities as well as being an action on the Forward Improvement Programme.

7 Conclusions

The main conclusions of NII are that there are no major shortfalls in the overall management of safety at Harwell; the overall strategy of decommissioning and remediation is appropriate for the site; the shut down and progress in decommissioning of the nuclear reactors has considerably reduced the nuclear risks from the site; and the remaining nuclear risk is expected to reduce as the site decommissioning programme progresses.

With regard to operations on the site continuing for the period until the next review, NII considers that the outcome of the licensee's review, together with the forward improvement programme agreed in response to the detailed findings of the NII assessment, provide confidence in the ability of UKAEA to continue to operate facilities on the Harwell site safely until the time of the next review; with the proviso that there is satisfactory completion of the agreed programme, and continuing satisfactory results from the routine monitoring and demonstrations of safety required under the nuclear site licensing arrangements.

With regard to the suitability of the SWPSR review process and document format adopted for the submission the conclusions reached by NII were that the SWPSR submission was satisfactory in relation to its scope and content although, ideally, future SWPSR submissions should only be submitted once the programme of individual facility safety case production, or the cycle of the facility periodic safety reviews have been completed. Bearing in mind the sheer number and magnitude of changes that are likely to occur on the Harwell site over the next ten years as decommissioning proceeds, we concluded that a flexible and efficient documentation system to cope with the changes could be achieved by the development of a ‘top tier’ site wide safety case. This would present the current scope and content of the SWPSR submission in a safety case format.

The assessment of the process adopted by UKAEA for Engineering Substantiation (i.e. comparing the existing facilities against modern standards) found that the process adds significant value to the Modern Standards Safety Cases and will be of benefit to the Site Wide Safety Case development. However, a number of topics within the process could be improved, particularly with regard to the explicit identification of the potential effects and issues arising from ageing.

8 Detailed Findings

During its assessment of the Harwell SWPSR submission the NII has identified the need for further work to be done by UKAEA. Grouping similar findings and sorting into common headings resulted in 14 detailed findings in three related groups: -

Group 1: Safety Cases

8.1 UKAEA Harwell should complete the individual MSSCs for the significant nuclear facilities.

8.2 UKAEA corporately should develop the style and format of the Site Wide PSR submissions.

8.3 UKAEA Harwell should develop a site wide ALARP study and calculate the total site wide risk

8.4 UKAEA Harwell should develop and present a new safety justification for HAC roof panels.

8.5 UKAEA Harwell should produce a prioritised two year forward improvement programme for addressing the recommendations arising from the UKAEA review and the NII assessment

Group 2: Safety Management System

8.6 UKAEA corporately should confirm an intention to secure and maintain a suitable and sufficient in-house human factors resource and produce a strategy and programme for achieving this aim.

8.7 UKAEA Harwell should present an analysis of the adequacy and effectiveness of their monitoring, audit and review arrangements against modern standards and guidelines.

8.8 UKAEA corporately should ensure the inclusion of management of contractors in its development of a company-wide competency framework

8.9 UKAEA Harwell should develop and implement a programme for the radiological protection plan.

8.10 UKAEA Harwell should undertake a study of ageing to produce a report demonstrating the continued suitability of its facilities for continued operation until the next review or the commencement of decommissioning as appropriate.

8.11 UKAEA corporately should review the procedure for Engineering Substantiation to ensure it adequately addresses the issue of ageing.

Group 3 Facilities and Processes

8.12 UKAEA Harwell should develop and implement an integrated site wide strategy for dealing with Plutonium Contaminated Material and radioactive waste storage.

8.13 UKAEA Harwell should review the arrangements for the control of radiological waste and criticality across the site to ensure consistency and compli-

ance with modern standards.

8.14 UKAEA Harwell should review RAM transport operations across the site.

A two-year plan to address these detailed findings has been agreed by NII and UKAEA.

9 References

1. Harwell Site Wide Periodic Review, HW/PSR/V0/001,Issue 2 June 2003 and associated and supporting documentation.
2. Health and Safety At Work etc. Act 1974 HMSO ISBN 0 10 543774 3
3. Nuclear Installations Act (as amended) 1965 HMSO ISBN 0 10 850216 3.
4. The full text of each of the 36 standard licence conditions can be seen via http://www.hse.gov.uk/nsd/index.htm
5. Safety Assessment Principles for Nuclear Plants, HSE Books 1992 ISBN 011882043 5 (also available via via http://www.hse.gov.uk/nsd/index.htm)
6. Safety Guide “Periodic Safety Review of Nuclear Power Plants” Safety Standards Series No. NS-G-2.10, IAEA September 2003
7. NII Guidance TAG T/AST/050 Technical Assessment Guide Periodic Safety Reviews (PSR’s) available via http://www.hse.gov.uk/nsd/index.htm
8. SAFETY AUDIT OF DOUNREAY 1998: Findings of the HSE/SEPA team audit of health and safety at Dounreay in 1998. HSE Books (also available via via http://www.hse.gov.uk/nsd/index.htm)