

HEALTH AND SAFETY EXECUTIVE - NUCLEAR DIRECTORATE

HM NUCLEAR INSTALLATIONS INSPECTORATE

DUNGENESS B PERIODIC SAFETY REVIEW

PROJECT OVERVIEW REPORT OF NII FINDINGS AND DECISION ON CONTINUED OPERATION

Summary

- 1 The Health and Safety Executive's (HSE) Nuclear Installations Inspectorate (NII) has completed its independent assessment of the second Periodic Safety Review (PSR) for the Dungeness B nuclear power station. The main conclusion is that the PSR, as submitted, whilst demonstrating an improvement in comparison with the previous Hinkley Point B/Hunterston B PSR submission, has a number of shortfalls both in the quality and scope of information that is required by the UK regulatory system. Nevertheless, after careful consideration NII has concluded that the issues arising from its PSR assessment are not immediate concerns for nuclear safety and that it is appropriate that normal station operation should continue whilst a remedial programme of work is progressed. The conclusions from NII's assessment have been described and communicated to British Energy Generation Ltd. (BE), the licensee, via a Decision Letter to the relevant Station Director.
- 2 This Project Overview Report gives some background to the regulatory decision. It explains the list of NII findings requiring substantive work from the licensee and puts it into context with other ongoing work at the station.

Background

- 3 Continuous day to day monitoring and inspection are important aspects for ensuring safe operation of nuclear installations. However international best practice recognises an additional review is also necessary that periodically considers the safety of the whole installation against modern safety standards and requirements. Within the UK, PSRs conducted by the nuclear site licensees meet this requirement and the periodicity is normally ten years.
- 4 The PSR aims to:
 - i) confirm that the plant is adequately safe for continued operation;
 - ii) identify and evaluate any factors which might limit the safe operation of the plant in the foreseeable future; and
 - iii) assess the plants' safety standards and practices and introduce any improvements which are reasonably practicable.
- 5 The first two aims are fulfilled by a re-examination of the safety case for the plant to confirm that it is still valid and will remain so up to the next review. As part of this

examination, any life limiting features are identified and their safe remaining lives are conservatively predicted (particularly where they may ultimately dictate the safe working life of the station).

- 6 The third aim is achieved by a comparison with current standards and re-analysis using up to date methodologies where appropriate.
- 7 NII's task is to ensure that the licensee carries out a comprehensive PSR and that the appropriate corrective actions and/or safety improvements are implemented within a reasonably practicable timescale. Although NII may conclude that the PSR provides an adequate basis for managing nuclear safety for a further ten years, continued operation will depend upon satisfactory results from further in-service and periodic inspections over that period.
- 8 Thus PSRs provide confidence in, but are not the sole means of ensuring, continued safe operation. Should any safety-related factors emerge subsequently that may raise questions on the continuing validity of the safety case, NII would require the licensee to resolve the issue. If the NII is not satisfied with the licensee's response, it has extensive powers under the licence to require any necessary changes, and can direct that the plant be shut down until it is satisfied that it can be operated safely. This process gives confidence that relevant safety issues will be identified and resolved as plants age.
- 9 The requirement on the licensee to conduct periodic reviews is derived from Licence Condition 15 (LC 15), which is attached to all nuclear site licences. The licensee's arrangements for complying with LC 15 include processes for undertaking both major (10 year) and minor (periodic maintenance outage) periodic reviews, and the checking and approvals processes to be used prior to issue to NII. BE's arrangements include a forward programme of PSR submissions. Under these arrangements, Dungeness B was due to submit a PSR at the end of 2006 for NII assessment against a planned Decision Date of January 2008.

BE's submission of PSR for Dungeness B

- 10 BE submitted the PSR at the end of March 2007, three months later than originally planned. In each case 40 review documents were provided (although one of these covering hazards, actually also included a further 18 lower tier documents). A list of reports is provided as Table 1.
- 11 The PSR documentation is hierarchical. There are four "top tier" summary documents. These are:
 - Chapter 1 - Adequacy of Nuclear Safety Case Statement
 - Chapter 2 - Operations and Safety Performance
 - Chapter 3 - Systems, Structures and Components
 - Chapter 4 - Safety Analysis

Chapter 1 has no specific supporting references because it is an overview document which provides a summary of the adequacy of the nuclear safety case. In effect, all the rest of the main review reports are supporting reports to Chapter 1. The remaining submissions support the top tier documents, so that there are four supporting reports to Chapter 2, covering different aspects of operations and safety performance, twenty-four supporting references to Chapter 3 giving information on Systems, Structures and Components, their engineering justification, operational performance and condition, and eight supporting reports to Chapter 4 describing different aspects of safety analysis, including fault studies, radiological consequences, hazards, worker risks and the probabilistic risk assessment.

- 12 Providing a report of the size and scope delivered was a considerable undertaking. BE reported to their nuclear safety committee that the project had taken in excess of four years (commencement to submission of main review reports), and that the resource in preparing the review had been in excess of 33 man years. This amount of effort is broadly in keeping with international expectations for periodic reviews.
- 13 The outcomes from the BE review included a number of shortfalls and improvement points. These were summarised in Chapter 1 of the PSR for the station. The work elements to rectify the shortfalls or implement the improvement points are called PSR Identified Corrective Actions (PICAs) by the licensee. These were classified as follows:
- Type A: A nuclear safety shortfall which requires further work.
 - Type B: A minor nuclear safety shortfall/potential safety enhancement which requires further work.
 - Type C: A shortfall previously identified and progressing under an existing work programme.
- 14 Dungeness B identified several hundred PICAs, and the majority were sentenced as “low safety significance”. The station however identified a substantial programme of 101 PICAs which were sentenced by BE as having safety significance (i.e. 1 Type A and 100 Type B PICAs).
- 15 BE concluded that:

*The outcome of this second PSR differs markedly from PSR1 in terms of the nature of the shortfalls identified. PSR1 identified a significant number of issues that resulted in major programmes of plant modifications. This has not been the case for PSR2 where the majority of shortfalls are not related to plant modifications. As well as this the safety significance of the shortfalls identified has been much lower...
... The conclusions that follow are conditional on the resolution of the shortfalls identified:*

- *One Type ‘A’ has been identified relating to water hammer in the carbon steel system. The safety position has been made secure. Further improvements are being reviewed..*
- *Overall the findings of PSR have confirmed that Dungeness B adequately meets current safety standards. Only a small (~15%) proportion of the shortfalls relate to standards issues, and the vast bulk of these relate to the completion of assessment work. None are categorised as Type A.*
- *A review of Ageing has been conducted and a small number of Type B shortfalls have been identified. Furthermore there is the ongoing need to update integrity assessments at the appropriate time to maintain the safety case to 2017. These assessments will be managed via the above ageing management processes.*
- *PSR2 recognises that operation of the graphite core is the major issue to be managed over the PSR2 period and that this will be achieved via interim reviews.*
- *The overall safety case has been reviewed against the Nuclear Safety Principles and the risks shown to be ALARP.*

Overall, the findings of the PSR have confirmed that Dungeness B adequately meets current safety standards. A review of the safety case and safety management systems for Dungeness B has been conducted. It is concluded that, subject to resolution of the shortfalls and the continuing programme of test and inspection that underpins the normal

operation of the station, adequate systems and processes are in place to maintain the case for safe operation of Dungeness B for this Periodic Safety Review period to December 2017.

- 16 BE's arrangements require that they make progress on implementing their findings whilst NII are assessing the periodic review. The expectation within their arrangements is that all safety significant PICAs should normally be programmed to be completed by the NII Decision Date. Exceptions to this are allowed for long-lead items, and of items requiring implementation at a reactor shutdown, etc., when a safety justification must be produced for any delays past the Decision Date. BE made insufficient resource and funding available to complete this implementation programme on schedule, but the majority of PICAs of high/medium safety significance were completed prior to the NII Decision Date.
- 17 BE have maintained a Project Team to manage and monitor the PICA implementation phase. There are team members both at station and at BE's corporate HQ, since PSR activities have taken place at both locations. This team has provided support at station during NII station visits on PSR-related issues. Station visits have shown that Dungeness B has taken "ownership" of its own periodic review and of the resulting work programme.

NII assessment of Dungeness B PSR

- 18 NII nuclear inspectors carried out a detailed assessment of the PSR submission documentation. Up to eighteen inspectors were used, each covering their area of expertise. Assessment reports or notes were produced covering Graphite, Internal Hazards, Fault Studies/Fuel Fault Studies, Chemistry, Radioactive Waste Management, Civil Engineering, Externals Hazards, Mechanical Engineering or key systems, structures and components, Oxidation, Structural Integrity of systems, structures and components, Control and Instrumentation, Electrical, Probabilistic Safety Analysis (PSA), and Human Factors. In the areas of PSA and Human Factors NII's expertise was supplemented by an external consultant under contract.
- 19 Many of the inspectors visited the station to inspect plant and better understand the PSR submissions and programme of work. In order to progress their findings, inspectors also requested identified references from the main review submissions. In response, BE provided many of these second tier reports, and the volume of material provided was in excess of the PSR submission itself.
- 20 During the assessment NII decided to maintain the decision date on the Periodic Safety Review as the 31st January 2008 despite BE's delay in submitting the Main Review, a delay of some 3 months.
- 21 In assessing the PSR, the nuclear inspectors followed NII guidance. This included NII's Technical Assessment Guide "Periodic Safety Reviews (PSRs)" (T/AST/050, available on NII's website). They also used other NII technical guidance, as appropriate and in particular NII's Safety Assessment Principles (SAPs) as the basic standard against which to judge the acceptability of the safety review (also available via NII's website).
- 22 NII's SAPs include some key messages on the Regulatory Background; the principles of So Far as Is Reasonably Practicable (SFAIRP), As Low As Reasonably Practicable (ALARP) and As Low As Reasonably Achievable (ALARA), Proportionality and the relevance to facilities built to earlier standards. In the case of the latter, NII recognises that:

...The extent to which the principles have been satisfied must also take into account the age of the facility or plant. For facilities that were designed and constructed to standards that are different from current standards the issue of whether sufficient measures are available to satisfy ALARP considerations will be judged case by case.

Summary of findings from NII specialist assessment

- 23 Following submission of the PSR documentation in March 2007, NII asked BE to revisit the findings raised by NII on the assessment of the Hinkley Point B/Hunterston B PSR2, reported at that time, in order to identify findings that were also applicable to Dungeness B and would require a work programme to deliver. These were to form part of the overall work programme identified by the assessment of the PSR.
- 24 Whilst demonstrating an improvement in comparison with the previous Hinkley Point B/Hunterston B PSR submission, NII viewed the submission as having a number of shortfalls both in the quality and scope of information that is required by the UK regulatory system. Although the PSR2 submissions provided good information on the operating experience of the plant and its reliability, there were some areas where the inspectors were not convinced that BE's review had been carried out to the required depth.
- 25 NII inspectors in most cases tried to resolve these differences with BE. Some initial findings were indeed agreed to be misunderstandings or miscommunications, and these were closed out after exchange of information, or further clarification by BE. Other NII findings had already been identified by BE and were already on the programme of work (PICA programme). However there remained a significant number of areas which in NII's view required additional work by BE.
- 26 At the end of the assessment phase of the PSR, NII drew up an Action Plan. This constituted those findings for which resolution could only be achieved by BE undertaking a programme of work. The Action Plan for Dungeness B is appended to this Project Overview Report, along with a commentary on why NII have raised the issue for resolution.
- 27 Key items on the Action Plan were identified to BE within the Decision Letter: these are listed below:
- BE has not provided a fully traceable review of seismic structural integrity for many of the structural components.
 - BE has not provided, within the PSR, an adequate review of the core restraint system using current methods and dosimetry models.
 - BE has not demonstrated in the PSR that their preventative maintenance regime, specifically with respect to C&I, fully addresses the need to prevent maintenance induced errors.
 - The approach to reliability data analysis in the PSA submitted within the PSR is not consistent with modern practices.

Summary of NII project-level considerations

- 28 As well as the specific findings by NII's nuclear inspectors, there were a number of project-level considerations that fed into the regulatory decision. Some of these were derived from taking an overview across the specialist comments. Other considerations

came by examining BE's PICA programme, their own findings and the progress during the year, others from relating PSR to other current programmes of work.

29 It became apparent that many assessment comments arose from mismatches between NII expectations and the PSR as submitted. NII had made its Safety Assessment Principles and supporting Technical Guidance available, and in addition had commented on a scope document produced by BE at the commencement of the Dungeness B PSR2 project. Notwithstanding all of this, certain themes run across the findings from more than one inspector. These include:

- Some of the reviews against modern standards remain to be completed, including in the area of C&I. Although this was identified as part of the assessment of the Hunterston B/Hinkley Point B PSR assessment, it is also fully applicable to the Dungeness B PSR. NII expected the PSR to be a more effective strategic look-forward in areas of plant ageing and future integrity cases. This comment particularly applies to integrity cases for steel structures. This is not a direct safety issue, since the periodic review does provide confidence that integrity of the reactors can be accurately predicted beyond the current date of extant integrity and safety cases. BE's intention is to provide integrity and safety cases before they expire, which is re-iterated within the work programme.
- The PSR reviews of plant obsolescence have not been integrated into the periodic review. There are two sides to this; there may be future threats to the safety case from plant obsolescence, but also there are the opportunities for ALARP improvements to be introduced when plant is re-engineered as part of planned replacement.

30 During the NII examination of the PICA programme and other current programmes of work other themes emerged:

- The integration between the periodic review and other programmes of work was less than NII expected. As an example the PSR did not fully account for some major work programmes currently ongoing. Some of these were identified within the PSR (Type C PICAs) as significant issues, to whose resolution BE were already committed, however not all these work programmes were completed to PSR programme dates. This means that the PSRs may not, in all instances, incorporated these improvements within their ALARP cases, as the improvements may not be realised in a sufficiently timely manner, may not be given the priority that they require and may not receive the resources that they demand.
- NII also has concerns over the progress that British Energy (BE) has made so far in closing out their PICA work programme. At the Decision Date 19 (out of 101) PICAs of high/medium safety significance remain to be completed. BE's own arrangements would normally expect almost all of these PICAs to be completed. NII's expectation within their Technical Guidance is also for a higher "success ratio" in closing out work programmes by this stage in a periodic review. NII would also expect a significant proportion of the PICAs of low safety significance to be closed out. For each PICA of

high/medium safety significance Dungeness B submitted an extension justification form which was assessed by the relevant NII technical assessor as to the significance of the delay and the acceptability of the justification. Although from an ALARP view the justifications in each case were found to be acceptable, NII will monitor the progress of all PICAs against the committed dates for completion by Dungeness B.

- 31 At a project level it was also possible to identify positive aspects of BE's periodic review projects for Dungeness B including:
- Many of the main review submissions give good information on the operating experience of the plant and its reliability.
 - BE's review process using their in-house Safety and Regulation Division has identified a number of issues with the PSR main reviews prior to submission to NII. These include many of the issues that otherwise would be NII findings. This shows evidence of effective in-house challenge and review.
 - BE's central PSR project team (part of Design Authority) had identified many issues for improvement with the PSR prior to submission to NII, including a review of those findings from the recent Hinkley Point B/Hunterston B to determine applicability to Dungeness B. This shows evidence of awareness of expected quality standards from the central team responsible for overall PSR quality.
 - BE has responded positively to the NII findings by developing a programme of work to address both their shortfalls and improvements, the findings identified through NII's assessment and by assessing the applicability of findings identified during the NII assessment of the Hinkley Point B/Hunterston B PSR2 and subsequently developing a programme of project work to address those applicable to Dungeness B. BE has committed to fund these and provide sufficient resource to discharge the programme of work in a timely manner.
 - BE has also proposed a process by which NII can monitor progress on the PSR work programmes during the next few years.
- 32 At a project level, it was also possible to discern positive experiences from interactions with station staff:
- Dungeness B station has been visited by a number of assessors during the project. NII staff has been given good support from station staff (including station PSR team) to allow them to carry out their assessment.
 - Dungeness B has shown good awareness of the PSR issues and ownership of their periodic review, both at inspection visits to station and also in participation in progress meetings and project meetings with NII.

Consolidated work programme

- 33 NII is aware that the majority of the findings from inspectors are "review issues" relating to the completeness of the periodic safety review against NII expectations. It is not clear until these review aspects have been completed whether safety improvements to plant or to operation practices are justified. This is not to downplay the importance of the findings, but to explain that these issues differ from "safety shortfalls", where the benefits of change are immediately clear. NII are very keen that these issues are worked through to completion, but the failure to complete them by the time of submission of the PSR is not

viewed as an immediate concern for nuclear safety, and thus it can be acceptable for station operation to continue whilst these reviews are carried out.

- 34 NII is also aware that insistence on priority being given to some issues can affect delivery of other issues, and that this may be detrimental overall to safety. NII therefore has chosen to challenge BE to develop work programmes for Dungeness B in which NII's Action Plan is addressed in a timely manner, but without adversely affecting the delivery of other safety improvements.
- 35 The resulting "consolidated work programme" therefore reflects BE's views on a practicable work programme to address both their own shortfalls and improvements and also the findings within NII's Action Plans. NII have accepted BE's assurance that this programme can be carried out without adverse effects on other safety-related work.
- 36 NII's Decision on the Dungeness B PSR is based upon acceptance of this consolidated work programme but also on holding BE to the delivery of these commitments. BE was therefore asked to develop a process by which they would monitor the progress on the consolidated work programme and report this to NII. BE has proposed such a process. NII judges that this process is capable of generating the information that NII requires.
- 37 On the basis of all the issues summarised in this Project Overview Report, NII has decided that the shortfalls do not warrant formal enforcement action at present, but that BE's performance in discharging the work programme will be closely monitored, and any slippage will be reviewed against options for further enforcement actions.

Conclusions – the Decision as expressed to the licensee

- 38 The bases for NII's decision, as outlined in the Decision Letter, were as follows:
- NII clearly said that the current submissions, whilst demonstrating an improvement in comparison with the previous Hinkley Point B/Hunterston B PSR submissions, was viewed as having a number of significant shortfalls both in the quality and the scope of information that is required by the UK regulatory system.
 - Despite this, NII concluded that the issues arising from its PSR assessment are not immediate concerns for nuclear safety and that it is appropriate that normal station operation should continue whilst a remedial programme of work is progressed.
 - An Action Plan has been agreed with the station covering the major NII findings.
 - BE have responded with a comprehensive programme of work which covers the items on the Action Plan, a programme of work specific to Dungeness B arising from the findings raised from NII's assessment of the Hinkley Point B/Hunterston B PSR2 that have been determined to be applicable to Dungeness B and also work to complete BE's own shortfalls and improvements as identified in the PSR (PICAs A, B and Significant C types).
 - BE have developed a process by which NII can monitor progress on the PSR work programmes during the next few years.
 - NII's view is that the current periodic review will not be complete and adequate until the end of this work programme.

- NII's decision is to accept the work programme as a baseline against which progress will be monitored. Any significant slippage on any aspect of the work will be reviewed against options for future enforcement action.

Table 1: Reports making up the PSR2 submissions for Dungeness B Power Stations

ID	Title
Chapter 1	Chapter 1 - Adequacy of Nuclear Safety Case Statement
Chapter 2	Chapter 2 - Operations and Safety Performance
Chapter 3	Chapter 3 - Systems, Structures and Components
Chapter 4	Chapter 4 - Safety Analysis
R2.01	R2.01 - Review of Operations
R2.02	R2.02 - Safety Management Systems
R2.03	R2.03 - Radiological Protection and Monitoring
R2.04	R2.04 - Emergency Planning Arrangements
R3.01	R3.01 - Fuel Handling
R3.02	R3.02 - Core System
R3.03	R3.03 - Control Rod Assemblies
R3.04	R3.04 - Secondary Shutdown Systems
R3.05	R3.05 - Gas Baffle
R3.06	R3.06 - Core Support
R3.07	R3.07 - Core Restraint
R3.08	R3.08 - Guide Tubes
R3.09	R3.09 – Boilers
R3.10	R3.10 - Gas Circulators
R3.11	R3.11 - Prestressed Concrete Pressure Vessels (PCPV)
R3.12	R3.12 - PCPV Liner and Penetrations
R3.13	R3.13 - Pressure Vessel Thermal Shield
R3.14	R3.14 - Primary Coolant System
R3.15	R3.15 - Secondary Coolant System
R3.16	R3.16 - Main Cooling Water and Auxiliary Systems
R3.17	R3.17 - Reactor Safety Circuits
R3.18	R3.18 - Control and Instrumentation
R3.19	R3.19 - Radioactive Waste Handling
R3.20	R3.20 - Steam Pipework
R3.21	R3.21 - Electrical Supplies
R3.22	R3.22 - Heating and Ventilation Systems
R3.23	R3.23 - Reactor Shutdown Sequence Equipment (PTIS)
R3.24	R3.24 - Civil Works

Table 1: (continued)
Reports making up the PSR2 submissions

ID	Title
R4.01	R4.01 - Fault Based Safety Assessment
R4.02	R4.02 - Transient Analysis
R4.03	R4.03 - Radiological Consequences
R4.04	R4.04 - Shutdown Safety Case
R4.05	R4.05 - Internal and External Hazards
R4.05 Appendix 1	R4.05 - Internal and External Hazards, Appendix 1 - Fire
R4.05 Appendix 2	R4.05 - Internal and External Hazards, Appendix 2 - Steam Release
R4.05 Appendix 3	R4.05 - Internal and External Hazards, Appendix 3 - Hot Gas Release
R4.05 Appendix 4	R4.05 - Internal and External Hazards, Appendix 4 - Cold Gas Release
R4.05 Appendix 5	R4.05 - Internal and External Hazards, Appendix 5 - Missile Impact
R4.05 Appendix 6	R4.05 - Internal and External Hazards, Appendix 6 - Dropped Loads and Lifting Equipment
R4.05 Appendix 7	R4.05 - Internal and External Hazards, Appendix 7 - Internal Flooding and Corrosive Fluid Release
R4.05 Appendix 8	R4.05 - Internal and External Hazards, Appendix 8 - Internal Toxic Gas Cloud
R4.05 Appendix 9	R4.05 - Internal and External Hazards, Appendix 9 - Vehicular Impact
R4.05 Appendix 10	R4.05 - Internal and External Hazards, Appendix 10 - Seismic
R4.05 Appendix 11	R4.05 - Internal and External Hazards, Appendix 11 - Wind Loading
R4.05 Appendix 12	R4.05 - Internal and External Hazards, Appendix 12 - External Flooding
R4.05 Appendix 13	R4.05 - Internal and External Hazards, Appendix 13 - Aircraft Impact Hazard
R4.05 Appendix 14	R4.05 - Internal and External Hazards, Appendix 14 - Industrial Hazards
R4.05 Appendix 15	R4.05 - Internal and External Hazards, Appendix 15 - Extreme Ambient Temperatures
R4.05 Appendix 16	R4.05 - Internal and External Hazards, Appendix 16 - Electro-Magnetic Interference (EMI)
R4.05 Appendix 17	R4.05 - Internal and External Hazards, Appendix 17 - Lightning Appendix
R4.05 Appendix 18	R4.05 - Internal and External Hazards, Appendix 18 - Drought and Biological Fouling
R4.06	R4.06 - Probabilistic Safety Assessment
R4.07	R4.07 – SBERGs [<i>Symptom Based Emergency Response Guidelines</i>]
R4.08	R4.08 - Worker Risk from Faults

Table 2: Dungeness B Projects*(Arising from NII Findings of assessment of Hinkley Point B and Hunterston B PSR2 and determined applicable at Dungeness B)*

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB.01	Provide revised ALARP statements.	HSE and NII have published recent guidance on reducing risks and demonstrating that risks have been reduced As Low As Reasonably Practicable. It was expected that the PSR would have included a statement that this is the case for the stations, and also a discussion of how ALARP has been applied in decisions on PSR corrective actions. There is limited discussion within Chapter 1 of the PSR Main Review, mainly restricted to a discussion of the quantitative risk results and the deterministic criteria of the Licensee's NSPs (Nuclear Safety Principles). This top-level statement falls short of the scope of ALARP as discussed in the published HSE and NSD guidance, as well as being poor in terms of the global assessment described in the IAEA standard.
DNB.02	Review potential interactions of services in trenches.	The assessor thought that the PSR should have extended the hazard identification process to consider interaction between services in trenches.
DNB.03	BE to confirm that adequate corrosion allowances are present in the component life assessments.	Self explanatory - the assessor thought the PSR required to be supplemented in this area.
DNB.04	Complete an adequate review of C&I against modern standards.	The PSR did not carry out a comprehensive review of C&I. against modern standards.
DNB.05	Carry out an independent audit of documentary evidence of C&I plant walkdowns, against the requirements of the licensee's formal guidance (internal guidance memo). If no documentary evidence exists, plant walkdowns should be carried out in compliance with licensee's formal guidance.	The assessor wishes additional analysis and review in this area, since walk downs are one of the means by which BE confirm the state of plant and the adequacy of hazard identification.
DNB.06	Carry out a review of hazard and interlocks schedule, establish safety function of fuel handling equipment, and company, national and international standards applicable. It should then carry out a comparison against the modern standards, including the Refuelling Safety Case Manual (RSCM), identify any shortfalls and put in place a programme to address the shortfalls.	The assessor expected a thorough review of fuel route C&I, and the PSR did not deliver this. NII requires a work programme to address this.

Table 2 (continued): Dungeness B Projects

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB.07	Provide a programme to address the shortcomings of the Seismic Safety Case, including analysis that the Seismic Risk is ALARP.	Technical details: the assessors thought that the PSR as submitted should be extended in its coverage of seismic faults. BE is to provide a work programme to address this.
DNB.08	Provide the timescales for issuing the irradiation dose recommendations for reactor internal structural components and for reviewing the implications.	The assessor wished to see this work programme formally identified from PSR and progressed to early completion.
DNB.09	Revised Radwaste Safety case to be issued.	BE have been reviewing and revising their radwaste safety case over a period of years. A revised version has been under discussion for some time. This Action Plan item was raised to ensure its prioritisation.
DNB.10	Commit to the programme for provision of the Visible Safety Case.	BE are currently performing an improvement programme for the AGR safety cases (the Visible Safety Case programme). When it was started the intention was for this to be complete prior to the PSR. Unfortunately there has been slippage, so that the PSR has not benefited from these improvements.
DNB.11	Provide a more robust demonstration that complete collapse of CW intake tunnels is not credible	Self explanatory – the assessor thought the PSR required to be supplemented in this area.
DNB.12	Demonstrate that the seismic structural integrity cases for the steel reactor internal components remain secure for operation to 2016.	BE already have plans for carrying out additional integrity/safety cases, but assessor wished these formally identified from PSR and progressed to early completion.
DNB.13	Develop an adequate EMI/RFI safety case.	The station currently controls EMI/RF (Electromagnetic Interference/Radio Frequency) by the exclusion of potentially interfering equipment from the site. The assessor was of the view that a more comprehensive safety case would be beneficial.
DNB.14	Review the technical basis of the SAGs and check the continuing availability of the relevant information and training at the stations.	In the 1990s, the licensee developed severe accident guidelines (SAGs) for the AGRs. These gave technical data and possible remedial actions for unforeseen circumstances, and addressed degraded core states and possible actions to mitigate off-site releases. NII's assessor was of the view that the PSR2 should have reviewed the basis of the SAGs.

Table 2 (continued): Dungeness B Projects

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB.15	Review access control points and emergency control centres during or after external events, and operators' actions following the events, to provide confirmation that access routes / equipment are viable.	The assessor thought that the information on hazard withstand capability and emergency arrangements should be reviewed side-by-side to confirm compatibility.
DNB.16	Develop a C&I ageing management strategy for addressing ageing and obsolescence (equipment/ expertise).	The assessor wishes a comprehensive management strategy. Being proactive rather than reactive brings many benefits. BE are proactive to an extent, but a review may show further improvements.
DNB.17	Complete the analysis of the effects of charge machine chilling during pressurisation & demonstrate that the charge machine IOF pressure boundary components are capable of withstanding the operational load conditions.	Technical detail: the assessor wishes additional analysis and review in this area.
DNB.18	Radiological consequences assessment :BE proposes to conduct a review of the current applicability of the assessment methods and data	IAEA Safety Standards series No.NS-G-1.2 "Safety Assessment and Verification for Nuclear Power Plants Safety Guide" provides recommendations to the designers of nuclear power plants for a comprehensive safety assessment in the initial design process and for modifications to the design, as well as recommendations to operating organizations for independent verification of the safety assessment for new nuclear power plants. It is the view of the NII assessor that, although BE have carried out a review of their fault studies, they would benefit from also considering the requirements of this international standard.
DNB.19	BE will perform a structural integrity assessment of the reactor internals and gas pressure boundary in response to appropriate reactivity fault transients and report in an EAN	Self explanatory - the assessor thought the PSR required to be supplemented in this area.

Table 3: Dungeness B Action Plan

(Arising from NII Findings of assessment of Hinkley Point B and Hunterston B PSR2 and determined applicable at Dungeness B)

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB/3.00/03	BEGL shall show where the seismic structural integrity safety case resides for all affected components and how this has been reviewed, or else propose how a review will be undertaken. (Conduct a review of the adequacy of the FE models used to derive the seismic loads on components)	For most of the Chapter 3 Main Reviews, the coverage of the seismic hazard is poor. Seismic loading is a fault loading for many components where structural integrity is relevant. However most of the Chapter 3 Main Reviews simply state that seismic matters are dealt with in the relevant part of Chapter 4. An overview check of the relevant parts of Chapter 4 of the DNB PSR2, has not found a clear description of where to find the seismic structural integrity safety cases, or any review of them.
DNB/3.03/08	BEGL shall carry out a review of the DNB control rod data analysis methods and their adequacy for detecting changes in performance such as recently found at Torness.	Following an initial query, a lengthy response indicated that the station has a fairly elaborate procedure for analysing the control rod drop data. It attributes the large variability in results to the variations in reactor conditions at the time of trip as well as differences in set up during maintenance and the need to extrapolate the performance for rods which are part-inserted at the time of trip. While this response provides some re-assurance that the station looks fairly closely at the drop time data, it remains far from clear whether the method is capable of picking up early adverse trends as was recently done at Torness
DNB/3.07/15	BEGL shall update the main review for the core restraint system to confirm integrity under normal operation and fault conditions using the latest neutron irradiation doses and dose damage relationship.	The main review for the core restraint does not use current neutron irradiation doses and dose damage relationship, and should be updated to take account of these.
DNB/3.07/16	BEGL shall confirm the integrity of other components which may be affected by the latest irradiation data as satisfactory.	The current irradiation data has also not been used to underwrite the integrity of other components that may be degraded.

Table 3 (continued): Dungeness B Action Plan

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB/3.07/17	<p>BEGl shall undertake a revised analysis of the core restraint system taking account of current methods and models to establish revised validated predictions of neutron dose and core restraint integrity. Upon completion to review implications for the graphite core safety case in particular to examine graphite core / core restraint interaction to demonstrate the continued adequacy of the graphite core safety case, and core restraint system, with cracked moderator bricks for normal operation, transients and faults.</p>	<p>Main review 3.07 presents the review for the core restraint system and reports “that the core restraint assessments supporting this submission are based on irradiation doses equivalent to 15fpyo (i.e. up to 31/03/2008). Therefore, the safety case does not underwrite the seismic capability of the core restraint system beyond this dose.” This is the subject of a PICA shortfall. British Energy argue “Because both the yield stress and UTS of the Warwick links rise with increasing irradiation, it is considered that margins against code allowables will be bounded by the start-of-life margins. Therefore operation beyond 15 fpyo does not threaten the seismic capability of the core restraint system. Furthermore, because there is considerable redundancy in the structure, even if the core restraint system were to lose a substantial proportion of its structural capacity, the system would be more than capable of fulfilling its safety role.”</p> <p>A recent IJFCO reported that neutron “doses for the restraint structure within the graphite may have been underestimated in a similar manner to HPB/HNB, but to a much lesser extent (maximum effective dose increase 52%). The majority of components are Cr-Mo steel, and there are no welds within the core.”</p> <p>BE also report “Based on upper bound shifts, it was predicted that the restraint cylinder would be operating off the upper shelf after about 26 years based on the accepted dose or about 25 years if account was taken of the potential 7% dose increase.” “... based on best estimate predictions, the core restraint would remain on the upper shelf at 35 years. It is therefore considered that the core restraint system would exhibit adequate toughness to withstand a seismic event throughout the period of this review.”</p>

Table 3 (continued): Dungeness B Action Plan

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB/3.09/18	BE shall examine the ability of the remote visual in-service inspections of the hanger rod bottom nuts and if appropriate develop a programme to deliver such inspections	<p>The Dungeness B boiler support system depends of its bottom support frame and a system of hanger rods which attach to fittings embedded in the concrete of the PCPV top cap. All these support system components were designed on the basis of redundancy. That is they are tolerant to partial failure e.g. one hanger failing would lead to adjacent hangers carrying the redistributed load.</p> <p>The concern regarding the boiler support system is the limited scope for in-service inspection of the bottom frame and the hanger rods themselves. The hanger rods are hidden by the cooling shrouds around their full height (except for a small gap at the top). The bottom frame is hidden by a combination of the boiler itself (above) and the circulator duct (below). The Boiler Movement Transducer (BMT) system is no longer relied on. The BMT could have given some indication of structural degradation in the boiler support system.</p> <p>It is worth examining in detail the ability of the remote visual in-service inspections of the hanger rod bottom nuts to detect if there is a gap between the nut / washer and the lower surface of the bottom frame.</p>

Table 3 (continued): Dungeness B Action Plan

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB/3.17/28	<p>BEGL shall develop and agree with NII a forward improvement programme to ensure that:</p> <ul style="list-style-type: none"> • maintenance activities applied to reactor safety circuits and, as necessary, other C&I safety systems are adequately specified so as to prevent, so far as is practicable, maintenance induced errors; and • a competence management framework is established to demonstrate that maintenance personnel required to work on reactor safety circuits and other C&I safety systems are suitable qualified and experienced for their own work activities, roles and responsibilities. This framework should be based upon the good practice described in modern C&I standards, such as BS EN/IEC 615081, and guidance provided in HSE documents entitled “Managing competence for safety-related systems, Part 1: Key guidance and Part 2: Supplementary material”. 	<p>The shortcomings noted in the PSR2 submission that are applicable to the preventive maintenance regime for C&I safety circuits gives rise to concern about the quality of information determined from these activities. This is significant in terms of feedback provided following maintenance with regard to defects that may have been identified and its subsequent use in evaluating the performance of reactor safety circuits.</p> <p>The occurrence of maintenance induced errors caused by either a failure to carry out the maintenance activity correctly or unsafe working practices gives rise to concern about::</p> <ul style="list-style-type: none"> • the level of detail provided in the instructions and documentation used for routine maintenance activities at reactor safety circuits; • the extent to which maintenance activities are monitored and supervised prior to restarting or resetting safety circuits back into normal operation; and • the competence of maintenance personnel to undertake maintenance tasks on reactor safety circuits. <p>The issue of the assurance of competence of maintenance personnel is not specifically covered in those parts of the PSR2 submission used in carrying out this C&I assessment. However, it is important that the licensee has arrangements in place to review the capabilities of maintenance personnel against an appropriate technical framework based upon modern C&I standards or guidance to ensure that they are (and remain) properly trained, have sufficient knowledge and experience of those reactor safety circuits that are being worked upon, and an understanding of the hazards which may arise during the maintenance activity(ies) and the precautions that need to be taken.</p>

¹ Competence requirements applicable to C&I safety systems are given in BS EN 61508-1:2002 “Functional safety of electrical/electronic/programmable electronic safety-related systems. Part 1: General requirements”.

Table 3 (continued): Dungeness B Action Plan

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB/4.05/36	BEG L shall undertake a formal review of the likelihood of secondary induced hazards, based on plant inspections and undertake modifications arising as necessary.	The treatment of secondary induced hazards is superficial, and not what is expected of a modern standards safety case. Undertaking a relatively simple walkdown process would rapidly screen out issues of no consequence and allow a focus on the remnant issues.
DNB/4.05/37	BEG L shall seismically qualify the seismic alarm system	The lack of qualification for the seismic alarm on the station is not seen as an acceptable position. It is a reasonably practicable enhancement. Given the strong attenuation observed local to the site following the recent Folkestone event, knowledge over the actual levels experienced by the site is seen as of considerable advantage.
DNB/GEN/40	<p>BEG L shall, following the completion of PSR related work, identify those relevant safety cases requiring amendment and prepare and submit to NII a programme of work to update and deliver those that are currently outstanding and those that require update. These will include, but are not limited to:</p> <ul style="list-style-type: none"> • Core restraint case • Core support case • Gas baffle dome case • Graphite core case • Revised depressurisation case • Steam release safety case • Loss of PVCW case • Detection and management of fuel failure occurring during normal operations case • Resumption of radial shuffling case • Robust fuel case • Pond dam boards case 	A number of safety case documents currently require update or issue. In addition, as a result of PSR2 related work other safety case documents will require update. The Dungeness B PSR2 provides evidence of an apparent shortage of Licensee SQEP resource to develop and produce new safety cases and updates to safety cases

Table 3 (continued): Dungeness B Action Plan

NII tracking no.	Commitment (summarised)	Background to Action Plan item
DNB/GEN/41	BEGL shall to provide NII with an acceptable programme to carry out the work identified as recommendations in the PSR, in subsequent correspondence and the requirements identified in this report.	BEGL must supply NII with an agreed programme for carrying out the work identified in the recommendations in the PSR. NII expect these requirements to be incorporated in that programme, including those commitments given in various letters to NII since the publication of the PSR.
DNB/PSA/47	BE shall produce a procedure on how data analysis is conducted covering all aspects of the PSA reliability data analysis task	<p>The approach to reliability data analysis in the PSAs for DNB is not consistent with modern practices:</p> <ul style="list-style-type: none"> • The generic data used is outdated and limited • Not sufficient use is made of AGR fleet data