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HEALTH AND SAFETY EXECUTIVE
HM NUCLEAR INSTALLATIONS INSPECTORATE

PROJECT:	Preliminary Investigation Report
SITE:	Sizewell A
TITLE:	Uncontrolled Partial Emptying of the Sizewell A Irradiated Fuel Cooling Pond on 7th January 2007
NUCLEAR SITE LICENCE NO:	51

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SUMMARY

At 11:30hrs on Sunday 7th January 2007 the Main Control Room was notified by a contractor (an employee of [redacted]), who was sorting clothing in the Active Laundry, that a large volume of water was leaking onto the ground floor of the Effluent Treatment Plant. Investigation by Operations staff found the source of the leak to be a vertical longitudinal split in a section of 8in plastic pipe in the cooling pond recirculation system. The in-service pond water recirculation pump was manually shutdown, stopping the leak. It was established that the pond water level had fallen by 330mm below the normal working level, without any engineered alarms initiating, and therefore approximately 40,000 gallons, or 180m^3, of radioactive material had been released from the failed pipe. Most of this water was contained within the Effluent Treatment Building, however, Operators noted that some pond water had escaped from the building and entered the site's storm drain system which discharges directly to sea.

Between 23rd and 25th January 2007 the site inspector and a colleague were at site establishing the facts that contributed to the event. During part of the day on 25th January 2007 the Environment Agency site inspector joined them. It appeared that a number of Licence Conditions had been breached and that regulatory action was possible, however, the Licensee was extremely busy cleaning up the contaminated building, determining how to re-establish pond cooling and dosing, ensuring that the pond alarm system was working as intended and carrying out an investigation into the event. A decision was made by the NII team that there was no requirement for an immediate (Prohibition) Notice.

Following the teams return to the office they have compared the findings of their initial investigation with the HSE Enforcement Management Model and concluded that enforcement expectation is at least the issuing of an Improvement Notice or Direction, and that Prosecution should be considered. The report summarises the investigation to this point and recommends that a Direction, under the Licence Conditions, be issued.

BACKGROUND

Status of Power Station

1. Sizewell 'A' power station was shutdown, and ceased to generate electricity, on 31st December 2006. Both reactors at the site were in the process of being cooled and depressurised during the first week of 2007. By the 6th/7th January 2007 a lot of demineralised water was being used as the in-service boilers were providing forced reactor cooling by venting off steam (as a once through process). As many systems had been, or were being, taken out of service there were a considerable number of alarms either initiating or standing on many alarm panels around the site. Operators were very busy ensuring safety during the shut down process of both reactors. Also, because of this activity many additional engineers and technicians were on site that weekend.

The Plant

2. When magnox fuel is discharged from a magnox reactor it is highly radioactive and it gives off significant decay heat for some time. The Sizewell 'A' nuclear power station irradiated fuel cooling pond, commonly referred to as the pond, provides an underwater storage area for irradiated magnox fuel elements until their radioactivity and heat levels have decayed to a sufficiently low level to permit their despatch from site. Sizewell has a pond that serves both of its magnox reactors; it typically contains about 5000 irradiated fuel elements. It was constructed above ground in the period 1962 to 1965; it is a massive concrete structure with outer walls that are 6ft 3in thick. The pond water acts both as a coolant and a radiation shield and it is important that it is kept clean, chemically consistent (correct pH and composition) and maintained at the correct temperature and depth. When full the designer intended the total volume of pond water to be 767,000 gallons, and have a depth of 23ft 3in, so as to ensure that whenever skips of fuel are moved about within the pond there will be a covering of at least 12ft of water that provides adequate shielding.

3. The water in the cooling pond is circulated continuously through the cooling pond water treatment plant in order to (i) remove excess heat, (ii) control the level of radioactive impurities and (iii) maintain chemical conditions (primarily pH and carbonate content). Only one of the two installed pond water recirculating pumps is necessary when passing the water through the cooling, filtering and chemical dosing equipment at a rate of approximately 50,000 gallons/hour. Active effluent from the pond water treatment plant drains into storage tanks prior to treatment; after treatment it passes to the Final Monitoring and Delay Tanks from which it is discharged to sea.

4. Water level is maintained via manual control with demineralised water added when necessary; all as specified in operating instructions. The water level is monitored constantly by ultrasonic detectors. Should the level change

outside set limits then an alarm will be initiated on the Ponds Operating Panel that is located in the Active Effluent Treatment Building, and a group alarm will be raised on both of the Reactor Desks that are located in the Main Control Room.

The Event

5. At 11:30hrs on Sunday 7th January 2007 the Main Control Room was notified by a Plant Worker (an employee of [redacted]), who was sorting clothing in the Active Laundry, that a large volume of water was leaking onto the ground floor of the Effluent Treatment Plant. Investigation by Operations staff found the source of the leak to be a vertical longitudinal split in a section of 8in plastic pipe in the cooling pond recirculation system. The 15ft long split was in the discharge leg pipework of the shutdown recirculation pump that is pressurised from the in-service recirculation pump. The in-service pond water recirculation pump was manually shutdown, stopping the leak. It was established that the pond water level had fallen by 330mm below the normal working level and therefore approximately 40,000 gallons, or 180m^3, had been released from the failed pipe. Most of this water was contained within the Effluent Treatment Building, however, Operators noted that some pond water had escaped from the building and would eventually enter the site's storm drain system which discharges directly to sea.

6. The Shift Charge Engineer instigated the emergency plan and declared a Site Incident. The muster allowed all staff and contractors on site to be accounted for. Duty people arrived and the Emergency Control Centre (ECC) and Access Control Point (ACP) were rapidly established so as to manage control of the event. Reporting of the event via the Site Event Reporting System (SERs) commenced at 13:11hrs and the ECC was set up by 13:30hrs on 7th January 2007. The NII duty officer recorded that he was informed of the event at 14:00hrs on 7th January 2007. The Central Emergency Support Centre (CESC) took over management of the Site Incident at 16:08hrs on 7th January 2007. It is reported that the pond operational level was restored at 04:55hrs on 8th January and the Site Incident was stood down at 06:13hrs on 8th January 2007.

NII Response

7. The NII duty officer raised a Fast Stream Report when he was notified of the event at 14:00hrs on 7th January 2007. The Magnox Electric Ltd duty officer reported the loss of 40,000 gallons of pond water that contained 3.6 GBq of radioactive Caesium. It was reported that approximately half had been lost into the storm drain and that the Environment Agency had been informed. The Emergency Plan had been initiated even though the leak had been stopped. The Licensee was initially rating the event as INES 1.

8. The NII duty officer put the Fast Stream Report on Divisional and Press Office circulation but he also phoned several key NII inspectors, including the site inspector, so that they were all aware of the event that afternoon.

9. On Monday, 8th January 2007 the NII site inspector spoke to the site at 07:30 hrs so as to produce a brief and make an up to date report on the situation at the NSD/1B meeting which takes place at 09:00hrs. Following discussions it was decided that the Site Inspector should attend site so as to establish that an appropriate response was taking place. The inspector drove to site (almost 300 miles) and arrived in the evening to find that the pond water level had been restored, off site release via the storm drain had ceased and most of the escaped pond water was safely contained within the Effluent Treatment Building basement. The following day was spent monitoring recovery operations, establishing some key facts, producing a further brief and discussing issues with the HSE Press Office before leaving the site. A key factor was that the pond had no recirculation system but it would take about 40 days before temperatures and chemical conditions became unacceptable. Another key fact was that the pond water in the building basement could be recovered and discharged via an authorised discharge route. Contact was also made with the local Environment Agency site inspector. Upon return to the office a site inspection report was produced which listed possible Licence Condition breaches. This was discussed and the decision made that an NII team should carry out an initial investigation so as to establish all of the facts of this event.

10. Between 23rd and 25th January 2007 the site inspector and a colleague were at site establishing the facts that contributed to the event. During part of the day on 25th January 2007 the Environment Agency site inspector joined them. It was clear that Licence Conditions had been breached and that regulatory action was possible, however, the Licensee was extremely busy cleaning up the contaminated building, determining how to re-establish pond cooling and dosing, ensuring that the pond alarm system was working as intended and carrying out an investigation into the event. The NII team decided that there was no requirement for an immediate (Prohibition or Improvement) Notice. If a Notice was to be issued then it could be done at a later date. This report describes NII initial investigation findings and gives recommendations on further action.

PRELIMINARY INVESTIGATION FINDINGS [Coin Case Number 4050842]

This Event

11. Everyone interviewed at site confirmed that pond water had been lost (not adequately controlled or contained) during this event. The site's estimates put the leak of pond water (radioactive material as it contains caesium and other radioactive nuclides) at 35,000 to 40,000 gallons and that some of this escaped off-site into the sea via the storm drain system. This appears to be in breach of LC 34 (1).

Previous Events

12. Sizewell A's OEF section has trawled through recent pond events. The most relevant of a small number of events are a pond recirculation pipework failure that occurred in June 1994 and a pond water leak from 8in Durapipe

recirculation line that occurred in April 2006. The 1994 event had resulted in 200 to 400 gallons of pond water being released into the Effluent Treatment Plant building when a 15cm long split occurred in the pond recirculation discharge pipework. The leak was terminated by shutting down the pump. The damaged pipework was replaced and other pipework was visually inspected. It was recognised that Durapipe was subject to ultraviolet degradation and that it may be embrittled.

13. On 18th April 2006 operators responding to high level alarms raised in Monitoring and Delay Tank 1 noted that pond water level had fallen by about 5cms and water was gushing from a pipeshaft. An 8in Durapipe had split in the recirculation discharge line, releasing about 6,000 gallons of pond water into the Effluent Treatment Plant basement before the pump was shut down. Investigation by a system engineer later determined that the leak had originated from a damaged flange face in a vylastic coated pipe section. He also noted "current standards would ensure that all pond recirculation pipework would be stainless steel." Amongst the actions that arose from this event the engineer had recorded: "(1) Walkdown the ponds system pipework and identify and review the integrity of any other durapipe spool pieces, (2) Highlight any recommendations of environmental significance, and (3) to identify the wider learning lessons and determine the best means of communication". The response to these actions is recorded as: "(1) System walkdown completed. Several sections of durapipe have some external damage and should be changed. Also, some pipe brackets have failed and need to be replaced. (2) Replace identified sections of pipework and brackets in a timely manner. (3) Because this failure was due to poor specification of the joint and poor maintenance there is a possibility of a reoccurrence on other pipework". The system engineer was actioned to "replace damaged pipework and brackets by 1st August 2006". The work was done under PMPs 06/068 and 06/068Rev1; with completion reported by the system engineer as end of December 2006, however, at the time of the NII site visit in the week 22nd to 25th February neither the PMPs nor the OEF database actions had been formally cleared.

The Pipe

14. The pipe that failed on 7th January 2007 was 8in nominal bore pipework. Site staff reported during the preliminary NII investigation that the designer's drawing show this as 8in Durapipe K-heavy. Product/advertising material from the early 1960's indicates that K-heavy was only available up to an internal diameter of 6in. The wall thickness of the failed pipe indicated that it was in fact 8in Durapipe K-normal, however, a sample sent to Durapipe confirmed that the pipe installed was simply a PVC pipe with an 8in diameter. Therefore, during construction the pipe installed was not as specified by the designer and it is not clear that this pipe ever met the specification required.

15. Section 4.2.2 of the Pond Safety Case (TE/SXA/REP/0118/96 Issue 5, Feb'99) states that inspection of all pipework carrying active liquids are defined in the Maintenance Schedule. No evidence could be found of this pipework ever having been on the Sizewell A Maintenance Schedule. The

system engineer claims that visual inspections are carried out occasionally but these have not looked for wall thinning or embrittlement of the pipe. There are possible breaches of LCs 19 (1), LC 28 (1) and LC 17 (1) here.

The Alarm and Pond Protection Systems

16. It was recognised that much of the plant in the Effluent Treatment Plant was nearing the end of its life in 2001, resulting in a Hazard and Operability Study (HAZOP) in September 2001. This recognised that spare part procurement would become a significant issue so plant modification proposal PMP 01/084 was raised. A Category 2 paper of intent appeared about 18 months later (SIZA/PMP/01/084; Sizewell A Power Station; Refurbishment of Effluent Treatment Plant: Paper of Intent, 4 Feb'03); it stated that a number of modifications would be raised as Category 3 stage submissions and carried out by Alstec Ltd.

17. Changes to relevant Control and Instrumentation were proposed in a category 3 PMP in 2006 (SIZ/PMP/084 SS9 VAR 5; Sizewell A Cooling Ponds: Renew Pond Level and Temperature Instrumentation and Installation of Pond Circulation Pump Trip Instrumentation, June 2006). Alstec installed the new system during 2006. The modification is still open as the Test/Commissioning Details section is not yet signed off, however, everything else associated with the modification is complete. Effectively, during the Effluent Treatment Plant refurbishment project, Alstec had removed an obsolete, but functioning, relay based alarm system and replaced it with a modern one that is a poor design, poorly installed and did not work on the day, without the Sizewell A responsible engineer (appointed for the PMP) and Operators being aware.

18. Pond level alarm management is now managed via a central processing unit (CPU) that is located within the Ponds Operating Panel in the Active Effluent Treatment Building. The CPU raises alarms on the facia of its local panel and, as the area is not manned all of the time, it also raises a group alarm in the Main Control Room (MCR). At the time of the event the CPU had failed resulting in a standing alarm in the MCR. The CPU failure/standing alarm had probably occurred on the night of 4/5 January 2007. As the MCR reactor desks both had the group alarm standing any new pond alarm(s) would not have been seen in the MCR.

19. There are now two pond level alarms, a hi/lo ±150mm alarm and a lo/lo -400mm alarm that also cuts out the recirculation pumps. It was reported that the MEL investigation had determined that the hi/lo alarm had not been modified correctly and that it would not have worked if the pond level detectors tried to initiate it. Consequently, even if the MCR group alarm had not been masked by the standing alarm, no alarm would have been raised by the engineered alarm system as the pond water level fell below 150mm of its normal operational level. This alarm is now working correctly. The systems engineer confirmed that his system checks following the event indicate that the software would have prevented the lo/lo alarm from tripping the running recirculation pump if pond level had fallen below -400mm. Alstec

reprogrammed the system on 22nd January 2007 so as to ensure that the lo/lo alarm would now work.

20. Effectively the alarm and trip system would not have worked on 7th January. Pond water level could have continued to fall. The next alarms that may have initiated would have been the local area gamma alarms that may have been heard by a person in the vicinity of the pond. During the weekend there is only a requirement for an operator to patrol this area once per 12-hour shift. The pond could have been drained (it takes about 10 hours) before the required plant tour by an operator had taken place. In this worst-case scenario, if the exposed irradiated fuel caught fire it would result in an airborne off-site release.

21. It was noted during the investigation that the recirculation pumps are each located in a cell that has its own sump fluid detection system. This leak was in an area that did not, and could not, result in any pond water entering these sumps. The refurbishment project is installing sump fluid detectors in the Effluent Treatment Plant basement and these would have been initiated by the leak if fully installed. None of the new plant mentioned above is on the Maintenance Schedule, although the reason claimed for this is that the modification is not yet closed out.

22. This part of the investigation indicates possible breaches of several Licence Conditions such as 17 (Quality Assurance), 19 (Construction or Installation of New Plant), 21 (Commissioning), 22 (Modification or Experiment on Existing Plant), 26 (Control and Supervision of Operations), 27 (Safety Mechanisms, Devices and Circuits) and 28 (Examination, Inspection, Maintenance and Testing). As an engineered system failed to detect the leak of pond water there was probably a breach of LC 34 (2).

Operators

23. It is clear that there was a standing alarm on each of the MCR Reactor Desks that would have masked any new pond alarms. The alarm had been standing for over 2 days and it had been handed over between many shifts (and their Duly Authorised Persons) without anybody recording it in a log or raising a defect so as to get it investigated and sorted out. The tolerance of standing alarms in the MCR after the reactors were shutdown raises issues associated with Operator Training (LC 10) and their suitability for the job (LC 12). The systems engineers had performed poorly with regard to the mismatch between MS and Safety Case (the pipe should have been on the MS) and just about everything associated with the Effluent Treatment Plant refurbishment project (LCs 17, 19, 21, 22, 26, 27 and 28).

24. The only good action noted was that when a contractor raised the alarm the operators appeared to react very well and avoided a significant event from becoming a very serious off-site event. Also, since the event the Licensee has initiated a Local Technical Investigation and a considerable effort has gone into clean up and learning from it.

Radiological Consideration

25. The following information was obtained from discussions with the Sizewell A radiological protection and chemistry section head; the information will be backed up by site records. The Sizewell cooling pond is unusual in that it does not have Caesium removal plant, consequently, regular pond water activity measurements are made and these indicate that before the leak the total activity of Cs-137 was 16.5MBq/m^3. This isotope makes up the vast majority of the pond water activity although there are small contributions from Cs-134 and Tritium. Using the simple ratio of water lost to pond volume gives an estimated release in 40,000 gallons of 3GBq of Cs-137.

26. In order to put this release from the pond containment into perspective it represents about 10% of the Cs-137 that is normally discharged to sea each month from the authorised and filtered Final Monitoring Delay Tank route. If 20,000 gallons had left the site via the storm drain then that would represent about 1% of the authorised minor discharge route annual limit for CS-137. The site's calculations indicate that these discharges represent no more than 1% of any IRR Schedule isotope reportable level. Further investigation after the event did identify another off-site discharge route that was via a laundry toilet floor drain that discharges into an off-site sewage works. Measurements there have found ~8Bq/kg in solid waste, however, this level is extremely low.

27. During the clean up operation there has been some dose burden. It amounted to no more than 1mSv/person/day. In the initial stages C3 conditions existed but people wore respirators and impervious overalls. No personal contamination events were recorded during the clean up operation.

28. The site has a number of ground bore-holes and soak aways that have been monitored following the event and no readings above normal background have been noted. Off-site beach samples and tacky shades have also indicated nothing above normal background data. Storm drain measurements indicate that highly diluted pond water has been present. This is consistent with the operators' statements that reported that pond water that had escaped the building was flushed down the storm drain system. Following the event some contaminated tarmac areas measuring a few square metres were identified outside the building. Counts of about 200cps(av)/3000cps(peak) β and ~0.5cps α are reported; this contamination is being removed using decontamination paint.

Possible Breached of Nuclear Site Licence Conditions (LCs)

29. This preliminary investigation has identified a number of LCs that appear to have been breached (contrary to the Nuclear Installations Act):

LC 10 – Training

10(1) The licensee shall make and implement adequate arrangements for suitable training for all those on site who have responsibility for any operation which may affect safety.

In this case the training appears to be inadequate for a number of reasons. The operations staff did not appear to recognise the safety significance of standing alarms on the main control room reactor desks and several of them had failed to follow the procedure which requires them to raise defects on such standing alarms. The systems engineers appeared to not understand why they need to control the activities of contractors, especially when they are replacing safety systems. Equally they did not appear to recognise the need to commission such equipment at the earliest opportunity so as to confirm its suitability for purpose.

LC12 – Duly Authorised and Other Suitably Qualified and Experienced Persons

12(1) The licensee shall make and implement adequate arrangements to ensure that only suitably qualified and experienced persons perform any duties which may affect the safety of operations .....

The operators and systems engineers mentioned under LC10 all made significant mistakes which call into question their suitability to carry out their roles. The investigators believe that the issue is more to do with being overworked at the time of the event but the need for some refresher training may have been identified.

LC17 – Quality Assurance

17(1) .....the licensee shall make and implement adequate quality assurance arrangements in respect of matters which may affect safety.

This aspect was not considered in detail during the preliminary investigation, however, a good QA/QC system should have prevented the installation of the wrong pipe going undetected for so long, the problems with the new alarm system and operators tolerating standing alarms.

LC 19 – Construction or Installation of New Plant

19(1) Where the licensee proposes to construct or install any new plant which may affect safety the licensee shall make and implement adequate arrangements to control the construction or installation.

If we simply consider the new pond alarm system then it is clear that the control arrangements were inadequate, their implementation was inadequate, or both were inadequate. The contractor had removed an obsolete (but fully functioning) alarm system and replaced it with one that had construction and software errors. He then handed it to the licensee without the licensee being aware that the system did not meet the designer's intent and it did not work.

LC 21 – Commissioning

21(1) The licensee shall make and implement adequate arrangements for the commissioning of any plant or process which may affect safety.

The pond alarm system had been in place for many months and although it was being used to protect against pond faults it had never been commissioned by the site's responsible system engineer. This issue appears to be more to do with implementation of arrangements rather than the arrangements themselves.

LC22 – Modification or Experiment on Existing Plant

22(1) The licensee shall make and implement adequate arrangements to control any modification or experiment carried out on any part of the existing plant or process which may affect safety.

It is believed that the modification arrangements are adequate at the site. Implementation of the control aspect is what appears to have fallen short of expectations when the pond alarm system was modified by a contractor.

LC 26 – Control and Supervision of Operations

26 The licensee shall ensure that no operations are carried out which may affect safety except under the control and supervision of suitably qualified and experienced persons appointed for that purpose by the licensee.

Given the failure of the plant modification responsible engineer to control the contractor while modifying the pond alarm system, and the willingness of main control room staff to accept standing alarms without question, there is an issue regarding the suitability of people to control operations on the site.

LC 27 – Safety Mechanisms, Devices and Circuits

27 The licensee shall ensure that a plant is not operated, inspected, maintained or tested unless suitable and sufficient safety mechanisms, devices and circuits are properly connected and in good working order.

In this case the pond alarm system was not connected properly and it did not work. As pond operations were continuing as normal there was a clear failure to comply with this LC.

LC 28 – Examination, Inspection, Maintenance and Testing

28(1) The licensee shall make and implement adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety.

The investigation identified a number of pond plant items and systems that should be on the Maintenance Schedule (MS) but they are not. The safety

case and MS are not consistent. Either the arrangement or their implementation are not adequate.

LC 34 – Leakage and Escape of Radioactive Material and Radioactive Waste

34(1) The licensee shall ensure, so far as is reasonably practicable, that radioactive material and radioactive waste on the site is at all times adequately controlled or contained so that it cannot leak or otherwise escape from such control or containment.

34(2) Notwithstanding paragraph (1) of this condition the licensee shall ensure, so far as is reasonably practicable, that no such leak or escape of radioactive material or radioactive waste can occur without being detected ....

Irradiated fuel cooling pond water is radioactive material as it contains Cs-137 and Tritium which may only be discharged from site under (EA) authorised conditions. Several witnesses described how 35,000-40,000 gallons of this pond water leaked from a failed pipe into the Effluent Treatment Building and that some of it escaped into the storm drain system where it would have been discharged into the North Sea. There is a lot of evidence that indicates that LC 34(1) was breached during this event.

The leak and escape could have been prevented if the pond alarm system had functioned as intended by the designer, and assumed by the pond safety case author. It was intended that engineered systems prevent loss of pond water and that people should not be a primary safety barrier. There is clearly significant evidence that indicates that LC 34(2) was breached on the day of this event.

DISCUSSION

30. It is noted that Sizewell A staff returned the pond water level to normal within a day of the event, they have cleaned up the Effluent Treatment Building and sorted out the problems with the pond protection/alarm system such that it is now fully functional. Replacement of the failed pipework has taken longer due to the lead times associated with procurement of appropriate pipework.

31. On 7th January 2007 the Sizewell A cooling pond alarms system would not have alerted the Main Control Room staff to the significant loss of water that was taking place. The required operator plant patrol could have easily missed the event due to 12-hour shifts being worked, thus resulting in uncovering of irradiated fuel and a probability of a fuel fire with consequential off-site release of radioactive material. It was fortunate that a contractor was working in the area and that he noticed the water and contacted the Main Control Room. It was also fortunate that an operator arrived in the area soon afterwards who correctly assessed the situation and shut down the pond recirculation pump. Unfortunately, by the time this action took place, sufficient pond water had accumulated that it had started to escape from the building where it eventually escaped into the North Sea via the storm drain system.

Cs-137 and Tritium was discharged to sea in the pond water. When in the clean up phase it was recognised that a drain in the laundry toilet floor had also discharged some water off-site, into a local sewage works. Measurements have confirmed that some pond water did leave the site via this route.

32. The NII's preliminary investigation found clear evidence that radioactive material (pond water) had been allowed to leak and escape out of control for 40 to 45 minutes without being detected by the engineered alarm system. It also found that operators had passed standing alarms in the Main Control Room (and elsewhere) between shifts for at least several days without anyone doing anything about it. There is evidence that systems engineers have been allowing contractors to carry out significant plant modifications without taking control of the process as the site's arrangements require; they also failed to check the work and carry out timely commissioning of equipment when the contractor reported that the modification was complete. This site has indicated that, despite its track record for good safety standards, it fell well short of the mark on this occasion. A number of possible LC breaches have been identified.

33. Appropriate HSE/NII action has been considered throughout the investigation. When at site it was clear that the licensee was responding appropriately and there was no requirement for immediate regulatory action. Since returning to the office the details of the event have been considered in the light of the HSC Enforcement Policy Statement (EPS) and the HSE Enforcement Management Model (EMM). HSC requires enforcement to be proportional, consistent, targeted and transparent and the EMM ensures that this is achieved. NSD Guidance (INS/030: The Use of the Enforcement Management Model (EMM) in NSD and G/INS/030: GUIDANCE: The use of the Enforcement Management Model in NSD) has been followed when applying the EMM to this case. As the event could have led to the exposure of people to ionising radiations the relevant HSE operational circular was also used for guidance (OC 130/11: Enforcement Management Model (EMM): Application to Ionising Radiations).

34. The EMM is supported by form EMM1 that helps the HSE investigator to work through the relevant EMM Tables so as to reach a consistent decision on appropriate action. A completed copy of form EMM1, for this event, is attached to this report. It records that a prohibition notice was not issued when first arriving at site (Section 2). In Section 3 it indicates how the risk gap was determined using Tables 2.1 and 2.2 of the EMM. These Tables consider the effect on individuals and many people. In this case they both indicate the same risk gap. The duty holder has a hazard which posses a significant threat to people if it is not controlled so as to make the likelihood of it coming into contact with them negligible. During this event the control was lost and the risk of serious personal injury fell into the remote or possible area, thus indicating a risk gap of substantial to extreme. Table 3 of the EMM indicated that standards are "established" in the case of licensed nuclear installations. Section 4 of EMM1 then considers initial enforcement expectation. As ionising radiation was involved Table 5.1 Revised see App C

of OC 130/11 was applied here. It indicates that for "established" standards a risk gap of Substantial should result in an enforcement expectation of IN/Direction/Specification and for a risk gap of Extreme the expectation would also be IN/Direction/Specification with a consideration of Prosecution. Section 5 of EMM1 is all about the dutyholder and the findings of HSE inspections at his premises. In the case of Sizewell A power station this is all positive as reflected on the attached EMM1.

35. The information recorded on EMM1 has been considered by a number of experience HSE/NII inspectors and it has been concluded that there is no obvious benefit to be gained from issuing an IN as the licensee has set about putting right all that was wrong in this case. However, the EMM indicates an expectation of regulatory action. After carefully considering the Licence Conditions it appears that the most appropriate way forward would be to issue a Direction under LC 15(4). This LC is about periodic review, however, 15(4) says, "The licensee shall, if so directed by the Executive, carry out a review and reassessment of safety and submit a report of such review and reassessment to the Executive at such intervals, within such a period and for such matters or operations as may be specified in the direction". It is possible to direct MEL to review the cooling pond water leak event that occurred on 7th January 2007, the Cooling Pond Safety Case, the Maintenance Schedule and operating instructions so as to determine what actions are required in the interest of safety in the SZA pond area, and to provide a written report to HSE within 3 months with a programme of improvement work. The identified actions should produce a better irradiated fuel cooling pond safety case, better links between safety case and items on the MS, better conduct of operations and project management.

36. Prosecution should be considered for breach of LCs (an offence contrary to Section 4.6 of Nuclear Installations Act 1965 (as amended)). The most straight forward case to prove would appear to be breaches of LCs 27 and 34. However, this would require the commitment of a considerable resource so as to take statements, producing a prosecution report, brief solicitors/QCs etc., at a time when NII's resources are stretched. The power station licensee would also be able to make a strong case that this was an unfortunate one off event that tarnished its otherwise exemplary record. It is not clear that a judge would be easily convinced that a serious event had taken place. It is not clear that public interest is best served by taking a prosecution at this stage. A decision on Prosecution does not need to be made immediately; this can be reviewed after the licensee has responded to a Direction.

CONCLUSION

37. The preliminary investigation into this event has identified a number of possible breaches of LCs. NII believe that there was a significant risk that operators, and even members of the public, could have been harmed if there had not been the fortunate, and appropriate, intervention of a contractor who just happened to be in the right plant area when things went wrong. The investigation has identified a number of shortcomings in a number of areas as

identified earlier in this report. Comparison of the findings with the EMM indicate that enforcement action is expected in the form of an Improvement Notice, Direction or Specification and that Prosecution may be appropriate.

38. The investigating inspectors, and authors of this report, believe that prosecution is not appropriate and consider the IN and Direction route is appropriate, however, they accept that NII managers may take a different view. Meetings within NII have decided that it is difficult to produce an IN in this case and that it is more appropriate to issue a Direction. After careful consideration it has been concluded that the Direction should be issued under LC 15(4) and a suggested draft is attached to this report.

RECOMMENDATIONS

39. The NSD/1B Superintending Inspector is asked to:

1) indicate his acceptance of this preliminary investigation report by signing the front cover,
2) support the decision that a Direction under LC 15(4) should be issued [Draft attached for consideration], and
3) agree that a decision on Prosecution is not yet required.

Site Licence No: 51

Licence Instrument No: 5XX

February 2007

NUCLEAR INSTALLATIONS ACT 1965 (AS AMENDED)

DIRECTION

Granted under Condition 15(4) of

Schedule 2 attached to

Nuclear Site Licence No: 51

Sizewell A

The Health and Safety Executive, for the purpose of Condition 15(4) of Schedule 2 attached to Nuclear Site Licence No: 51, herby directs Magnox Electric Ltd to carry out a review and reassessment of safety and submit a report of such review and reassessment of the pond water leak event which occurred on Sunday, 7th January 2007, of the Irradiated Fuel Cooling Pond Safety Case, of pond safety systems that need to be on the Maintenance Schedule and, of the operating instructions which ensure maintenance of pond safety case barriers. This review and reassessment report must be presented to the Health and Safety Executive on or before 31st May 2007.

Dated: February 2007

For and on behalf of the
Health and Safety Executive

Signed:

Dr A N Hall

A person authorised to act in that
Behalf

HSE Health & Safety Executive

Enforcement Management Model

Enforcement Assessment Record

Section 1

Duty holder	Client No	Magnox Electric Ltd		
Site/Premises	Location No	Sizewell A	Event No	

Brief description of circumstances

Loss of up to 40,000 gallons of pond water on 7th January 2007. Most of the water was retained within the Active Effluent Treatment Building but some escaped and went to the North Sea via the site's storm drain system. The event was detected by a contractor, the engineered alarm system/protection system did not work on the day, however, if it had done then control room staff would have been unaware due to standing alarms. Breached of various Licence Conditions identified, but primarily LC 34. Clearly a breach of Section 4.6 of the Nuclear Installations Act 1965. As there was no harm then it is less clear that there has been a breach of the Health and Safety at Work etc Act 1974.

Section 2 – Imminent risk of serious personal injury

Prohibition notice Yes ☐ No ☒ Section 25 powers Yes ☐ No ☒

Section 3 – Risk gap (From Table 1 and Figures 2.1 or 2.2)

Actual risk	Consequence		Serious ☒	Significant ☒	Minor ☐
	Likelihood	Probable ☐	Possible ☒	Remote ☒	Nil / negligible ☐
Benchmark	Consequence		Serious ☒	Significant ☒	Minor ☐
	Likelihood	Probable ☐	Possible ☐	Remote ☐	Nil / negligible ☒
Risk gap (and table used)	**Table 2.1**	Extreme ☒	Substantial ☒	Moderate ☐	Nominal ☐
	Table 2.2	Extreme ☒	Substantial ☒	Moderate ☐	Nominal ☐

Section 4 – Initial Enforcement Expectation (Tables 5.1, 5.2 or 5.3)

Benchmark standard *(Table 3)*			Defined ☐	Established ☒	Interpretative ☐
Compliance / admin descriptor *(Table 4)*			Absent ☐	Inadequate ☐	Minor ☒
Compliance with permissioning document			Contravention ☐	Irregularities ☐	Compliance ☒
Initial Enforcement Expectation		Prosecution ☒	I / N ☒	Letter ☐	Verbal warning ☐
Permissioning document impact (table 5.3 only)	Revocation / refusal / direction ☐	Amendment / refusal / variation ☐	Amendment ☐	Letter ☐	Letter / verbal warning

Section 5 – Dutyholder factors *(all elements do not always apply)*

Is there a record of previous relevant written enforcement action, such as notices, prosecutions, or letters requiring action?	Yes ☐	No ☒	
Is there a history of related incidents, accidents, ill health, etc?	Yes ☐	No ☒	One similar event noted
Is there a history of previous relevant verbal enforcement?	Yes ☐	No ☒	
Did the dutyholder gain or deliberately seek economic advantage from non-compliance?	Yes ☐	No ☒	
Level of actual harm arising from the matter under consideration?	Serious personal injury or serious health effect ☐	No serious harm ☒	
What is the standard of general conditions?	Poor ☐	Reasonable or N/A ☐	Good ☒
What is the inspection history of the dutyholder?	Poor ☐	Reasonable or N/A ☐	Good ☒
What is the attitude of the dutyholder to H&S issues?	Hostile / indifferent ☐	Reasonable ☐	Positive ☒

Indicated enforcement action *(after considering local factors)*

Enforcement	Prosecution ☐	I / N ☒	Letter ☐	Verbal warning ☐	
Permissioning	Revocation / refusal / direction ☐	Amendment / refusal / variation ☐	Amendment ☐	Letter	Verbal warning ☐

Strategic factors

Does action coincide with public interest?	Yes ☒	No ☐
Are vulnerable groups protected by the action?	Yes ☒	No ☐
What is the long-term impact of the action?	Sustained ☒	None ☐
What is the effect of the action on other dutyholders?	Positive ☒	Negative ☐
What is the initial effect of action on compliance with benchmark?	Achieved ☒	Incomplete ☐
What is the functional impact of the action?	Acceptable ☒	Unacceptable ☐
Have the principles and expectations of the Enforcement policy been met?	Yes ☒	No ☐

Outcome of management review

Regulatory action required – IN or LC Direction; some action would clearly be expected by a member of the public.

Enforcement action plan *(Priorities for action, and timescales)*

Issue an IN – but very difficult as the Licensee has now taken appropriate action and is almost certainly compliant with the LCs (27 and 34) where non-compliance may have existed.

LC Direction – After considerable discussion it is felt that the best approach would be to issue a Direction under LC15(4) which states: "The licensee shall, if so directed by the Executive, carry out a review and reassessment of safety and submit a report of such review and assessment to the Executive at such intervals, within such a period and for such matters or operations as may be specified in the direction."

MEL to review the event on 7 January 2007, the Cooling Pond Safety Case, the Maintenance Schedule and all operating instructions so as to determine what actions are required in the interest of safety in the SZA pond area.

Name of inspector [redacted] Date completed 08/02/07

Line manager's assessment

See Division 1 PAR 2007/0011

Name of line manager [redacted] Date 09/02/07