Office for Nuclear Regulation

Permissioning of Bradwell Licensed Nuclear Site into Care and Maintenance

Assessment of the Safety Documentation for Bradwell Licensed Nuclear Site to Support ONR Issuing a Consent for Entry of the Site into the Decommissioning Stage of Care and Maintenance

Project Assessment Report ONR-SDFW-PAR-18-025
Revision 0
November 2018

Published 10/2019

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EXECUTIVE SUMMARY

Assessment of the Safety Documentation for Bradwell Licensed Nuclear Site to Support ONR Issuing a Consent for Entry of the Site into the Stage of Care and Maintenance

Permission Requested:

Magnox Ltd (ML), the licensee, has requested ONR's consent under Licence Condition (LC) 35(5) for Bradwell licensed nuclear site to proceed from the stage of Care and Maintenance preparations to the decommissioning stage of Care and Maintenance (C&M). The requirement for this permission arises from ONR issuing a Specification in 2017 under LC35(5) requiring ML to apply for Consent to enter the decommissioning stage of C&M.

Background

The reactors on the Bradwell site ceased electricity generation in 2002 and since then extensive decommissioning and other modification work has been undertaken to move the site towards its decommissioning stage of "Care and Maintenance" (C&M). The ML C&M strategy is based on the International Atomic Energy Agency's (IAEA) concept of deferred dismantling. This internationally recognised approach is one whereby progressive risk reduction is accrued from natural decay of radioactivity. The safe quiescent period at Bradwell is expected to last approximately seventy years. The licensee will be implementing a planned programme of monitoring and inspection and, where necessary, maintenance to ensure the integrity of the structures, systems and components important to safety, are not significantly degraded during the period of C&M.

The C&M safety case submitted by ML also complies with the licence requirement for periodic safety review (PSR). ML has made commitments to substantiate the C&M regime for the next 12 years (to allow for two 5-year maintenance cycles), subject to acceptance by ONR. No cliff-edge effects have been identified during the subsequent 5 year period. There are no additional findings specific to the PSR.

To support the transition into the C&M stage the reactor buildings have been modified into "Safestores" capable of providing adequate containment and shielding for the remaining activated materials during C&M. ML has removed a significant number of reactor systems and has demolished most of the ancillary buildings, including the turbine hall. The reactor buildings have been clad with special weatherproofing. This will protect the remaining reactor core, reactor pressure vessel, and other primary circuit structures which will contain radioactive material during the period of C&M. These activated materials are primarily the concrete bio-shield, the graphite core, the reactor pressure vessel and associated structures.

Upon entry to C&M Bradwell will have completed processing of its intermediate level waste on site and packaging the waste for interim storage in a newly constructed store. The redundant ponds have been cleaned, drained, sealed and over-clad with a protective structure to provide a weather-proof enclosure.

Figure 1: Bradwell Site in C&M (artist's impression)

Bradwell will be the first British nuclear power generating site to enter an extended period of C&M. During C&M the site will not normally be manned by engineering staff and therefore there needs to be high confidence that the structures both internal and external will maintain their integrity and will remain capable of being dismantled at the end of the 70 year period. It is also necessary that it is passively safe with the contents physically and chemically stable throughout that time. Limited routine inspection is planned initially on an annual basis with more detailed in-depth inspections every 5 years.

ML has prepared the Bradwell site in a configuration that is suitable for long term storage of the radioactive inventory that will remain during the planned duration of 70 years in C&M (see Figure 1 above). The safety case covers the site in this quiescent phase, justifying 'operation' of the site and routine examination, inspection, testing and maintenance of the facilities within it, and also the safety management arrangements to ensure continued safety of the site and operations within it.

Although the nuclear risks from the site are considered to be low, this first-of-a-kind transition sets precedence for the UK and as such warrants the use of primary licensing powers to permission this major change to the lifecycle stage of the installation.

Assessment and inspection work carried out by ONR in consideration of this request

ONR has undertaken routine inspections on the site throughout the period of decommissioning and preparations for C&M. In addition ONR assessed the original safety case submitted in 2011 and PSR in 2012. ONR assessment work has maintained an oversight of the issues and agreements made based on those original assessments.

ML submitted a combined C&M safety case and PSR submission in 2017 in the form of addenda to the original 2011 submission and a team of ONR specialist assessors has undertaken specific topic assessments to judge the adequacy of the submission.

ONR has also witnessed a series of commissioning tests of the new arrangements for running the site remotely from the Sizewell A site, and undertaken readiness reviews, to judge whether or not the site is ready for permissioning to enter the C&M stage of decommissioning.

Matters arising from ONR's work

The main findings of the assessment and inspection programme are as follows:-

- The Bradwell site has been prepared to a high standard and has achieved a state suitable to enter C&M.
- The Sizewell A site has prepared satisfactory management arrangements to run the Bradwell site remotely and have implemented a significant programme of training and familiarisation to ensure that nominated personnel have the necessary expertise to work at Bradwell.
- All the necessary procedures, data, knowledge and information required to operate and complete the remaining lifecycle of the site have been prepared and stored in a modern standards document management system to act as a resource library when planning work at Bradwell.
- The management of staff has been undertaken responsibly and sufficient persons have been allocated to Bradwell work to undertake it safely.
- Some minor work will remain to be done after Bradwell applies for ONR consent to enter C&M; this is because some of the work can only be completed after the site has entered C&M. ML has committed to completing the residual programme of work by March 2019.
- The submission also fulfils the requirements of a PSR and at the time of issuing the Consent a letter will also confirm the next PSR cycle as 12 years. This period will allow the results of the first two cycles of five yearly maintenance to be properly assessed by ML.
- The site will retain a guard force on a permanent manning basis during the initial stages of C&M. The planned move of the site to unmanned status will need to be subject to a separate, additional permission under the security regulations.

Conclusions

The conclusions of the ONR assessment are:-

- The Bradwell site is ready to enter C&M
- The Sizewell A site is ready to manage the Bradwell site remotely.
- The small amount of preparation work still to complete is not significant or critical to maintaining nuclear safety. ML has committed to completing this work by March 2019.

Recommendations

The recommendations of this report are that: -

1. A Consent should be issued to permission the Bradwell site to enter the Care and Maintenance stage of decommissioning.
2. The PSR should be accepted and a period of twelve years set until the next review.

LIST OF ABBREVIATIONS

AETP	Active Effluent Treatment Plant
ALARP	As low as reasonably practicable
C&I	Control and Instrumentation
C&M	Care and Maintenance
CHS	Conventional Health and Safety
CNS	Civil Nuclear Security (ONR)
DCIC	Ductile Cast Iron Container
DPAF	Decommissioning Proposal Approval Form
fLoC	final-stage Letter of Compliance
HIRE	Hazard Identification and Risk Evaluation
IAEA	International Atomic Energy Agency
IDWMS	Integrated Decommissioning and Waste Management Strategy
ILW	Intermediate Level Waste
INSA	Independent Nuclear Safety Assessment
ISF	Interim Storage Facility
LC	Licence Condition
LI	Licence Instrument
LTP	Lifetime Plan
MAC	Miscellaneous Activated Components
MCLA	Maintained Contaminated Land Area
MCP	Management Control Procedure
ML	Magnox Ltd.
NDA	Nuclear Decommissioning Authority
NSC	Nuclear Safety Committee
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PoC	Paper of Concept
PoI	Paper of Intent
PSR	Preliminary Safety Report
RIMA	Reception, Inspection and Maintenance Area
REPPIR	Radiation Emergency Preparedness and Public Information Regulations 2001
RGP	Relevant Good Practice
RWMC	Radioactive Waste Management Safety Case
SAP	Safety Assessment Principle(s)
SCENATE	Safety Case and Environment Advisory Team
SDC	Site Decommissioning Committee
SDMC	Safety Mechanisms Devices and Circuits

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1 PERMISSION REQUESTED

1. Magnox Ltd (ML), the licensee, has requested ONR's consent under Licence Condition (LC) 35(5) for Bradwell licensed nuclear site to proceed from the stage of Care and Maintenance preparations to enter the decommissioning stage of Care and Maintenance (C&M) Ref [1] .

2. The requirement for this permission arises from ONR issuing a Specification in 2017 under LC35(5) requiring ML to apply for Consent to enter the decommissioning stage of C&M. The requirement for this permission was specified by ONR in Licence Instrument (LI) No.516, Ref. [2]. This Project Assessment Report (PAR) outlines ONR's evaluation of the justification provided by the licensee to support its issuing of the Consent Ref [3].

2 BACKGROUND

3. The ML company arrangements for decommissioning its sites divide the activities into a series of stages aligned with its declared lifecycle phases of:

- Design build and commission
- Generation
- Defueling
- C&M preparations
- C&M (Quiescence)
- Dismantling and Final Site Clearance
- Long term storage pending availability of a disposal route

4. At the Bradwell licensed site, the first three stages above have been completed. The remaining stages above fall within the overall lifecycle phase of Decommissioning and Site Remediation.

5. The C&M preparations at the Bradwell licensed site are currently very close to completion and ML intends to place the Site into a passively safe configuration for the C&M stage of the sites lifecycle. The preparations phase included the post-operational clean-out of the defueled plant, removing conventional and radiological hazards as far as is reasonably practicable.

6. The ML C&M stage is a period of 'quiescence' lasting for a nominal 70 years to take advantage of the process of natural radioactive decay to reduce the risks associated with residual radioactive inventory and eventual decommissioning activities. During this period the licensee justifies plant safety by having removed all hazards as far as practicable prior to entry into C&M and contained and shielded any remaining radioactive inventory through passive means.

7. Maintenance of the provisions for assurance of safety is through implementation of an ongoing long-term programme of inspections, maintenance and monitoring activities. This will be supported by any remediation that may be identified as necessary through those inspections/monitoring activities - a regime of 'care and maintenance'.

8. The adequacy of the final C&M entry state after all preparations are completed to contain and shield the remaining radioactive inventory and to provide for the safe management of the residual site hazards for the C&M period, is justified by a C&M Safety Case and other arrangements. This Project Assessment Report (PAR) provides the basis of our assessment of the safety documentation and outlines some of the relevant historical background.

9. The declared C&M entry state for Bradwell is described as:

- Two partially de-planted reactor buildings, each with a single ‘safestore’ structure enclosing the existing reactor building/boiler houses/circulator hall/annexe profile, and with the reactor vessels, boilers, and gas ducts all remaining in-situ.
- An Intermediate Level Waste (ILW) store referred to as an ILW Interim Storage Facility (ISF). The ISF will hold Ductile Cast Iron Container packages (DCIC’s) awaiting final disposal. (Includes planned DCIC imports from Dungeness A and Sizewell A sites).
- Residual below-ground structures associated with the pond facility, active effluent treatment plant (AETP), pond water treatment plant, and active waste vaults; decontaminated to acceptable levels and covered by suitable low-profile weather envelopes.
- Active drains that are not accessible for removal; primary containment removed, secondary containment left in-situ, decontaminated as appropriate and capped or grouted as necessary.
- A new smaller AETP and discharge pipeline to the estuary if necessary to manage liquid waste arisings during the C&M phase.
- A new surface water discharge pipeline to the estuary.
- Radiologically contaminated land areas (primarily at the North end of the site) retained in-situ and managed throughout C&M.
- A simple site electrical substation and network.
- A new combined gatehouse and site C&I monitoring facility.
- All other structures decontaminated and demolished to ground level where practicable.
- A re-configured site fence.

10. As the first site to enter into C&M, Bradwell is what ML has called its ‘lead and learn’ site where it piloted a number of elements of the licensee’s radioactive waste management and decommissioning strategies. The strategies were developed to support ML’s lifetime plan ‘LTP 15’ for decommissioning its fleet of reactor sites. The entry of Bradwell site into C&M will set precedent for the UK as the first site to enter this phase of decommissioning. As such, it was considered that ONR should formally permission the transition from the preparatory phase into the C&M stage. This was effected by issuing a Specification under LC35, subsequently requiring a Consent from ONR before entering into C&M. A supporting PAR was issued Ref. [4] to explain the basis for this decision.

11. This PAR outlines ONR’s assessment of the ML C&M related safety documentation which provides the justification for the Bradwell C&M entry state. The safety documentation is presented as an original Paper of Intent and supporting Stage Submissions, and a number of subsequent updates including new addenda to the Stage Submissions and integrated Periodic Safety Review submissions.

3 HISTORY OF INSPECTION AND ASSESSMENT

3.1 SAFETY CASE ASSESSMENT

12. In March 2010, ML issued an overarching Paper of Intent Ref. [5] for the Bradwell site C&M Safety Case giving the anticipated Entry State for the site and using seven stage submissions Refs. [6], [7], [8], [9], [10], [11] and [12]. The first six stage submissions address the various physical aspects of the site, and the seventh addresses the safety management arrangements at the point of entry (including site procedures and maintenance schedules). The submissions (SS1, SS2 and SS7) covering the reactor and ponds ‘safestores’ and the safety management arrangements went to the NSC in

2010 and 2012 respectively for advice. This is part of the ML internal due process. Since 2010, ML guidance has been developed as described below.

13. In 2014/15 the considerable costs of the extant decommissioning plans and the competition of the contract for management of the ML sites led to the introduction of a number of strategic optioneering processes to optimise packaging proposals across the Magnox 'fleet' and regionalise storage provisions rather than constructing stores at all sites.

14. This led to the introduction in 2016 of a formal change to the Magnox radioactive waste management strategy Ref [13]. It also led to the associated development through 2015/2016 of a revision to the corporate decommissioning programme referred to as Lifetime Plan 2015 ('LTP15'). These changes were incorporated into a new Company Standard called the Integrated Decommissioning and Waste Management Strategy (IDWMS) known by its number as S-036 Ref. [14].

15. Implementation of the changes to the Magnox Radioactive Waste Management Strategy was accepted Ref. [15] by ONR in May 2015 subject to continuing engagement in development of the detail. Also the resultant changes to the regulatory milestones required under Licence Condition 35 (LC35) associated with the new decommissioning programme were subsequently accepted through two interventions in April 2017 and October 2017. The two interventions related to nuclear and conventional safety matters respectively Ref. [16], [17].

16. These changes led to the development of a revised generic company specification for configuration, transition, and management of the sites for C&M Ref [18]. The specification document incorporates a tabular summary of the entry state configurations for each of the ML sites which reflects that defined in the new Company Standard S-036.

17. The site-specific entry state definition document for Bradwell is described in accordance with this in its C&M Entry State Definition and Configuration & Control documents Ref. [19], [20]. The documents are change controlled as necessary through a Site Decommissioning Committee (SDC). The entry state definition is essentially a '4 box model' with 2 reactor safestores, a ponds/vaults safestore, and an ILW storage facility. Delivery of this entry state is through C&M preparation activities/projects justified by safety submissions in accord with Magnox company procedure MCP99.

18. The overall safety case for this entry state definition was originally intended in 2010 to be the C&M safety case in the form of 7 stage submissions under a Paper of Intent as described at the outset of this section. In practice, the stage submissions have essentially become high level Preliminary Safety Reports for the various aspects of the C&M entry state giving their outline justifications. The detailed safety cases for each aspect were incorporated into project documents for their delivery under MCP99.

19. The decision was therefore made by ML for the C&M Safety Case to be revised and re-issued in the form of addenda to the original stage submissions. These were submitted to ONR in July 2017 Refs. [21], [22], [23], [24], [25], and [26].The case will be finalised in a final summary report approximately 4 months after entry to C&M.

20. Due to the similarities between proposed entry states for the ponds and the active waste vaults, (i.e. contaminated structures under a single common weatherproof envelope), ML decided to present the re-issue of the stage submission 2 and 3 addenda as a single document.

3.2 PSR ASSESSMENTS

21. In parallel with the C&M Safety Case development work, other work was being taken forward on Bradwell's Periodic Safety Review (PSR) for which the decision date was 31 March 2012. The PSR was delivered through a Category 2 'outcome' submission Ref. [27] supported by 9 Topic Reports, Ref. [28], [29], [30], [31], [32], [33], [34], [35] and [36].The summary 'outcome' report was delivered to ONR in 2011 for assessment, one year ahead of the decision deadline.

22. ONR assessment was completed in 2012 and a decision letter issued Ref. [37] with 2 main findings to add to those identified by ML. The C&M Safety case submissions had also identified numerous opportunities for improvement and it was therefore appropriate to integrate these two sets of commitments in the addenda re-issue.

23. The practicality of managing future PSRs through the period of C&M, which would in due course be managed by a single central team, and the need to align reviews of safety with significant changes in the site lifecycle phases which incur associated changes in site safety cases, led ML to propose an optimisation process for PSR timings Ref. [38]. This would essentially re-align PSR decision dates with the C&M entry dates and for Bradwell has meant bringing forward the next PSR to 2018 rather than 2022, and integrating it with the C&M safety case submissions.

3.3 CURRENT SAFETY CASE SUBMISSION

24. The form of the original (2010) C&M safety case stage submissions was a presentation of the relevant aspects of the: -

- proposed C&M entry state,
- associated justification for that selection,
- Independent Nuclear Safety Assessment,
- associated commitments that needed to be delivered to meet the selected configuration, and
- demonstration that the site can be safely managed, monitored, and maintained throughout the C&M period.

25. Close out of the commitments is managed by a Safety Case commitment Implementation Group which presents evidence of closure to the C&M Safety Case and Environment Advisory Team (SCENATE).

26. To take account of all of these developments, the format of the addenda which will represent the re-issue of the safety case for C&M for Bradwell, includes the safety justifications for the proposed configurations supported by fault schedules and relevant sections of the site Radioactive Waste Management Safety Case (RWMC). It also includes a record of the close out of the original stage submission commitments including any incorporated from the ongoing work carried over from the PSR.

27. The addenda for Bradwell stage submissions 2 and 3 (for the Ponds complex and active waste vaults) is presented as a single submission. Stage submission 7 addendum has been extended to address the change to remote management of the site from Sizewell A site and the associated management of change transition arrangements (which are the subject of a separate Management of Change submission).

28. The stage submission 7 addendum is further extended with an Appendix to detail the integration of the PSR into the C&M Safety Case. Each of the addenda also includes an appendix giving the relevant outcome of the PSR. They incorporate any findings for which reasonably practicable improvements could be made as further commitments. The addenda therefore present a re-baselined set of commitments for the point of entry into C&M.

29. Assessment of the safety justification for entry to C&M as presented in the C&M Safety Case addenda Refs. [21] - [26] has been undertaken in line with the DFW Project Task Sheet Ref. [39]. This was informed as appropriate by prior assessment of the original stage submissions and of configuration delivery projects that have already been adopted. This Project Assessment Report records the findings of those assessments and makes recommendations related to the permission being sought.

4 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS PERMISSION

30. ONR has carried out a programme of work associated with this project involving level 3 and 4 meetings, inspections, and assessments, over the period between 2010 and the current submissions.

31. The initial work focused on evaluation of the PSR submissions of 2011, and of the original 3 stage submissions for the C&M safety case which went to the NSC for advice, plus that on land contamination. The addendum to the stage ILW storage submission was a Category 3 submission which was not specifically assessed. However, the safety of interim storage was considered in the permissioning of the conditioning arrangements for sludge and resin.

32. An overview of much of this initial work undertaken on the PSR and original stage submissions is provided in section 5 of the PAR Ref. [4]. The PAR was prepared in support of the Specification to call for Consent for entry to C&M.

33. The current assessment work has involved site inspections and information exchanges and regular telecom meetings between ONR specialists and ML staff. The work focused on evaluation of the recent stage submission addenda, taking account of the aforementioned initial work.

34. In particular, attention has been given to:-

- confirmation of the adequacy of the declared site physical configuration for C&M entry
- the associated inspection, monitoring, and management arrangements.
- the completion of the commitments made with respect to findings from the PSR and the original stage submissions.

35. ONR's inspection and assessment work have engaged in the C&M transition arrangements with respect to people, functional arrangements, knowledge management and compliance in physical configuration delivery.

5 MATTERS ARISING FROM ONR'S WORK

5.1 2011 PERIODIC SAFETY REVIEW:

36. ONR assessed the 2011 PSR and concurred with the 46 findings from the licensee's review. ONR also identified two additional matters that required taking forward along with the commitments made by the licensee with respect to its own findings, these were:-

- Firstly, the traditional PSR process was not suited to a site that is undergoing rapid change during decommissioning. Development of appropriate arrangements for compliance with LC15 was therefore required.

- Secondly, the PSR did not provide sufficient information on the site's compliance with site Licence Conditions 32 (accumulation of radioactive waste), and LC34 (leakage and escape of radioactive material and radioactive waste. ONR required further information on compliance arrangements, the on-

site performance against these arrangements, and an assessment of them for the next period of operation.

37. The first of these matters was addressed through a work-stream involving ongoing discussions and engagements between ML and ONR to develop an efficient and appropriate means of compliance with LC15 for sites progressing through their latter lifecycle phases. An NSC paper was produced and presented by ML describing the optimisation of its PSR programme Ref. [38] and the proposal to resynchronise the PSR at entry to C&M was incorporated into its Stage Submission 7 paper thereby closing the finding.

38. The second matter was addressed in a report Ref. [40] presented to Bradwell's Nuclear Safety Committee (NSC) in March 2013. This report reviewed Bradwell's compliance arrangements against the five elements of Health and Safety management cited in HSG65 (Policy, Organisation, Planning/implementation, Measuring performance, and Review/audit) and concluded the adequacy of its arrangements. The report was provided to ONR.

39. Commitments made by the licensee with regard to addressing all of the findings from the PSR were given in a letter Ref. [41] outlining a forward improvement plan for dealing with them with targeted completion dates and the approach to addressing ONR's findings as above. A final report for the PSR was subsequently produced in March 2013 Ref. [42] summarising how all of the findings had been closed out apart from five which were part of the ongoing C&M preparations work stream.

40. The five ongoing findings were:

- Finding F10 (Safety Case) – Lifetime nuclear safety requirements to be more visible in the Reference Safety Case
- Finding F30 (Safety Case) – Update required of Safety Case for modern standard external hazards assessment.
- Finding F38 (Plant) – Arrangements for detection and removal of water ingress from reactor building basements require review against modern standards expectations.
- Finding F12 (Ageing) – More detailed assessment needed of structures for chemical degradation from groundwater and airborne sources.
- Finding F33 (Ageing) – Degradation of elements of reactor weatherproof envelope needs to be addressed (boiler house roofs).

41. At the time of submission of the stage submission addenda finding F30 had been closed out. F30 required the update of the safety cases to take account of developments in standards, information and codes related to external hazards assessment.). The stage submission addenda themselves incorporate that update as summarised in Appendix A table 2 of Stage Submission 7 Ref. [26].

42. The status of the remaining four outstanding findings is addressed in the Appendix A of the relevant stage submission addenda. F10 is relevant to all the stage submissions and is addressed by the production of their addenda which, together with the final report will form the new re-baselined reference safety case for the site.

43. F38 and F33 were relevant to stage submission 1 for the reactor safestores and were taken up as formal commitments for completion prior to entry to C&M involving installation of modern new provisions. F33 was progressed by interim repairs to the boiler house roofs and was subsequently closed out through completion of the weatherproof envelope installation project which fully resolved the roof degradation issue. The former finding on water ingress is being closed out through new commitments 1.9 and 1.13.

44. F12 was relevant to the stage submissions for both the reactor safestores and the ponds and vaults complex. Assessment and testing of the reactor building structures has been undertaken but further testing is required prior to C&M entry to determine the level of deterioration to the concrete and steel reinforcement. Further assessments of the ponds and vaults structures have been undertaken and where work is still outstanding commitments have been identified to capture this.

5.2 INITIAL STAGE SUBMISSIONS:

45. ML's initial work on stage submissions 1, 2, 4, and 7 and matters arising from ONR's assessment of them led to ML implementing a number of significant projects, namely:-

- Reinforcement of boiler support arrangements to underpin their seismic withstand for the justification for leaving them in situ until final site clearance
- Provision of a new cladding system for the reactor safestores, monitoring system and water detection and removal provisions to maintain a favourable environment for management of corrosion.
- Construction of an Interim Storage Facility (ISF) to house ILW packages (Ductile Cast Iron Containers or 'DCICs') during the C&M phase.
- Provision of conditioning arrangements for sludge and resin for storage in DCICs within the ISF and introduction of requirements for venting DCICs.
- Sealing arrangements for the pond surfaces to stabilise residual contamination while avoiding pressurisation failure of the sealant layer
- Provision of a cap for ground contamination at the North end of the site and groundwater monitoring to minimise migration of activity during C&M
- Development of 'handshake' arrangements for import of ILW waste packages from other Magnox sites.
- Development of transition arrangements for management of the Bradwell site during C&M from Sizewell A as a 'buddy site'.
- Development with ONR's CNS section of a protection plan for the site during C&M commensurate with having no site security presence on a permanent basis. Co-ordination of this plan with provisions for managing occasional ongoing ILW operations, and periodic inspection/maintenance activities, during C&M.
- Characterisation of Asbestos Containing Materials (ACMs) across the site and development of an Asbestos Management Plan (AMP) for managing these materials up to, and through the C&M phase.

46. Arising from the ONR assessments associated with the permissioning of these projects were a number of recommendations which it was recognised would carry through to the assessment of the Stage Submission addenda for the justification for entry to C&M. These are outlined in the paragraphs below.

47. The Safestore PCSR assessment for lifting the hold point on cladding installation, Ref. [43], identified that the environment within the safestore (particularly humidity, salt ions, and temperatures), is important in governing the rate of degradation of internal structures and corrosion of steelwork. The difficulty of designing a passive ventilation system for a large compartmentalised building such as the Safestore makes it important that actual conditions are monitored and ventilation system adjustments made accordingly if necessary. The current cladding design does not include louvres but provisions are included to allow for this if necessary. An appropriate monitoring scheme was considered a crucial requirement of the long-term inspection arrangements.

48. The civil engineering assessment Ref. [44] of the Safestore PCSR concurred with the need for monitoring. It noted that steel thickness measurements and concrete sampling were expected activities of an inspection and monitoring regime that should be devised to measure and forecast the corrosion rates and confirm the structural

safety margins. It also noted that the inspection activities were to be included in stage submission 7 addendum. Specific expectations of the EIMT regime for C&M were:

- Detailed structural inspections and tests (to satisfy Licence Condition 28) to be undertaken every 5 years.
- An annual pre-winter check for weather tightness and effective drainage.
- A responsive approach to inspect after any severe weather events.

(Note that SS1 Addendum 1 Ref [21] also identifies that annual inspections may be required to maintain the cladding system warranty in Appendix C page A60 of that document.

49. The above civil engineering assessment also noted that the inspection regime for internal structures (RPVs, ducts, boilers, access structures etc.) requires adequate monitoring, inspection and maintenance arrangements involving measurement of air temperatures, humidity, and condensation.

50. The ONR 20 Dec 2012 assessment Ref. [45] of the ventilation design report supported its recommendations to make provision for draining condensate/collection in sumps, and installation of associated pumps.

51. The assessment of the pond surfaces sealing modification proposal Ref. [46] concluded that the use of a polyurea coating as a sealant along with pressure relief holes was a novel approach. Overall, the proposal appeared to provide an adequate level of safety assuming that adequate arrangements for EIMT were implemented throughout the C&M period.

52. The assessment Ref. [47] of remediation of land contamination for C&M using the proposed cap for management of contaminated land in the North end area of the site where the original active effluent line was known to have leaked was found to be satisfactory. The assessment finding was subject to a number of recommendations relating to Sr90 characterisation, recording residual contamination, and monitoring of ground and groundwater contamination which would be addressed in the addendum to stage submission 4.

53. In parallel with the Fuel Element Debris (FED) retrieval and treatment project for removal of site operational wastes a corporate strategy for optimisation of fleet lifetime plans has been developed. These projects have been progressed through the C&M preparations phase and a high level overview of this work was summarised in the PAR for the Bradwell specification for a consent Ref. [4]. Work is currently still being progressed to completion in a number of areas, and in a limited number of cases, will remain ongoing after entry to C&M.

54. The Stage Submissions Addenda represent the main body of the update of the site's reference safety case and the status of the above work is integrated into these addenda along with lists of commitments for completing this work. The lists also include new work commitments identified in updating the safety case for the C&M period. Part of the current assessment for this PAR was the consideration of whether these commitments satisfactorily address the recommendations arising from the initial submissions and resulting projects. It also underpins, the justification for entry to the C&M phase

5.3 ONR ASSESSMENT OF THE 2017 CARE AND MAINTENANCE SAFETY CASE SUBMISSION

5.3.1 The Bradwell C&M Safety Case

55. The detailed safety justification for the C&M stage of decommissioning is provided within addenda Ref. [21] - [26] to the original stage submissions Ref. [6] - [12]. The addenda are in effect revisions to the original stage submission providing the substantiated safety case, including the safety justifications for the proposed configurations supported by fault schedules, etc. The addenda include a set of commitments regarding work that must be completed to fully justify and underpin the C&M state.

56. The stage submissions addenda are:

- Stage submission 1: Reactor safestores Ref. [21]
- Stage submission 2&3: Ponds and vaults (combined into a single addenda because the ponds and active waste vaults are under a single common weatherproof envelope and are appropriately considered together) Ref. [22]
- Stage submission 4: Land quality and concrete structures Ref. [23]
- Stage submission 5: ILW storage Ref. [24]
- Stage submission 6: Site infrastructure Ref. [25]
- Stage submission 7: Safety management arrangements Ref. [26]

Each stage submission has been subject to Magnox Ltd.'s Independent Nuclear Safety Assessment (INSA) process.

57. The safety case concludes that the remaining risk of a nuclear incident is very low. No significant radiological consequences were found to arise from any reasonably foreseeable incident scenarios.

58. As per the NPSC paper Ref. [38] the C&M safety case submitted by ML also complies with the requirements of the periodic safety review submission. No cliff-edge effects have been identified during the subsequent 5 year period and ONR have no additional findings specific to the PSR over and above those raised on the safety case stage submission documents.

59. A team of ONR specialist inspectors assessed the Bradwell Care and Maintenance combined Safety Case and Periodic Safety Review Submission (C&M submission) and each produced an assessment report detailing their assessment and issues identified.

- Structural and Mechanical Topic Assessment Ref. [48]
- Radiological Waste Topic Assessment Ref. [49]
- Radiological Protection Topic Assessment Ref. [50]
- Civils and Structures Topic Assessment Ref. [51]
- Leadership and Management for Safety Topic Assessment Ref. [52]
- Electrical and Control and Instrumentation Topic Assessment Ref. [53]
- Conventional Health and Safety Topic Assessment Ref. [54]
- Security Topic Assessment Ref. [55]

60. Each ONR Specialist Inspector produced a number of queries that were passed on to ML for response. In all fifty six individual queries were raised by ONR, and these have had satisfactory responses from ML, Ref. [56].

5.3.2 Project Issues

61. Four areas of common concern amongst the ONR assessment team resulted from the assessment of the C&M submission. These queries were collated together into four project queries.

62. The first was the proposal to adopt a five yearly inspection regime for the site when in C&M. ML's response outlined that:-

- The site was rendered passively safe and does not require any systems to be running, all redundant ancillary equipment and systems have been removed. Therefore the level of machinery maintenance is negligible. The remaining bulk concrete structures already have either five yearly or four yearly maintenance periods and therefore the change is not considered significant.

- There have been several years of operational history in the stripped out state and this has not shown more frequent structural inspections are required although some environmental monitoring for humidity and condensation control will continue for a period into C&M. This is necessary to assess the likelihood of condensation creating an issue with corrosion rates for the metal parts of the primary circuit and the core once in the fully sealed C&M state.

63. The second was the issue of maintaining the knowledge and experience base such that persons working at Bradwell maintained Suitably Qualified and Experienced Persons (SQEP) status throughout the period of C&M.

- ML's response is that the process for training staff to work at Bradwell will follow the existing processes and procedures such that a suitable body of SQEP personnel will be available at all times. To support the required training and familiarisation process all the relevant knowledge, including maintenance and operating procedures, structural and equipment drawings, company procedures and relevant historical information is stored in a software based Knowledge and Information Data Library (KIDL) which will make the information readily available to persons needing to access it.

- Third party contractors engaging with ML will be put through the company's framework process which reviews their competency to work at the Bradwell site. All appointments will be reviewed by ML to ensure they are SQEP.

64. The third issue was the control of risks to persons entering the cold and dark facilities to open them up and establish safe access and egress routes and worksites. When entering the cold and dark facilities after a period where they have been sealed, there is the potential for exposure to leaked radioactive contamination, loose asbestos fibres and conventional risks such as falling from corroded walkways or through corroded handrails.

- ML has written special access and egress procedures for use in C&M that prescribe a phased entry procedure where SQEP personnel check for radioactivity and loose asbestos and assess the adequacy of the walkways, staircases and handrails as they go. Only once safe access/egress and a safe worksite been established is the work allowed to start.

- These procedures were demonstrated during the programme of commissioning tests to ONR's satisfaction (see section 5.3.13).

65. The fourth issue concerned the stripping of asbestos contaminated lagging from the Reactor Pressure Vessel (RPV). The safety case claimed that doing so was not reasonably practicable due to dose predictions being estimated at 79 man-Sv as a result of the current radiation dose levels, together with estimated residence time in the work areas.

- This justification was questioned, and eventually accepted on the basis that the work would involve opening up the basement void structure to provide access routes to the RPV. This could adversely affect the environmental conditions in the basement voids and compromise the structural withstand of the overall structure. Although dose rates can be measured reasonably accurately, the point in time when (or if) the asbestos starts to degrade and release loose

fibres cannot be determined with precision due to the uncertainties involved.

- The conclusion is that the difficulties involved in digging into the structure to access the area combined with the dose rates involved and difficulties in handling the material in the void areas makes a compelling case to seal the remaining material in and leave it until final site clearance.

66. The rest of the 56 queries were topic specific and summaries of the individual topic assessment findings are given in the following sections.

5.3.3 Structural and Mechanical topic assessment:

67. This assessment concentrated on the mechanical engineering and structural integrity aspects of Bradwell site C&M arrangements. The assessment was focussed on ML's monitoring and maintenance strategy in managing the ageing effects in the primary circuit components and assessed its adequacy in maintaining the integrity of those components during the C&M phase.

68. The assessment (mechanical engineering and structural integrity) concentrated on whether, with the proposed care and maintenance arrangements, the primary circuit will contain the nuclear material for 70 years and whether the Safestores structural components will maintain their geometry for 70 years. The assessment included a site visit to inspect the Safestore and discuss the assumptions with the Safety Case Manager and the Engineer Manager Ref. [57]. Additionally ONR commissioned the ONR Graphite Technical Advisory Committee for Nuclear plant (GTAC) to consider the stability of decommissioned graphite cores during C&M, which was used to provide additional technical support.

69. The assessment primarily focused on the integrity of the primary circuit components that form the containment of the radioactive materials in the Safestores, and their ageing management in the C&M period. In addition, the assessment also considered the structural integrity of components supporting the primary circuit (e.g. reactor pressure vessel support), including duct hangers, to ensure that risks of any active degradation mechanism are reduced to SFAIRP during the C&M period.

70. The reactors are now defueled and in benign state. Hence, there are no progressively active degradation mechanisms like thermal ageing and radiation embrittlement. The only loading is the self-weight of the graphite core on the "diagrid" structure that supports it. ONR queried the radiation embrittlement effects on the diagrid during the operating periods of the reactors. The assessor considered the response from ML alongside the "incredibility of failure" assessment provided in the safety case, which judged that the core support and the diagrid is in a reasonable condition, and will remain so over the C&M period.

71. Corrosion is the only progressive degradation mechanism that may remain over the C&M period, potentially affecting the primary circuit pressure boundary. The weather shield "Safestore" provides the protection to the primary circuit by preventing ingress of rain water inside the building and also helps to control the internal humidity and moisture. Although ML does not propose to install any permanent condition monitoring equipment over the C&M period, periodic visual monitoring of the structural steel work supporting the Safestore will qualitatively indicate presence of condensation and/or corrosion inside. Further corrosion coupons will be provided, using the Safestore structural decking panels, inside the boiler houses for visual monitoring and corrosion analysis purposes.

72. The level of corrosion that can be expected during C&M correlates directly to moisture levels within the structures. Following the end of operation the site started monitoring moisture levels within the core vessels using the stand pipes' gas extraction points as

per the monitoring arrangements during operations. Initial results were positive, indicating a definite temperature difference between the core and ambient conditions. However, subsequent refinements of the system indicated that the temperature difference was much less.

73. In response to this ML has installed moisture monitoring systems inside the primary circuit and water level detection monitors in the voids to check if risks from condensation and accumulation of water inside the concrete bio-shield remain acceptable over the C&M period. The risk of groundwater penetration to the concrete basement voids has been mitigated by repairs to the concrete structure and it is anticipated that the vaults will remain dry. However, the possibility of leaks into the voids over the C&M period cannot be discounted entirely.

74. ML has also provided information on the studies undertaken concerning corrosion rates for carbon steels under similar reactor environments in UK. Based on the available data ML has used a bounding rate of corrosion for assessment purposes. Even with the upper bound rate of corrosion considering “wetting”, ONR is satisfied that the loss in section would be acceptable as this is unlikely to have a significant effect on the integrity of the primary circuit and reactor internal support structure. In addition ONR considers that the water level detection system inside the MAC voids will assist in minimising and managing potential water ingress and water logging inside the bio-shield.

75. Magnox propose that a five-yearly inspection is appropriate for the structures and plant where:

- The current condition is considered to be good; and
- The ageing effects are well understood (based upon historical information) and are known not to be fast-acting.

76. Where there is uncertainty in the above, ML considers more frequent inspections may be necessary once further information becomes available and the structures performance can be trended.

77. ONR considers this inspection strategy is adequate for the care and maintenance period from the mechanical engineering and structural integrity perspectives.

5.3.4 Radiological Waste

78. Several aspects of the C&M safety case relevant to the Radiological Waste assessment have been addressed by previous regulatory activities by ONR (and the Environment Agency, where relevant). This included formal permissioning, a summary of which is presented in the PAR for the specification for C&M entry Ref. [4]. This includes establishing an interim storage facility (ISF), the use of Ductile Cast Iron Containers (DCICs) as waste packages for storage of ILW in the ISF, the end states for the pond and areas of contaminated land.

79. These decisions have not been reassessed as they went through due process at the time. The associated documentation underpinning these decisions, such as assessment reports and project assessment reports have been reviewed to ensure that the C&M state is consistent with the original assessments, and that any issues or reservations highlighted when the decisions were made are adequately closed out.

5.3.4.1 Storage of ILW

80. Stage submission 5 addendum Ref. [24] provides the baseline safety case for the storage of ILW in DCICs in the Interim Storage Facility (ISF) during C&M. The Reception, Inspection and Maintenance Area (RIMA) will be used to receive consigned

DCICs and carry out any ex-situ inspections. The storage array is surrounded by a shield wall sufficient to shield DCICs stacked two high.

81. The ISF will store an inventory of un-encapsulated conditioned ILW in DCICs in type II (MOSAIK) and type VI (cuboidal “yellow box”) DCICs during the period of C&M (or until they can be consigned to the GDF). SS5 presents a safety justification based around the ISF being in a passively safe state, with no active systems required to maintain safety. The safety justification is based primarily on the DCIC waste packages, which provide primary containment and contain ILW conditioned to a passively safe condition that does not require any active management to maintain safety.

82. There are no claims on the ISF to provide any containment function. Its purpose is to provide a weather envelope and maintain environmental storage conditions to prevent any significant degradation of the DCICs so that they remain in a suitable condition for consignment to a future Geological Disposal Facility (GDF). The ISF is designed to maintain the internal environmental conditions largely through passive means via the envelope insulation and air tightness.

83. A building management system (BMS) is operated to monitor temperature and humidity. The temperature is monitored, but there is no means to provide active temperature control. A limit for relative humidity is defined. The BMS automatically activates a de-humidifier if the relative humidity exceeds 70% to minimise the risk of condensation forming Refs. [10], [24], [58] and [59].

84. It was recognised in the parent SS5 Ref. [10] and POSR Ref. [60] that some of the DCIC waste streams could generate gases (notably hydrogen) which could lead to pressurisation of a sealed DCIC. To mitigate this risk, ML made a corporate decision to fit filtered vents into the lids of all DCICs in interim storage. ML carried out an assessment that confirmed that a flammable atmosphere forming in the ISF is not credible given the low rates of hydrogen evolution from the treated packages.

85. On entry to C&M, all DCICs in the Bradwell ISF (and those to be received from Dungeness A and Sizewell A) will contain un-encapsulated and conditioned ILW. All the DCICs will have final letters of compliance (fLoC) from Radioactive Waste Management Ltd (RWM) or an adequate justification to give confidence that a fLoC will eventually be obtained Refs. [24] and [61].

86. The ISF will remain operational in relation to receiving DCICs from DNA and SZA. The current schedule indicates that DCIC will be received through to June 2021 Ref. [62]. The safety cases for receiving these DCICs will be covered by specific safety cases that will temporarily modify the baseline C&M safety case as required Ref. [63].

87. Appropriate arrangements are in place to ensure that DCICs received from DNA and SZA will be compliant with the requirements for interim storage in the ISF. The ISF has an appropriate Condition for Acceptance for DCICs, which includes the condition that the DCICs have or will receive a fLoC Ref. [61], giving assurance that they are conditioned to a passively safe condition. The quality plans for transport of DCICs from DNA and SZA Ref. [64] requires that DCICs are despatched in pristine condition, which provides assurance that DCICs received will not have any damage which may compromise their containment function or protection provided by the painted surface. Arrangements for safe handling during transport and repair on arrival ensure DCIC’s in the ISF are in appropriate condition.

5.3.4.2 Contaminated Land

88. Characterisation of the site has been underway for many years and so there is a good understanding of land contamination on site. This is documented separately, including

in the ML land quality register (known as the Index of areas of potential concern; Ref. [65].

89. The C&M configuration for these identified areas of contaminated land have been developed in line with the ML standard for the management of land quality (S-154; Ref. [66]). Areas of land are designated such that they can be managed appropriately through C&M.

90. The most significant area of land contamination is at the North End of the site where the Original Active Effluent Discharge Line (OAEDL) is known to have leaked in the past. SS4 describes the remediation work carried out on this area, to remove bulk contaminated soils and install an engineered cap over the remaining contaminated area. The remedial work is complete. A commitment (4.1) captures work to verify that the work has been completed adequately and to characterise remaining contamination. A network of boreholes will be used to monitor any migration of contamination from this area.

91. A site wide programme for monitoring of sub-surface water through boreholes and in the Borrow Dyke (a water course which receives sub-surface water at the North end of site and goes off-site) during C&M is in place Ref. [67]. The boreholes have been located to be able to confirm that the distribution and migration of contamination remains in line with expectations. The arrangements include trigger values for specific radionuclides at specific sampling locations to identify any unexpected changes in activity to prompt investigative action. These monitoring activities are expected to be maintained for at least 10 years to establish trends, before considering any reduction in inspection/monitoring frequency Refs. [23] and [68].

92. The case identifies all remaining structures, covering redundant drains, voids, tunnels and culverts, and presents the optioneering work and justification for the C&M configuration for each. The addendum Ref. [23] presents the C&M state achieved. In general, the approach was to remove or remediate contaminated structures where possible, and to ensure that remaining structures were in a passively safe state (typically backfilled with cementitious grout to stabilise the structure and immobilise remaining radioactive inventory). These remaining structures were not expected to require any routine monitoring during C&M.

5.3.4.3 Reactor Structures and Graphite Core

93. During C&M, there is a significant accumulation of radioactive material within the concrete bio-shield of the reactor safestore (detailed in Appendix B of Ref. [6] and [21]). This is dominated in terms of volume by the graphite (mostly ILW) comprising the reactor core, and smaller volumes of ILW and LLW present in activated reactor components and contamination associated with the reactor systems. There is also a single neutron source within each reactor (although the sources have now decayed to a level that they only emit gamma radiation due to activated Co-60). There is no nuclear fuel left in the reactors.

94. This inventory will be retained within the safestore building until final site clearance. This approach is accepted as ALARP as part of the C&M decommissioning strategy, deferring retrieval and disposal of this material to take advantage of radioactive decay over the period of C&M. There are no mechanisms for significant degradation or fire hazards to arise. The material is passive and stored at ambient pressure and temperature.

95. Containment is provided by the reactor bio-shield and components (e.g. primary circuit) and Miscellaneous Activated Components (MAC) voids. The safestore structure is required to maintain its integrity over C&M and will be subject to an appropriate

monitoring and inspection regime for its structural integrity, providing assurance that this inventory will remain adequately contained over C&M.

96. The reactor voids are below the water table and so the potential for water ingress is recognised, although they are expected to remain dry following remediation works to repair any concrete degradation. The presence of water in the voids will not have any significant effect on the metallic waste and is not of safety significance with any requirement for prompt intervention. However, water detection equipment has been installed and accumulated water will be removed.

97. ONR is satisfied that the evidence provided demonstrates that the risks on site have been reduced ALARP. The remaining inventory of radioactive material on site is in a passively safe condition and adequately contained. Appropriate monitoring and inspection will be in place to ensure the on-going safety of this material.

5.3.4.4 Ponds

98. The decommissioned ponds complex has been enclosed in a purpose built structure to provide shelter from the environment. This is a substantial clad steel frame structure, designed to modern standards, and is piled into the ground works and tied to the foundations of the Reactor safestores. This structure is intended to minimise degradation of the structures and the ingress of rainwater due to environmental effects during the remaining life of the ponds complex.

99. During decommissioning, the ponds were emptied, drained and the internal surfaces were decontaminated using ultra-high pressure water jetting to remove surface contamination, which was predominantly contained within the paint layer and the outer shallow layer of concrete Refs [7], [8] and [22]. Due to high dose rates encountered in the bottom of the pond, the work was limited to removing the paint down to a nominal height of 1m from the pond and where the paint layer was removed; a new coat of paint was applied as a means of contamination control.

100. Work has been carried out on the pond structure to minimise the potential for groundwater ingress through construction joints and penetrations and other potential leak paths. However, much of the pond structure is below groundwater level, and therefore the hydraulic gradient may lead to water ingress during C&M. In consequence, the potential for water ingress and accumulation within the pond is recognised. This water could potentially be radiologically contaminated, although there is considered to be minimal potential for any contamination to migrate out of the ponds complex into surrounding ground under normal conditions Ref. [69].

101. An impermeable polymer sealant (around 4mm thick) was applied over the original epoxy paint remaining on the lower sections of the walls to prevent peeling of the epoxy paint layer and minimising the extent of leaching of activity from the concrete into any water seepage into the pond potential release of airborne contamination (Ref. [69]) .

102. References [7], [8] and [22] define an inspection and monitoring regime for the sealant. It will be visually inspected at 5-yearly intervals to identify any defects, such as the sealant peeling away from the surface Ref. [22]. There are also sample coupons covered by the sealant in the pond structure which are available for inspection. Any defects in the sealant will be repaired under a separate safety justification specific to the circumstances at the time.

103. ONR permissioned the use of the sealant previously through licence instrument 506 Ref. [69]. The underpinning assessment accepted that the use of the sealant broadly met regulatory expectations and was an adequate means to contain contamination in the remaining epoxy paint layer Ref. [70]. However, it was noted that there would be a

requirement for inspection and monitoring of the sealant, with the ability for repair, as required.

104. The pond sealant will be monitored throughout C&M stage by periodic visual inspection. Inspections carried out to date using high performance lighting and cameras have provided operational evidence that defects can be observed effectively Ref. [56], based on the resulting images and supporting records.

105. The sealant inspections will be carried out as part of the civil engineering inspections, expected to take place every 5 years Ref. [56]. The PAR supporting the use of the sealant suggested that the inspections should be more frequent than this during the early years of C&M to gain confidence in the performance and adequacy of the sealant Ref. [69]. In support of 5-yearly inspections, ML reported that the sealant has been inspected during 6-monthly system inspections since its installation in around 2013 Ref. [71] and so far, and the findings from these inspections have not highlighted any significant degradation in the sealant or issues with adherence to the wall surface.

106. In the event of sealant failure there would be no immediate safety concern or need for immediate action and any repairs could potentially be deferred for years without any safety related impact Ref. [69]. Any substantial ingress of water occurring would trigger the alarm and prompt appropriate remedial action.

107. ONR consider these arrangements are adequate to manage the ponds safestore in compliance with LC34 during C&M.

5.3.5 Radiological Protection

108. The radiological protection arrangements ML will use for C&M are a continuation of the current arrangements suitably adapted to account for the remote management of the site and the working of smaller groups. The work will be planned at Sizewell A site using dose assessments detailing the remaining elevated dose rate areas on the site. Dose rates have been obtained via direct measurements and subsequent modelling to underpin the arguments made. The C&M transition team at Bradwell have also produced computer aided design drawings of each area at Bradwell with both radiation protection and asbestos information included. These will be available on the Knowledge Information Data Library (KIDL) for C&M and summarised in the C&M information packs.

109. When the site is accessed and the reactor safestores and ponds complex are opened up for maintenance or repair, the operators will face a combined risk of potential exposure to radiological and asbestos hazards which may have occurred since the previous entry. There is also a risk from conventional health and safety concerns due to possible structural degradation of stairways, handrails and elevated grated walkways. The process and procedures used for compliance with the licence conditions and the IRR's will be based on the existing procedures used at Bradwell to enter potentially contaminated areas, suitably adapted for remote deployment with a reduced staffing level and site infrastructure.

110. When access to the Bradwell site is required, doses to persons will be estimated along with the asbestos and conventional health and safety risks in order to produce a comprehensive risk assessment. Control on-site will be via the access management arrangements with monitoring and appropriate personal protective equipment. All the dose metering equipment and PPE required will be provided along with suitable numbers of SQEP radiological personnel in order to ensure that all work on the site continues to comply with the requirements of the site licence conditions and the IRR's.

111. Radon is a naturally occurring radioactive gas that is present on the site. ML has undertaken a campaign of radon monitoring at various points around the radiological

controlled area (RCA) in 2017 and the available data confirms that there is no concern regarding the levels of radon present. However ML has agreed to develop a programme of radon monitoring during the lead up to entry into C&M and during the initial stages of C&M. This will allow better understanding of radon levels during C&M and will be managed by Sizewell A with appropriate controls introduced should the review of the radon levels require any action Ref. [61].

112. The dose predictions for asbestos removal from the reactor vessel support the conclusion that it is not feasible to clear the Reactor 1 and 2 vessel external surfaces of asbestos due to the high radiation doses received and poor access restrictions in and around the RPV (see section 5.3.2).

113. Dose assessments for working with the DCIC packages are within legal limits. The ISF consists of an ILW storage area surrounded by a shield wall sufficient for DCICs stacked 2 high. During the initial period of C&M, DCICs will be received from the other ML south eastern sites, requiring routine external package inspections and maintenance. The ISF will store this inventory of ILW during C&M until consignment to the GDF. The ISF includes an inspection and maintenance area within.

114. The ISF does not provide any containment function as its purpose is to provide a weather protection maintaining environmental conditions to prevent any significant degradation of stored material. There is no forced ventilation or filtration. The DCIC waste packages provide primary containment and contain ILW conditioned to a passively safe condition that does not require any active management to maintain safety.

5.3.6 Civil Engineering Topic Assessment

115. This assessment focussed on the structures that contain nuclear matter, or provide effective radiation shielding, or are important in maintaining the future integrity of those containment or shielding structures. Within the Reactor Safestores, these are the two RPVs, the 12 boilers, the primary circuit ducts that connect them, all their support structures, and the two buildings that house them.

116. This assessment is a continuation of one started in 2010 Ref. [72]. The scope of this report covers the updates to the previously assessed Stage Submissions, and concentrates on the outstanding work items and commitments identified in that first AR.

117. The Pond Safestore was not included in this assessment sample as the significant civil engineering related risks have been adequately addressed during the historical interventions Ref. [73]. Therefore this assessment concentrated on the reactor safestores as the ISF is a modern standards store and the risks from the ILW were considered in the ONR assessment.

118. One output from the previous assessment of the Reactor Safestores is a list of outstanding items that are required to be completed before the site enters the C&M stage. The basis of the assessment was to check and comment on the progress on these items, which were: -

- Design and install the boiler support reinforcement scheme
- Design and install additional duct supports
- Complete structural inspections and repairs identified in Ref. [73]
- Assess the suitability of the existing site rainwater drainage system
- Document the above in an Addendum to Stage Submission 1
- Devise the inspection and maintenance schedule and procedures (Stage Submission 7 appendices Ref. [74]

- Collate relevant information for future inspection, maintenance and repairs of the cladding, its support structure, and the drainage systems for the knowledge centre (the 'Hub').

119. Planned EIMT (Examination, Inspection, Maintenance and Testing) for the Reactor Safestores will be undertaken every 5 years, but initially annual inspections of some newly installed structures will take place. The planned activities include inspection of the civil structures and the weatherproof envelope, and the maintenance of the water detection and retrieval system. The recent over-clad is guaranteed by the manufacturer for 40 years, and as the C&M phase is currently scheduled to end in 2083, it is expected that a recladding of the Reactor Safestores may be necessary.

120. Short term loss of weather protection can be tolerated. However it is important to ensure that repairs are implemented promptly to prevent the acceleration of moisture-induced corrosion through water ingress. Following any extreme external event, ML. will commission inspections and take appropriate remedial or recovery action as soon as reasonably practicable.

121. External hazards have been considered including a seismic event (which is the dominant load case for the boiler supports), high winds (which dictate the design of the cladding), flooding, extreme temperatures, snow and ice, lightning, and man-made external hazards such as radio frequency and electromagnetic interference, off-site explosions, and missiles. The return frequencies considered for these events are as follows:

- Seismic event: 1 in 1000 years
- Coastal and rainfall flooding: 1 in 1000 years
- Storm winds: 1 in 100 years
- Snow and ice: 1 in 100 years
- Extreme temperatures: 1 in 100 years

122. Water level detection will be installed to monitor the water in the voids which will alarm at a monitoring facility and a commitment has been raised to track this to completion. Given the expected low rate of arisings, response to the alarm is not time critical. This level detection alarm will be set such that it provides an indication of water ingress being present but allows the C&M management organisation time to respond prior to the water level becoming an issue.

123. The existing Maintenance Schedule (MS) is being modified in parallel with the on-going changes to the plant and building configuration. This means that a completed version of the MS for C&M was not available for review. However, ML demonstrated that the important elements of an adequate MS are contained in the reference documents from which the MS will be compiled. Several queries on the MS and the EIMT arrangements were raised by ONR, all of which were satisfactorily answered by ML, Ref. [56]

124. ML has worked to eliminate the need for active systems on the site in order to justify a site-wide, 5-yearly inspection frequency. This frequency aligns with previously agreed arrangements for the inspection and maintenance of civil engineering structures under Licence Condition 28. Reactive inspections will be undertaken following any extreme weather event and the Reactor Safestores have no features such as roof drains, gutters or downpipes that could be blocked by vegetation or nesting birds. Therefore the 5 yearly inspections are considered to be acceptable.

5.3.7 Leadership and Management for Safety (LMfS)

5.3.7.1 Management of SQEP Capability

125. In order to prepare for the site entering C&M, ML has undertaken a programme of work to establish a management capability at the Sizewell A site that will run the Bradwell site in C&M and the work has been monitored and inspected by ONR as part of its assessment as it has developed.

126. The work can be broken down into several topics as follows:-

- Creating a workforce of Bradwell competent persons at Sizewell A
- Developing the remote management procedures and quality plans
- Retaining essential knowledge for future reference
- Demonstrating readiness
- Transferring ownership from Bradwell site to Sizewell A site.
- Creating a workforce of Bradwell competent persons at Sizewell

127. ML has carefully managed the staff at the Bradwell site, reducing numbers as the various projects reached completion. Personnel who wish to carry on working for ML have been retained in the organisation where possible. Others were advised when they would be made redundant following completion of the work they were involved with. During the period of preparation for C&M ONR received no complaints from Bradwell staff regarding their treatment.

128. As the work to prepare for C&M entered its final phase in mid-2017 the reduction and subsequent re-organisation of staff became a challenging exercise due to the level of control put on the staff competency management and the stringent authorisation process for nuclear supervisory and management roles. The level of control applied was equivalent to that for an operating nuclear reactor. This was considered disproportionate for the levels of risk given the site had de-fuelled, nearly completed its programme of ILW processing and had adopted office hours working four days a week. Therefore more proportionate arrangements managed under the auspices of a Resources Governance Panel were trialled and were very successful in providing an appropriate but more proportionate level of control of staffing changes. These arrangements are now being adopted fleet-wide.

129. There is insufficient work remaining on the Bradwell site to justify a dedicated Bradwell specific workforce in C&M. Therefore ML identified staffing levels on the basis of the remaining workload and then assigned Sizewell A staff to cover this work retaining key suitable Bradwell staff by transferring them to Sizewell A station where possible.

130. The training and familiarisation programme for SZA staff ran to some 3000 hours of training with up to sixty Sizewell A staff attending the Bradwell site for familiarisation and training over the C&M preparatory period.

5.3.7.2 Development of the remote management systems

131. The operating procedures and quality management system at Bradwell ran to some 855 documents, many of which were concerned with redundant equipment that had been removed and disposed of, and management processes that were no longer relevant.

132. Review of the documentation identified 190 documents that needed to be retained for C&M operations and these have been updated to reflect the state of the site in C&M operations and re-formatted to become part of the Sizewell A management system. Several new procedures have been added to cover specific operations that will commence once the site is in C&M such as deploying to Bradwell from Sizewell A and opening up and entering the facilities.

133. Very few operating processes and alarms remain for C&M operations as the site has been designed to adopt a passive operating state not requiring operator intervention. Only a handful of alarm signals remain active, some for the Interim Storage Facility ISF, water ingress monitors in the safestore voids and ponds complex and security intruder detection. A new site access gatehouse has been provided and a remote monitoring system installed to provide for 24/7 monitoring of the site via a software link between the sites.

5.3.7.3 Retaining essential knowledge

134. ML recognises the necessity of retaining essential knowledge of the site for use by future generations both for the C&M operations and the eventual site clearance. The site was divided into 28 functional units and for each unit a pack of information was prepared. These packs, known as 'C&M Information Packs', provide all the relevant historical, operating, maintenance and design information required to underpin the remaining lifecycle of the site.

135. These packs are available on a new knowledge and information data library (KIDL), a bespoke software documentation database which also stores all the drawings, operating procedures, quality plans and records relating to the site. A graphical user interface (GUI) is used to make the system user friendly and promote the rapid retrieval of information.

136. ONR has witnessed demonstrations of the system and is satisfied that Magnox Limited has introduced a suitable knowledge management system that is consistent with the requirements of Licence Condition 6, Documents, Records, Authorities and Certificates.

137. ONR is satisfied that Magnox Limited has adequately managed its organisation in preparation for Care and Maintenance and is compliant with Licence Condition 36 (Organisational Capability).

5.3.8 Electrical and Control & Instrumentation (EC&I)

138. The Bradwell C&M Safety Case stage submission documents presented its analysis of requirements and arrangements of the EC&I systems necessary to support the site during its C&M phase and based on this the following key safety case claims were identified which formed the basis of ONR's assessment:

- No EC&I safety measures are required.
- There are no time critical demands on EC&I systems.
- Adequate EC&I monitoring, examination, inspection, maintenance and testing arrangements will be implemented.
- Site EC&I monitoring and alarms will be adequate.
- Entry into C&M will only occur once all of the relevant EC&I licensee 'Commitments' have been satisfactorily completed.

139. ONR did not identify any information that would undermine the five key safety case claims or its judgement that EC&I relevant risks have been reduced so far as is reasonably practicable.

140. The electrical supply connection to the site is via a single circuit to the electrical distribution network operator and therefore a loss of power may be relatively more frequent and of longer duration than if the connection was via multiple circuits. ONR guidance expects there to be a suitably independent and diverse engineered back-up source (e.g. diesel generators) with the ability to power relevant safety-significant systems. However, this guidance is intended for operating nuclear reactors and is not considered relevant here since the licensee has justified that there are no time critical

demands on EC&I systems and there are no electrically powered safety mechanisms, devices and circuits (SMDC's) required in the interests of safety.

141. A battery-backed uninterruptible power supply (UPS) is provided for the security system. This is consistent with good practice as it will isolate this system from power dips on the main site supply and provide for continued operation for a number of hours should the main supply fail. However if the UPS were to fail, the security arrangements are such that radiologically significant areas will take some significant time to access and so there is no scenarios which will require an urgent response to prevent a radiologically release. Also should the security system fail and the site is unmanned, the failure would be revealed through loss of communications alarm at the remote location.

142. The EC&I equipment is conventional and similar to other EC&I engineering assets that the licensee routinely manages. Appendix C of Reference 7 sets out the EIMT activities required for C&M, including the relevant inspection frequencies. Therefore ONR is confident that overall fit for purpose security and C&I arrangements have been put in place. ONR will continue to monitor the systems as part of the routine regulatory activities via the future site inspection programme.

5.3.9 Conventional Health and Safety

143. The most significant conventional health and safety risk during Care and Maintenance is created by the remaining asbestos containing materials (ACM) that were used extensively in the construction of the site.

144. ML has removed all the asbestos as far as is reasonably practicable, removing and disposing of some 4000 tonnes of asbestos. However asbestos containing materials still remain in places such as the cladding of the reactor pressure vessel (RPV), through wall penetrations and pipework gaskets where removal would entail significant intrusive work. The amount of cost and effort to dig into the concrete walls and dismantle the remaining primary circuit pipework to remove it would be difficult, costly, incur significant radiological dose penalties and would impair the containment of the graphite core and the integrity of the affected walls.

145. Therefore the strategy adopted by ML is to seal the remaining ACM into the structure and monitor during the period of C&M to detect any degradation of the material by means of testing for loose ACM fibres. During C&M, checks for ACM contamination will be performed as part of the setting to work process and routine checks of the facilities will be scheduled as part of the asset care programme.

146. The setting to work procedure will also be instrumental in addressing other conventional risks such as falling from height and compliance with the requirements for safe access and egress and sound working conditions. This is covered in the general findings section above.

147. The ONR assessment concluded that ML has well established asbestos management arrangements; however, there are areas where improvements were advisable to ensure that the arrangements to manage ACMs during C&M remain effective.

148. During the assessment, issues were raised regarding areas for improvement, including improving the quality of the asbestos register; the justification for ACM condition monitoring intervals; how radiological protection arrangements influence asbestos management; developing assurance arrangements for entry into C&M and provision of information to workers that may disturb ACMs. These issues were incorporated in the table of fifty six issues raised by ONR and were subject to adequate responses by ML, Ref. [56]

5.3.10 Security

149. ONR Civil Nuclear Security inspectors have conducted a number of inspections to confirm ML's readiness to manage security at the Bradwell site during C&M. Analysis stemming from these inspections has informed the security conclusion that ML has demonstrated adequate security arrangements and appropriate readiness to enter C&M.

150. This report does not discuss the detailed security arrangements as these are classified. However, in general the security of the site is assured by a fortress approach. The facilities remaining on the site are secured and monitored in a manner such that any intruder trying to access them would be detected and prevented from entering a sensitive area for a length of time sufficient to mount a suitable emergency response.

5.3.11 Emergency Arrangements for the C&M Period.

151. The Radiation Emergency Preparedness and Public Information Regulations 2001 (REPPIR) require the operator to identify hazards and risks to establish whether a radiation emergency is reasonably foreseeable. (A radiation emergency is one which could lead to exposure of a member of the public to ionising radiation in excess of 5mSv in the year following the event.) In such cases, the regulations require a Local Authority Off-site Plan to be in place for mitigating the consequences of such an event and within which the operator must supply the public with specific information related to the event within a defined zone around the site.

152. The major contributor to the hazards on nuclear power generation sites is the nuclear fuel, and after cessation of generation in decommissioning stations when all the fuel has been removed from the site, the hazard is significantly reduced to the extent where the risks to the public are likely to be below the REPPIR trigger levels. This is confirmed for each site through a review of the Hazard Identification and Risk Evaluation (HIRE) report which is produced for these sites as a requirement of REPPIR and which is subject to a statutory 3 yearly review.

153. At Bradwell, the defueling and despatch of all fuel from the site was completed in 2006. ML then re-baselined the safety case for the site to reflect the hazards associated with a defueled site (the Re-baselined Post-Defueling Safety Case – RPDSC). Ref [75]. The fault schedules associated with this safety case were also subsequently reviewed in support of a new HIRE report Ref. [76] for REPPIR which was issued in November 2012. This concluded that there were no foreseeable faults in the current safety case or those envisaged for the C&M Preparations and C&M 'Quiescent' phases (including ISF storage) that could lead to a radiation emergency as defined in REPPIR.

154. ONR undertook an assessment Ref. [77] of the suitability and sufficiency of this HIRE for the purpose of determination of the Bradwell emergency Planning Zone and found it to be satisfactory. It also concurred with the licensee's conclusion that there were no fault sequences that could lead to a radiation emergency and accordingly recommended re-consideration of the requirement for a REPPIR off-site emergency planning area at Bradwell.

155. ML formally submitted its Report of Assessment of the HIRE Ref. [78] under cover of a letter Ref. [79] in January 2013 with a request for agreement to withdraw the Bradwell off-site emergency plan based upon its conclusions. ONR has a legal responsibility under REPPIR to define an off-site emergency planning area and area within which public information must be provided, and accordingly carried out an assessment of this submission.

156. The conclusion of ONR's determination Ref. [80] was that a radiation emergency as defined in REPPIR is no longer judged to be reasonably foreseeable for the Bradwell site and that there is thus no need for a local authority off-site plan under REPPIR or for the provision by the operator of prior information to the public. However, the radioactive inventory at Bradwell continues to exceed the specified quantities set out within REPPIR and this obliges ML to continue to review and submit a HIRE periodically or following a material change in the work with ionising radiation. Also the removal of the requirement for an off-site plan does not obviate the legal requirement under Licence Condition 11 for the operator to make and implement adequate arrangements for dealing with any accident or emergency on the licensed site.

157. ML is therefore required to have suitable arrangements in place under Licence Condition 11 for its on-site management of accidents that may occur at any time within the C&M period whilst Bradwell remains a licensed site. These arrangements do not require an Operators Plan for dealing with foreseeable radiation emergencies on the premises but must make contingency provisions under the IRRs for dealing with any radiation accident which may occur.

158. ML withdrew its Emergency Handbook for the site and issued a new set of Accident and Emergency Arrangements Ref. [81] based upon making contingency provisions for tasks undertaken on the reduced risk site. These arrangements were formally approved in September 2017 Ref. [82].

159. The level of residual risk is such that any events relating to nuclear safety during C&M no longer require an immediate response to maintain the protection of the public. The arrangements for emergency response will be implemented remotely by Sizewell A personnel and have been judged to fulfil the requirements for Bradwell site's compliance under the IRRs. This will accordingly obviate the need for ongoing approval of the Bradwell site's emergency arrangements under licence condition 11, which would represent duplicate control measures. The current approval for the 2017 Bradwell Accident and Emergency Arrangements has therefore been withdrawn and the site will therefore no longer be expected/required to submit changes to its arrangements to ONR for approval. Refs. [83] and [84]

160. With respect to the ongoing REPPIR requirement for review /resubmission of the HIRE, ML has fulfilled its legal commitment for triennial review of the HIRE with its declaration Ref. [85] in January 2016 of no detrimental changes since the last review. ONR's assessment of this review identified no associated questions and the declaration was formally acknowledged in 2017 Ref. [86].

161. The next review of the HIRE is due by January 2019. This will need to take account of the programme of transfers of ILW packages from Dungeness and Sizewell A sites to Bradwell during the C&M period in line with the strategy changes for consolidation and regionalisation of waste storage arrangements.

162. This will form a robust baseline for future reviews through the C&M period which should also maximise the potential to 'future-proof' assessments against any regulatory changes that may arise from the current review of the REPPIR regulations and guidance.

5.3.12 Closure of Magnox Limited's Commitments.

163. As part of the assessment of the C&M safety case a review the documentation developed for BWA's entry to C&M during these preparations over the last 8 years was undertaken to check the consistency of the trail of agreed commitments from the various original submissions in 2011, through the closure processes for findings and commitments, to the planned configuration at entry to C&M at the end of 2018.

164. The site configuration and justification for entry to C&M was presented in a Paper of Intent supported by seven stage submissions issued between 2010 and 2014 Refs. [6] - [12] and the Periodic Safety Review submissions in 2011 Refs. [28] - [36].

165. The commitments from the original stage submissions covered various specific improvements and a number of proposals for major projects such as the construction of the safestore weather envelopes, the ponds stabilisation/sealing programme, the Interim Storage Facility construction for ILW packages, the reinforcement of boiler support arrangements, and the containment provisions for contaminated land, as outlined in the 'Initial Stage Submissions' section earlier. Assessments undertaken on these various submissions including the PSR identified a number of findings which were integrated into lists with ML's ongoing commitments.

166. As these projects were progressed, optimisation of the strategy for decommissioning and radioactive waste management was continuing at a corporate level within Magnox and associated adjustments were made to the planned site configuration and C&M arrangements for Bradwell. This led to a need to update the safety justifications supporting the site's entry to C&M which was done through a revised Paper of Intent and a set of addenda to the original stage submissions in 2017 Refs. [21] - [26].

167. In preparing these safety case updates ML consolidated a number of further work commitments and rationalised these into new integrated work lists incorporating the extant commitments from the various original submissions. It also established the basis for an EMIT schedule founded on the updated safety case requirements Ref. [87].

168. ML also instituted a process for management of its commitments and produced reports on the closure of commitments associated with each of the stage submissions.

169. The ONR Project Support lead for ML has undertaken a sample check of the claims commitments and assumptions written into the original stage submission safety justifications, the assessment findings from these and the projects arising from them, and the findings from the 2012 PSR.

170. A number of potential anomalies or omissions were identified through this review and these were referred as appropriate either to Magnox Ltd or to the ONR specialists for further consideration. A file note was prepared to summarise this review for the record Ref. [88].

171. The matters identified from this review have been followed through and with minor exceptions all have been satisfactorily addressed or have been shown to have a satisfactory route to closure largely through the EMIT schedule which will be finalised shortly before the planned entry of the site into the C&M stage.

172. The minor exceptions are that the decision relating to the unloading of the springs on redundant duct hangars and the confirmation of adequacy of redundant building base slabs for containment should be completed before entry to C&M. Also the absence of specific maintenance tasks for management of sterile zones around the safestores should be addressed. These matters have been highlighted in a letter to Magnox Ref. [89] along with some detailed inspection/maintenance related recommendations for justification or incorporation into the EMIT schedule as it is finalised.

173. Given the referral of the above matters to ML to highlight the minor potential anomalies identified and ONR expectations, it is considered that ML has satisfactorily demonstrated a sufficiently robust and consistent process for tracking, implementation, and closure of the relevant commitments and findings arising from the safety justifications supporting entry to C&M.

5.3.13 Demonstrating readiness

174. In order to test the management arrangements ML undertook a series of operational commissioning tests. The key tests were observed by ONR inspectors and ONR's comments were captured as part of the test close out procedure.

175. The tests covered operations on the site including:-

- Receiving persons and contractors onto site
- Entering and establishing a worksite in the safestore facilities
- Receipt and package handling in the ISF
- Radiological Waste control procedures.

176. The tests were undertaken during July and August 2018 and were successful in providing assurance that the management arrangements proposed for C&M would be adequate to run the site safely during this period. Refs. [90] and [91]

5.3.14 Granting Consent

177. ML has applied for ONR Consent at a point where beginning the transition to the C&M regime offers the most efficient transition to occur. ML has supported its application with a dedicated 'Justification for Entry to C&M' report, Ref. [92]. This report sets out precisely the site state and the level of completion of the management arrangements necessary for ML to feel comfortable about requesting consent.

178. The document bases the application on completion of the physical preparation work and the management arrangements for the four remaining facilities along with the security system and the drains arrangements. This means that some work will continue past the point where consent is granted (such as landscaping the site and removing the management Porta-Cabin complex and demolishing the old training facility). ML has committed to complete the site preparations programme by end of March 2019 and issue final C&M safety case and PSR reports to close out the C&M safety case and PSR submission.

179. The transition to full operation in C&M is likely to take several years. In addition to the completion of the site physical works and the management arrangements, the site has not yet been authorised for normally unmanned operations. Therefore it is likely that the site will continue with a 24/7 security presence for some time until normally unmanned operations are authorised. At this time ML will need to make an additional submission to ONR security section under the security regulations to permission the change.

180. ILW packages will continue to be shipped from Dungeness A and Sizewell A to the ISF at Bradwell in a programme currently scheduled to complete in 2021. This does not require additional permissioning by ONR, as it is already covered under the existing arrangements and procedures which will continue in C&M. Therefore, the shipments are not affected by the transition.

181. At some more distant point in the future, when enough of the ML fleet have entered C&M, ML plans to adopt the management of the fleet via a central hub organisation. It will not be viable to set this up until there are a reasonable number of stations in C&M. Once ML is ready to set up the central hub the transition of the management of the Bradwell site from Sizewell A to the central hub organisation will probably be permissioned under a separate LC 36 submission (organisational capability).

182. A readiness inspection was undertaken encompassing both sites to review the readiness against the Justification document Ref. [93] And it was considered that the

site would be ready to apply for consent in early November. A subsequent check visit was undertaken in October 2018 Ref. [71] and the finding was that Bradwell had reached a satisfactory level of readiness for ONR to grant the consent to enter C&M.

5.3.15 Other Government Regulatory Bodies

183. ONR works jointly with the Environment Agency (EA) regarding the regulation of nuclear sites. Over the sixteen years that Bradwell has been in decommissioning there has been consistent regular communication between the ONR and EA staff involved in the regulation of the Bradwell site.

184. In March 2017, when it was recognised that the site was quickly approaching the point at which it could enter C&M, ONR and EA agreed with ML to hold bi-monthly joint regulator meetings to review Bradwell's preparations for C&M together and ensure that the regulation of the site from both nuclear safety and environmental safety were properly co-ordinated. Nine joint regulatory meeting have been held at roughly two-monthly intervals over the intervening period and at the meeting held on the 9th August 2018, EA confirmed that it has no objection to the Bradwell site entering C&M Ref. [94] and [95].

6 CONCLUSIONS

185. The conclusions of the ONR assessment are:-

- The Bradwell site is ready to enter C&M
- The Sizewell A site is ready to manage the Bradwell site remotely.
- The small amount of work still to complete is not significant or critical to maintaining nuclear safety. ML has committed to completing this work by March 2019.

7 RECOMMENDATIONS

186. The project assessment report recommends;-

- A Consent should be issued to permission the Bradwell site to enter the Care and Maintenance stage of decommissioning.
- The PSR should be accepted and a period of twelve years set until the next review.

187. To conclude, I am satisfied with the claims, arguments and evidence laid down within the Bradwell C&M Submission and have no reservations about granting consent for the site to enter C&M.

8 REFERENCES

[1] "BWA53396 - Bradwell Request for ONR Consent to Enter the Care and Maintenance Stage - 6 November 2018 (TRIM: 2018/361554)".

[2] "Licence Instrument No. 516 Letter out and Specification for Bradwell into Care and Maintenance 14 July 2017 TRIM 2017/272604".

[3] "BWA53396 - Bradwell Request for ONR Consent to Enter the Care and Maintenance Stage. (TRIM: 2018/360888)".

[4] "ONR-SDFW-PAR-17-001 Rev0 V2 Specification for Entry of Bradwell Licensed Nuclear Site into the Stage of Care and Maintenance. TRIM 2017/278020".

[5] "MS/NSC 1038 Addendum 1. Bradwell Site. 3. Paper of Intent. Care and Maintenance Safety Case March 2010 TRIM 2011/196072".

[6] "DPAF/4286-SS1 Care and Maintenance Safety Case, Stage Submission 1 – Reactor Safestores, Issue 2, Nov 2010, TRIM 2011/196076".

[7] "DPAF/4286-SS2 Care and Maintenance Safety Case, Stage Submission 2 – Fuel Cooling Ponds Complex, Issue 3, Dec 2010, TRIM 2011/196083".

[8] "DPAF/4286-SS3 Care and Maintenance Safety Case, Stage Submission 3 – Active Waste Vaults, Issue 2, Feb 2014, TRIM 2014/63168".

[9] "DPAF/4286-SS4 Care and Maintenance Safety Case, Stage Submission 4 – Land Contamination and Balance of Plant, Issue 2, March 2013, TRIM 2014/10840".

[10] "DPAF/4286-SS5 Care and Maintenance Safety Case, Stage Submission 5 – Interim Storage Facility, Issue 1, March 2014: Ref12 within TRIM 2017/276331, and supporting Pre-Operational Safety Report DPAF 4348-POSR 19/12/13 (TRIM: 2013/471706)".

[11] "DPAF/4286-SS6 Care and Maintenance Safety Case, Stage Submission 6 – Site Infrastructure, Issue 2, Jan 2013: Ref13 of 'References' contained within TRIM 2017/276331".

[12] "DPAF/4286-SS7 Care and Maintenance Safety Case, Stage Submission 7 – Safety Management Arrangements, Issue 2, March 2013, TRIM 2013/160161".

[13] "M/WF/GEN/REP/0008/14 Issue 1. LC35 Decommissioning Programme Change justification. Magnox Radioactive Waste Management Strategy. May 2016 TRIM 2016/407351".

[14] "S-036. Issue 6 Integrated Decommissioning and Waste Management Strategy. July 2016. TRIM 2016/441571".

[15] "Letter MXL90021N. [redacted] to [redacted] 29 May 2015 'LC35 Decommissioning – Proposed Magnox Radioactive Waste Strategy TRIM 2015/187119".

[16] "Letter MXL90037. 19 April 2017. [redacted] to [redacted] Re-alignment of Site LC35 Programmes with Lifetime Plans. TRIM 2017/156764".

[17] "Letter MXL90041N. 27 Oct 2017. [redacted] to [redacted] Proposed Changes to LC35 Decommissioning Programmes for Asbestos Management. TRIM 2017/399336".

[18] "CM-REP-001 Issue 2. Care and Maintenance Entry Specification, Management and Transition Arrangements December 2015 (Approved for issue Feb 2016). TRIM 2016/447058".

[19] "BRAD/REP/ENG/001 Issue 9. Bradwell Site. Care and Maintenance Phase Plant Configuration and Control. Sept 2016 (Reference 3 attached to Bradwell C&M Safety Case Stage Submissions Paper of Intent) TRIM 2017/276331".

[20] "BRAD/C&M/REP/024 Issue 2. Bradwell Site. C&M Entry State Definition. Sept 2016. (Reference 5 attached to Bradwell C&M Safety Case Stage Submissions Paper of Intent) TRIM 2017/276331".

[21] "Bradwell Site. Care and Maintenance Safety Case. Stage Submission 1. Addendum 1. - Reactor Safestores. BWA/DPAF4286/SS1-Addendum 1 June 2017 TRIM 2017/276367".

[22] “Bradwell Site. Care and Maintenance Safety Case. Stage Submission 2/3. Addendum 1. - Ponds and Vaults. BWA/DPAF4286/SS2/3- Addendum 1 June 2017 TRIM 2017/276379”.

[23] “Bradwell Site. Care and Maintenance Safety Case. Stage Submission 4. Addendum 1. - Land Quality and Concrete Structures. BWA/DPAF4286/SS4- Addendum 1 Issue 1 March 2015 TRIM 2017/276390”.

[24] “Bradwell Site. Care and Maintenance Safety Case. Stage Submission 5. Addendum 1. - Intermediate Level Waste Storage. BWA/DPAF4286/SS5- Addendum 1 June 2017 TRIM 2017/276407”.

[25] “Bradwell Site. Care and Maintenance Safety Case. Stage Submission 6. Addendum 1. - Site Infrastructure. BWA/DPAF4286/SS6- Addendum 1 March 2016 TRIM 2017/276432”.

[26] “Bradwell Site. Care and Maintenance Safety Case. Stage Submission 7. Addendum 1. - BWA/DPAF4286/SS7- Addendum 1 July 2017 (TRIM: 2017/276441)”.

[27] “MS/NSC 1005 Addendum 2. Bradwell Site. Periodic Safety Review to Justify Continued Decommissioning Activities beyond March 2012 – Outcome Report. 27 Jan 2011 TRIM 2011/86941”.

[28] “Bradwell PSR Topic Report No.1 Management of Safety and the Environment. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195537”.

[29] “Bradwell PSR Topic Report No.2 Primary Gas Circuit and Internals. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195549”.

[30] “Bradwell PSR Topic Report No.3 Reactor Civil Structures. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195554”.

[31] “Bradwell PSR Topic Report No.4 Active Waste compound and Active Effluent Treatment Plant. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195742”.

[32] “Bradwell PSR Topic Report No.5 Low Level Waste Management Facilities. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195758”.

[33] “Bradwell PSR Topic Report No.6 Ponds Complex Including Pond Water treatment plant. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195790”.

[34] “Bradwell PSR Topic Report No.7 Land Contamination. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195795”.

[35] “Bradwell PSR Topic Report No.8 Site Infrastructure. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195802”.

[36] “Bradwell PSR Topic Report - External Hazards. PSR to Justify Continued Decommissioning Activities beyond March 2012. TRIM 2011/195806”.

[37] “Bradwell Periodic Safety Review: Decision letter following ONR Assessment. BWA80038N 23 March 2012. TRIM 2012/127731”.

[38] “NP/SC 5132 Rev 1 Paper for Information: Optimisation of the LC15 Periodic Safety Review Programme. Sept 2012 TRIM 2012/372839”.

[39] “Intervention /Project Task sheet for Assessment and Permissioning of Bradwell Site Entry into C&M TRIM 2017/342017”.

[40] “BRAD/PSR/REP/030 Issue 1. Bradwell Site. Periodic Safety Review to Justify Continued Decommissioning Activities beyond March 2012 – Additional Review of Compliance with LC32 and LC34 to support the 2012 PSR. Feb 2013 TRIM 2013/129434”.

[41] “Magnox - Bradwell - Periodic Safety Review - Close out of Priority 1 and 2 Findings and The Forward Improvement Plan - BWA52317 - 22 March 2012 TRIM 2012/130530”.

[42] “Final Report of the PSR to Support Continued Decommissioning Activities beyond March 2012. NP/SC 5177 Issue 1 March 2013 (BRAD/DPAF/NSSR/4226) TRIM 2013/137047”.

[43] “ONR-BRA-PAR-12-063, Bradwell - Reactor Safestore Cladding - Relating to LI No.505 (TRIM: 2013/35725)”.

[44] “ONR-CNRP-AR-12-145 Bradwel C&M - Civil engineering assessment (TRIM: 2013/425632)”.

[45] “Bradwell Safestore Ventilation Design Report Assessment - [redacted] 20 December 2012 (TRIM: 2012/500990)”.

[46] “ONR-BWA-PAR-13-014 Bradwell Pond C&M Entry State Revision 0 (TRIM: 2013/166534)”.

[47] “ONR-DFW-AR-13-063 Bradwell C&M- Stage Submission 4 Land Quality and Balance of Plant Revision A (TRIM: 2013/425632)”.

[48] “ONR-SDFW-AR-17-104 Bradwell C&M PSR – Assessment of the Structural Integrity & Mechanical Engineering aspects, 11 June 2018. (TRIM: 2018/68847),”.

[49] “ONR-SDFW-AR-18-020 Bradwell - Care and Maintenance (C&M) Safety Case - Assessment of the NLR aspects of the C&M safety case, 5 September 2018 (TRIM: 2018/286809)”.

[50] “ONR-SDFW-AR-18-056 Bradwell C&M, Assessment of the Radiological Protection aspects, 5 October 2018. (TRIM: 2018/316866)”.

[51] “ONR-SDFW-AR-18-22 Bradwell C&M, Assessment of the Civil Engineering aspects, 11 July 2018 (TRIM 2018/189546)”.

[52] “ONR-SDFW-AR-18-47 Bradwell Site Care and Maintenance - LMfS assessment – 28 August 2018, (TRIM: 2018/273920)”.

[53] “ONR-SDFW-AR-17-117 Bradwell C&M Permission - EC&I Assessment Report 28 June 2018: (TRIM: 2018/163384)”.

[54] “CHS assessment (TRIM: 2018/141662)”.

[55] “Letter BRD 7042 Amendment No. A001 – Bradwell Nuclear Site Security Plan Issue 5, 8 October 2018. (TRIM: 2018/325114)”.

[56] “IR ONR-SDFW-IR-18-126 Bradwell SBI on Preparations for Care and Maintenance Operations: Close out of ONR assessment issues,16-18 October (TRIM 2018/352135)”.

[57] “ONR – SDFW – CR – 17 – 665 Revision 0 – Contact Record - Bradwell Care and Maintenance (C&M) Mechanical Engineering and Structure Integrity Aspects – TRIM 2017/407397”.

[58] “ONR inspection at Bradwell, 24-26 April 2018. Contact record for NLR discussions (ONR-SDFW-CR-18-082) (TRIM: 2018/149938). NLR questions provided in advance (TRIM: 2018/149873) and Magnox written responses (TRIM: 2018/151894)”.

[59] “Intervention Report ONR inspctions at Bradwell 24-26 April 2018 (ONR-SDFW-IR-18-018; TRIM: 2018/157846)”.

[60] “Pre-Operational Safety Report for the interim storage facility at Bradwell for Ductile Cast Iron Containers containing Intermediate Level Waste (DPAF4348, Issue 1, December 2013) (TRIM: 2018/162352)”.

[61] “Magnox response to ONR questions, presented at waste programme level 4 meeting, December 2017 (TRIM: 2018/154147)”.

[62] “Schedule for receipt of DCICs from Dungeness A and Sizewell A (TRIM: 2018/98776)”.

[63] “Contact record: Bradwell Care and Maintenance joint regulatory project meeting, 27 March 2018 (ONR-SDFW-CR-17-1158) (TRIM: 2018/108207)”.

[64] “Dungeness A site: Container level quality plan for the transport of final disposal IP-2 MOSAIK DCICs for resins from Dungeness A site to Bradwell site for interim storage (DUN/WP/23605/QP/4025 Issue 4) (TRIM: 2018/73064)”.

[65] “Bradwell site, Index of areas of potential concern (BRAD/WMD/REP/5003, Issue 1, June 2012) (TRIM: 2018/238158)”.

[66] “S-154: Arrangements for the management of land quality. Issue 3 (TRIM: 2018/126099)”.

[67] “Technical basis for routine inspection, maintenance and testing/monitoring arrangements for land quality during Care & Maintenance period (Reference: 14514570395.502/A.1, January 2015) (TRIM: 2018/161838)”.

[68] “Inspection and monitoring strategy for ductile cast iron containers (MES/EST/MIMP/REP/0078/11), Issue 3, July 2015 (TRIM: 2018/161496).”.

[69] “Bradwell Care and Maintenance: Sealing of the redundant fuel cooling ponds. Agreement 506 (ONR-BWA-PAR-13-014) (TRIM: 2013/166534)”.

[70] “Bradwell Care and Maintenance: Radioactive waste management assessment of sealing of the redundant fuel cooling ponds (ONR-DFW-AR-13-025) (TRIM: 2013/162337)”.

[71] “IR ONR-SDFW-IR-18-126 Bradwell SBI on Preparations for Care and Maintenance Operations: Close out of ONR assessment issues - 16-18 October 2018, (TRIM: 2018/352135)”.

[72] “ONR Assessment Report, ONR-CNRP-AR-12-145, Bradwell Site, Care & Maintenance, Assessment of the proposals for the Reactor Safestores: Civil engineering aspects, January 2013. TRIM 2012/463915”.

[73] “Email from Civil engineering assessor to Project Inspector on Bradwell Ponds – outcome of meeting with Licensee on 17/7/12. 18/7/12. TRIM 2013/157347”.

[74] “Magnox Ltd., Bradwell Site. Care and Maintenance Safety Case, Stage Submission 7, Addendum 1 - Safety Management Arrangements. DPAF/4286-SS7 Addendum. July 2017. (TRIM 2017/276441)”.

[75] “Bradwell Re-baselined Post Defuelling Safety Case. DPAF/NSSR/3961 Issue 3. Aug 2008. TRIM 2008/601295”.

[76] “Bradwell Site: REPPIR Regulation 6(4) Hazard Identification and Risk Evaluation Assessment Report. M/EF/BWA/REP/0005/12 Issue 1. Nov 2012. TRIM 2014/232904”.

[77] “Assessment of Bradwell REPPIR Hazard Identification and Risk Evaluation (HIRE). Assessment report ONR-DFW-AR-13-061 Rev 1 Feb 2014 TRIM 2013/471502”.

[78] “Bradwell Site: REPPIR Regulation 6(4) Hazard Identification and Risk Evaluation. Report of Assessment. NP/SC 5163 Dec 2012 (TRIM: 2013/1462)”.

[79] “Bradwell HIRE. Report of Assessment. Letter no. BWA52538. 31 January 2013 TRIM 2014/232926”.

[80] “Project Assessment Report. ONR-COP-PAR-14-003. Determination of a Revision to the Extent of the Local Authority Off-site Emergency Planning Area and the Operator’s Prior Information Area under REPPIR. 20 June 2014. TRIM 2014/233625”.

[81] “Bradwell Accident and Emergency Arrangements BRAD/AEA Issue 2 12/4/2017. Attachment to letter BWA 53252 TRIM 2017/358680”.

[82] “Licence Instrument No. 517. Approval of Bradwell Accident and Emergency Arrangements Issue 2, dated 12/4/17. TRIM 2017/335045”.

[83] “Bradwell Site: LI 519 Withdrawal of Approval LI 517 under LC 11(3) for Emergency Arrangements (TRIM: 2018/322766)”.

[84] “ONR-SDFW-PAR-18-031 Bradwell LI 519 : Application for Approval under LC 11(3) of revised Bradwell Emergency Arrangements for C&M (TRIM: 2018/315406)”.

[85] “Bradwell Site HIRE Declaration Submission under REPPIR Regulation 6(3). Letter BWA53072. 6 January 2016. TRIM 2016/32058”.

[86] “ONR-EPR-Bradwell DNC (Declaration of No Change) Letter of Acknowledgement. 26 September 2017. EPR letter ref ONR-EPR-17-039. (TRIM: 2017/369047)”.

[87] “C&M Consolidation Compliance Maintenance Schedule Requirements from the Top-Down Review of the C&M Configuration BRAD/C&M/ REP/030 Issue1 June 2017 Ref 26 in attachment to Stage Submission 7 Addendum 1 TRIM 2017/276441”.

[88] “File Note FN-PC-18-01 Closure of Magnox Commitments and ONR assessment expectations TRIM 2018/172308”.

[89] “BWA 80081R letter re Magnox Response to BWA80080R. – (overview of matters requiring further consideration in development of the EIM&T schedule). 12 June 2018. TRIM 2018/195400.”.

[90] “ONR-SDFW-CR-18-338 - Bradwell Care and Maintenance Attendance at commissioning tests 2A, 2B, 3, 4, 8 and 16,- July 9 to 12th 2018 (TRIM: 2018/240965)”.

[91] “ONR-SDFW-CR-18-423 - Bradwell Care and Maintenance: Attendance at Commissioning tests 12 and 13 - 18 & 19 July 2018 (TRIM: 2018/257058)”.

[92] “BWA533400 - Bradwell Into C&M Draft Permissioning Documentation [OFFICIAL] (TRIM: 2018/354214)”.

[93] “ONR-SDFW-IR-18-100 Bradwell and Sizewell A SBI on Preparations for Care and Maintenance Operations: C&M readiness Reviews - 11-13, 19 September 2018, (TRIM: 2018/319565)”.

[94] “BWA53385, ONR CNS00317, EA58250 - Regulatory Level 4 Minutes [OFFICIAL] (TRIM: 2018/355945)”.

[95] “EPR/ZP3493SQ/V006: Re Consent for Bradwell site to commence Care and Maintenance operations. 9 November 2018, (TRIM: 2018/366599)”.