June 19, 2002

MEMORANDUM TO: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield

FROM: Janice Dunn Lee, Director ***/RA/***
Office of International Programs

SUBJECT: VISIT OF LAURENCE WILLIAMS, HM CHIEF INSPECTOR, UNITED KINGDOM NUCLEAR INSTALLATIONS INSPECTORATE (NII), JUNE 25, 2002

Mr. Laurence Williams, HM Chief Inspector, United Kingdom Nuclear Installations Inspectorate, will meet with the Commission and NRC staff on Tuesday, June 25, 2002. He will be accompanied by Alan Rae, an employee of the U.K. Nuclear Installations Inspectorate who spent nine months on assignment in NRR in 2001. While at NRC, Mr. Williams will also meet with representatives from the Offices of Nuclear Reactor Regulation (NRR), Nuclear Materials Safety and Safeguards (NMSS), Nuclear Security and Incident Response (NSIR), and Nuclear Regulatory Research (RES) to discuss a range of issues including license renewal, liabilities management (or site clean-up), and to continue discussions begun in January on security issues. Authorization to continue discussions at the classified level was requested in COMSECY 02-0033 dated June 14, 2002.

Mr. Williams and Mr. Rae will also visit Region II, the Oconee nuclear power plant, the Institute for Nuclear Power Operations (INPO), and the World Association for Nuclear Operations (WANO), and will meet with the Department of Energy (DOE).

Attached are the meeting schedule, a detailed itinerary with subject matter to be discussed, biographical information, background information, and suggested talking points for use during the visit.

Attachments:
1. Commission Schedule
2. Biographical Information
3. Topics of Interest and Suggested Talking Points
4. Background Information
5. Current NRC-HSE Cooperative Research Agreements
6. NII Organizational Chart
7. List of U.K. NPPs and Key Parameters

cc: SECY NRR
EDO OPA
RES NSIR
NMSS OGC

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**OFFICIAL RECORD COPY**

Attachment 1

**VISIT TO NRC OF**
**MR. LAURENCE WILLIAMS**
**CHIEF INSPECTOR**
**UNITED KINGDOM NUCLEAR INSTALLATIONS INSPECTORATE**
**JUNE 25, 2002**

SCHEDULE

| | |
|---|---|
| 8:00 a.m. | Meeting with John Greeves, NMSS |
| 9:00 a.m. | Meeting with Commissioner McGaffigan |
| 9:30 a.m. | Meeting with Commissioner Dicus |
| 10:30 a.m. | Meeting with EDO Travers |
| 11:00 a.m. | Meeting with Commissioner Diaz |
| 11:30 a.m. | Meeting with Chairman Meserve |
| 12:00 noon | Chairman-hosted lunch |
| 1:30 p.m. | Meeting with NRR |
| 4:00 p.m. | Meeting with RES/NSIR |
| 5:00 p.m. | Meeting with Janice Dunn Lee and Donna Chaney, OIP |
| 6:00 p.m. | Dinner with Commissioner Dicus |

PREVIOUS CONTACT WITH THE COMMISSION

Mr. Williams previously visited the Commission on January 23, 2002.

ACCOMPANYING PERSONS

Mr. Alan Rae

Note: Alan Rae, an employee of the U.K. Nuclear Installations Inspectorate, was assigned to NRR for nine months beginning February 13, 2001. He participated in NRC's pre-application review of the Westinghouse AP-1000 reactor design. Subsequent to that assignment, Mr. Rae became an assistant to Mr. Williams. Mr. Williams has expressed his support for the placement of an NRC staffer at the NII, if we are interested and able to do so. Dr. Makuteswara Srinivasan from the Office of Nuclear Regulatory Research is being proposed for a three-month assignment at NII in the area of safety issues related to the application of graphites in advanced gas reactors.

Attachment 2

## BIOGRAPHY FOR LAURENCE WILLIAMS

Laurence Williams is the Director of the Health and Safety Executive's Nuclear Safety Directorate; and he is Her Majesty's Chief Inspector of Nuclear Installations. He holds an Honors Degree in Mechanical Engineering and a Masters Degree in Nuclear Reactor Technology.

After graduating, he joined the Nuclear Power Group where he worked, inter alia, on the design of the High Temperature Gas Cooled Reactor. He subsequently joined the Central Electricity Generating Board where he worked on nuclear fuel and thermal performance of the Magnox and Advanced Gas Cooled Reactors and on the thermal performance of nuclear fuel transport flasks.

In 1976, he joined the Nuclear Installations Inspectorate as a Nuclear Inspector and has held a variety of posts including the assessment of the safety case for PWR fuel for the Sizewell B reactor, fuel behavior in the Commercial Fast Breeder Reactor, the civil structure design of BNFL's THORP reprocessing plant. He has also been responsible for the regulatory inspection of BNFL's Sellafield Site as well as all the commercial nuclear power stations. Prior to his promotion to Director, he was Head of HSE's Nuclear and Hazardous Installations Policy Division.

Mr. Williams has worked on a number of international activities with the OECD/NEA, IAEA, the European Union and the European Bank for Reconstruction and Development.

## Biography for Alan Rae

Alan Rae is a Principal Inspector of Nuclear Installations within HSE's Nuclear Safety Division. He is currently the Chief Inspector's Technical Assistant and Head of the Director's Secretariat. Mr. Rae has a Honors degree in Mechanical Engineering. Prior to HSE, he worked in the U.K. nuclear industry for 12 years in both nuclear fuel manufacturing and reactor operations.

Since joining HSE in 1989, Mr. Rae worked primarily on regulation of reactor safety where he has served as NII's Site Inspector at a number of reactor sites. This included a four-year assignment as Site Inspector for Sizewell B, the U.K.'s only PWR, during commissioning and early operational period. As part of this activity, Mr. Rae participated in an NRC Team Inspection at Commanche Peak in 1993 and undertook a series of NRC training courses in 1993/1995. Mr. Rae has also been NII Project Manager for the Advanced Gas-cooled Reactor (AGR) Periodic Safety Review program and as Site Inspector for NII's interests in the inspection and regulation of part of the U.K. defense program. In 2001, Mr. Rae was seconded to NRC for several months where he undertook the role of Project Manager for part of the AP1000 Design Certification review.

Attachment 3

# TOPICS OF INTEREST AND SUGGESTED TALKING POINTS

## *TOPICS*

The NII has listed the following topics to discuss with NRC staff and management during Mr. Williams' visit:

- Progress with development and implementation of risk informed inspection:
  What has been learned from Risk Based regulation to date and how does NRC see this developing?
  What is NRC's view of Safety Performance Indicators and which ones does NRC use?
  What action would be taken for poorly performing stations to improve their standards?
  What does NRC think of INPO standards and criteria? Does NRC use INPO ratings?

- Extension of NRC/HSE agreement:
  Discussion of agreement to exchange classified information.
  Future cooperation in reactor, non-reactor areas (e.g., NII methodology on risk) and security.

- Completion of phase 2 of AP1000 review.

- Liabilities management - cleanup at old sites.

- License renewal.

- Circumferential cracking of Reactor pressure vessel head penetration nozzles experience at Oconee, status of Davis Besse.

Several additional items may be of interest:

- Results of U.S. participation in the Second Review Meeting of the Convention on Nuclear Safety.
- Security at nuclear facilities post 9/11.
  Staffing shortages at the Office of Civil Nuclear Security (OCNS), Department of Trade and Industry (DTI).
- Staffing shortages at NII.
  Funding for new hires.

## *SUGGESTED TALKING POINTS*

<u>Security</u>

- Mention the recent wire press article that reports reduced standard security checks at nuclear installations pending new staff hires at the Office of Civil Nuclear Security, DTI.

- Inquire as to new requirements being put in place at civilian nuclear facilities, post 9/11, to address increased safety concerns.

- Inquire about enhanced emergency response procedures to respond to possible attacks at nuclear facilities.

- Ask about U.K. views regarding stronger controls on radioactive sources, including the upcoming revision to the IAEA Code of Conduct on the Security of Radioactive Sources. Will the NII be making any changes regarding export of sources?

- Discuss a possible agreement between NRC and HSE to exchange classified information in order to facilities further our discussions on security issues.

Results of the April CNS Review Meeting

- Discuss NRC impressions of the review meeting, including usefulness of country reviews.

- Mention that the U.S. was pleased to fully participate for the first time during the Second Review meeting.

- Note that the change in schedule milestones for the next review (April, 2005) to allow for more time for preparation of questions and responses on the national reports will be very helpful.

- Mention the useful feedback the U.S. received on our national report and note that we will be giving careful attention to the periodic safety review process as performed by other countries and whether and how our oversight processes might be improved.

Staffing shortages at NII

- Inquire about reported staffing shortages at NII to address new workload, including possible new plant build and liabilities management.

Attachment 4

# NUCLEAR INSTALLATIONS INSPECTORATE (NII) ACTIVITIES

## What It Does

Nuclear Installations Inspectorate (NII) is responsible for granting nuclear site licences and enforcing compliance with the safety conditions attached to these, together with other health and safety legislation. A single license will cover all activities on a nuclear site from construction through operation into decommissioning. The transitions between these stages are controlled by regulatory powers, such as Directions and Consents. The NII recovers the full cost of regulating nuclear safety, together with the cost of research into nuclear safety sponsored by the Commission, from the nuclear site licensees under the Nuclear Installations Act 1965 (as amended). Under privatization research, funds are to be derived directly from levies on licensees. The total number of staff employed by NII in regulating the U.K.'s nuclear facilities is 237. This comprises 144 inspectors, 2 scientists, and 91 administrative staff. The 'inspector' category includes staff employed on both site inspection and assessment activities. Fifty-eight of the administrative staff provide direct support to inspectors, a ratio of about 1:2.5. NII also places contracts with external technical organizations for analyses and research. Technical work directly supporting regulatory issues is funded through a Nuclear Support Studies budget, which is about 2.5 million pounds (USD $4 million) per year. This translates into about 36 staff years of effort. Various contractors are used, including AEA Technology, National Nuclear Corporation, and others.

## What It Regulates

NII regulates nuclear safety at 35 operating power reactors, 6 commercial gas-cooled reactors that are undergoing decommissioning, various prototype and test reactors that are undergoing decommissioning (e.g., Dounreay Prototype Fast Reactor, Winfrith Steam Generating Heavy Water Reactor, Windscale Advanced Gas-Cooled Reactor), a fuel enrichment plant (Capenhurst), fuel fabrication facilities (Springfields), fuel reprocessing plants (Sellafield and Dounreay), a low-level waste repository (Drigg), the Atomic Weapons Establishment at Aldermaston, dockyards facilities for nuclear-powered submarines (Devonport, Rosyth, and Barrow-in-Furness), and a small number of research reactors. The licensees are responsible for the safety of their operations, and must develop their own nuclear safety standards. They must then demonstrate to NII that these reduce the risk to staff and members of the public to as low a level as reasonably practicable, as required by the Health and Safety at Work, etc., Act 1974. NII assesses these submissions against its published Safety Assessment Principles, which represent its own standards.

There are 34 operating gas-cooled reactors in the U.K., of which 14 are Advanced Gas-cooled Reactors (AGRs), and 20 are older Magnox reactors. There is also one operating civil PWR at Sizewell. There are no power reactors under construction. The Prototype Fast Reactor at Dounreay is being decommissioned. As well as reprocessing spent fuel from the Magnox reactors, Sellafield also reprocesses enriched spent fuel from the AGRs and PWRs in its Thermal Oxide Reprocessing Plant (THORP). The Drigg facility is used for the disposal of low-level wastes; the U.K. currently has no disposal route for intermediate- and high-level wastes. All 14 of the AGRs have now been privatized, together with Sizewell B, and are owned

by the private company British Energy, and operated by its subsidiary companies, Nuclear Electric Ltd. (10) and Scottish Nuclear Ltd. (4). Only the 20 operating Magnox reactors remain state-owned, together with the shutdown reactors undergoing decommissioning: they are all owned by BNFL. There are two state-owned nuclear electrical generating companies -- Nuclear Electric plc, which operates 26 reactors in England and Wales, and Scottish Nuclear Ltd., which is now operating the two nuclear power stations previously owned by the south of Scotland Electricity Board.

## Legislative and Regulatory Framework

### *Main Legislation*

In the U.K., the main legislation governing the safety of nuclear installations is the Health and Safety at Work, etc. Act 1974 ("the HSW Act") and the associated relevant statutory provisions of the Nuclear Installations Act 1965 ("the NI Act"). There has been no need for major changes to these Acts, but amendments have been made whenever necessary. In particular, the Nuclear Installations Act 1965, etc. (Repeals and Modifications) Regulations 1974 made HSE the nuclear licensing Authority for nuclear sites. Under the HSW Act, employers are responsible for ensuring the safety of their workers and the public from dangers arising from that work. This responsibility is reinforced for nuclear installations by the NI Act under which no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force, as granted by the HSE. Only a corporate body, such as a registered company or a public body, can hold such a licence and the licence is not transferable. HSE's Nuclear Safety Directorate (NSD) administers this licensing function on its behalf. The licensing regime is complemented by the Ionizing Radiations Regulations 1999 (IRRs) which provide for the protection of all workers and members of the public, whether on licensed sites or elsewhere, from ionizing radiations.

### *U.K. Framework*

Before a site can be licensed, a prospective operator must show that the plant to be used will be safe and that the operator can manage the site and deal with any liabilities remaining when the nuclear installation is finally shut down. The onus is on the applicant to prove the safety of the site and their own viability before HSE will grant a licence: without a licence, they cannot build or operate a nuclear installation. HSE makes it clear that safety law holds licensees responsible for safety. The HSE sets safety goals and it is for licensees to set out how they will meet them. This policy ensures that the licensees accept that responsibility, while allowing them to find their own ways of meeting the needs. Therefore, a balance has to be struck in how far HSE becomes involved in the design and assessment process. This calls for careful choice of the key safety issues and what to examine. Licence applicants or licensees must carry out their own detailed assessment and audit of the design and of the design process from the point of view of safety. HSE satisfies itself that licensees have the organization for this and that they are carrying out their functions effectively.

***Nuclear Safety Directorate - Staffing***

The Nuclear Safety Directorate (NSD) is that part of HSE that has been delegated the responsibility of regulating the U.K.'s nuclear industry. The Nuclear Installations Inspectorate (NII) is the major part of NSD. NSD employed 233 staff in the period 1999/2000. This included 144 inspectors and technical staff and 89 administrative staff. All are based at Bootle in Merseyside except a small administrative team in HSE's Head Office in London. Nearly two-thirds of NSD's staff are technically-qualified, educated to degree level, and had at least ten years experience in industry before joining HSE. They carry out site inspection, specialist, or safety case assessment roles, delivering the regulatory functions required by nuclear legislation and the Health and Safety at Work Act (Article 7). HSE has recently provided an increase in its staff budget allocations for NSD and recruitment of new nuclear inspectors is underway, with the aim of increasing the number of inspectors to 179. To complement this increase in inspectors additional administrative staff have also been recruited.

***Training and Development of Regulatory Staff***

NSD understands and is committed to the business and personal benefits of investing in well-targeted, quality-training, and development. This supports its program of continuous improvement. The commitment is underpinned each year by the review and allocation of re-sources, both financial and people, which enable its training and development priorities to be planned, met and evaluated. Further evidence of NSD's commitment was its achievement of the Investors in People (IiP) Standard: independent confirmation that NSD arrangements for training and development met a national standard. All new NSD staff receive a range of induction training. For inspectors it includes, within 12-18 months of their appointment, specific training to develop the skills and attitudes necessary to become an effective regulator. Linked activity includes several mandatory courses, including:

- completion of some modules of the post graduate Diploma in Occupational Health and Safety
- familiarization with the IRR99
- an introduction to health and safety law, relevant nuclear regulation and nuclear licence compliance
- understanding the assessment of safety cases
- awareness of radiological protection
- pursuit of the Health & Safety Regulator's National Vocational Qualification (NVQ); and
- awareness of personal safety on site

In addition to the mandatory courses identified above, most new inspectors receive on-job support. Many shadow experienced staff to benefit from the practical, on-the-job guidance that they can offer. Examples include participating in emergency exercises and being part of team audit/inspections at nuclear sites. Once through the 12-18-month induction period, Continuous Professional Development (CPD) provides for the on-going training and development of NSD staff, especially for the technical training of its regulators. Opportunities are provided to help regulatory staff develop in their discipline/specialist area; or to acquire new skills after a change of duties. As examples: NSD runs its own Site Inspection Course for all regulators new to, or returning to, site inspection duties, and arranges for full-scale reactor simulator training to refresh the skills of reactor inspectors and assessors. Inspectors can also attend externally

organized courses and conferences both in the U.K. and abroad. Such events are usually designed to keep delegates abreast of the latest technological developments and ways of working in the nuclear and other high hazard industries. A range of non-technical training is also provided for management and personal development. Examples include leadership training; effective management, team-working; effective communication, and stress awareness workshops. As a further strand of CPD, each year the Director of NSD leads a strategic overview of staffing and positioning of expertise in the Directorate in relation to delivery of its short-medium term business objectives. This is known as the Career Development Review process. Its aim is to ensure that NSD continues to have the right expertise, in the right place, at the right time to enable NSD to sustain delivery of its mission; and wherever possible, to achieve this by meeting individuals' development goals.

The Chief Inspector and the other Senior Management Group members also review the Directorate's Training and Development Plan and associated Budget twice a year; they are particularly concerned to see the impact that their investment in training and development has had on the delivery of NSD's business. On average, that budget runs at around £300k per annum for the direct cost of off-job training activity; and when on-job activity is added the cost increases to about £750k per annum, with a significant proportion invested in the technical training and development of inspectors.

**Status of U.K. Civil Nuclear Power Program**

***National Policy Towards Nuclear Activities***

The Government's Department of Trade and Industry (DTI) sponsors the nuclear industry in the U.K. Commercial nuclear power generation is carried out by three companies: one private sector company British Energy plc (BE), and British Nuclear Fuels Limited (BNFL) (wholly government-owned) and Magnox Electric plc (ME, wholly owned by BNFL) in the public sector. BE, the larger of the two, is a holding company with two subsidiaries, British Energy Generation Ltd. (BEGL) that operates the Pressurized Water Reactor (PWR) and five Advanced Gas Reactor (AGR) stations in England, and British Energy Generation (U.K.) Ltd (BEG(U.K.)L) that operates two AGR stations in Scotland. BNFL and ME own and operate seven Magnox stations in England, Wales, and Scotland. The U.K. Government's energy policy is to ensure secure, diverse, and sustainable energy at competitive prices. The Government frequently reviews a number of policy areas (for example, energy sources for power generation, utility regulation) to ensure that these contribute to that broader objective. During 1999, (the latest date for which a figure is available) nuclear installations represented about 18 percent of the installed electricity generating capacity in the U.K. In terms of electricity supplied, nuclear installations accounted for about 26 percent of the U.K.'s electricity output. Provided that stations maintain their existing high standards of safety and environmental protection, the Government believes that nuclear power should continue to contribute to the U.K.'s electricity supply industry.

In May 2002, the U.K. Department of Trade and Industry (DTI) called for a national debate on the role of nuclear and renewable energy in meeting the country's future power needs. Specifically, DTI solicited responses to the Prime Minister's Performance and Innovation Unit report, issued in February 2002, which called for a greater role for renewables and further debate on the future role of nuclear power. Ministers are urging responses ahead of their

planned publication of a draft white paper on energy policy at the end of this year. The Performance and Innovation Unit report was commissioned in the wake of the California energy crisis and focused on the likely need for the U.K. to meet stricter agreements on reducing greenhouse gases in future years, as well as achieving a sustainable and well-balanced energy mix.

***Review of Energy Objectives***

The Prime Minister announced on June 27, 2001, in response to a question in Parliament, that he has asked for a review of the longer term, strategic issues surrounding energy policy for Great Britain. The review is to be within the context of meeting the challenge of global warming, while ensuring reliable and competitive energy supplies. The aim of the review will be to set out the objectives of energy policy and develop a strategy that ensures current policy commitments are consistent with longer-term goals. The Minister for Industry and Energy will chair the advisory group for the Project. Other Ministers on the Advisory Group include the Minister for the Environment and the Chief Secretary to the Treasury. The Performance and Innovation Unit will be responsible for the management of the project. The Unit will work closely with the DTI, the Department of Environment, Food and Rural Affairs (DEFRA), the Treasury and other Government Departments who have a responsibility for or an interest in energy policy. The Unit aims to complete its work by the end of the year when the Minister for Industry and Energy will deliver the report to the Prime Minister.

***Formation of a Liabilities Management Authority***

In November, 2001, Patricia Hewitt MP, Secretary of State for Trade and Industry, announced a new U.K. approach to clean up of the legacy created in the early years of Britain's military and civil nuclear programs. A Liabilities Management Authority (LMA) will be established to take on responsibility for most of the U.K.'s public sector civil nuclear liabilities on behalf of the government. Once established, the LMA will employ contractors to perform the work. In preparation for the LMA, the Department of Trade and Industry (DTI) has established a Liabilities Management Unit (LMU) within DTI to assess U.K. liabilities, particularly those of the U.K. Atomic Energy Authority and BNFL; develop an overall U.K. liabilities management strategy including contracting/procurement strategies and commercial practices; and begin the process of creating a viable long-term supply chain for the LMA with a view to promoting competition for nuclear clean up work. The LMU team visited NRC on April 22 to discuss funding, procurement and regulatory issues.

***British Energy Discussions with BNFL on Magnox Plants***

British Energy is in talks with British Nuclear Fuels in which it would operate four of BNFL's six magnox units; Oldbury, Wylfa, Dungeness and Sizewell. The deal would allow BE to run the plants for the remainder of their operating lives without taking on any of the financial risk. Specifically, BE would be provided a guarantee that it would be paid a management fee that would protect it from any losses made from the difference between the cost of electricity production and the sale price. Moreover, BE would not take on the cost of decommissioning the units, which will be assumed through taxes collected by the yet-to-be-formed Liabilities Management Authority (see above).

The agreement could provide a greater share of the electricity market and enable BE to leverage its trading expertise to boost its financial performance. The company has suffered from the collapse in wholesale energy prices as it is a pure generating company and cannot make up lost margins through consumer supply operations. It would also leave BNFL to focus on its nuclear engineering business. If concluded, the deal would mark the first step in the U.K. government's plans to privatize BNFL to meet its commitment to creating a public-private partnership for the group. However, BE and BNFL are still involved in a dispute over the amount that BNFL charges BE for fuel reprocessing.

***Magnox Issues***

There have been operating problems at several of the Magnox stations that have resulted in reduced output from BNFL's Magnox fleet. The reactors at Hinkley A (prior to final closure) and at Bradwell were out of service for most of the 1999/2000 financial year and reactor one at Sizewell A was off-line for a substantial period from November 1999. Also, the reactors at Wylfa have been shutdown since early in 2000. At Hinkley A there was a need to revise the safety case and reinforce it in light of additional information concerning the materials used for the reactor pressure boundary and their performance. At Bradwell, concrete beam reinforcements have had to be carried out to meet the requirements of the seismic safety case. Again, at Sizewell A safety case revisions have had to be made to take account of the results of inspections of the plant. The Wylfa reactors have been shut down for several months following the detection, using new enhanced inspection techniques, of cracks in part of the reactor pressure boundary while a revised safety case is developed and plant modifications completed. More recently, one of the Bradwell reactors was delayed in coming back from its normal statutory outage while enhancements to the reactor pressure vessel safety case where made. Also, the other reactor at Bradwell was shut down for a period to ensure that adequate back up electrical supplies remained available under fault conditions. In addition to these abnormal outages, the Magnox reactors have been subject to their normal statutory outages for maintenance and inspections.

***Chapelcross Fuel Route Incidents***

During refueling operations on Reactor 2 in March 2001, an irradiated fuel element failed to release from the grab holding the element while it was withdrawn from the reactor. Routine methods were used to release the grab. However, the irradiated fuel element snagged during the operation and was lifted out of its shielding. Personnel responded quickly and the radiological dose received by them was small. The HSE investigated the event and judged that it was due to inadequate design and operation of the equipment. The licensee modified the equipment and procedures in accordance with the nuclear site licence requirements and HSE agreed to fueling operations continuing. In July 2001, a carousel containing 24 irradiated fuel elements from reactor 3 fell a short distance from a fueling machine grab at Chapelcross Nuclear Power Station. Subsequent investigation established that at least 12 of the fuel elements had been dislodged and had fallen approximately 25 meters down the heavily shielded fuel route shaft. A number of the elements had fallen into a water-filled transfer flask, which was situated at the bottom of the fuel route shaft. HSE ensured that all necessary measures were taken by BNFL Magnox to safeguard the public near, and employees on, the Chapelcross site while actions were undertaken to recover the fuel safely. HSE is investigating the incident.

### *Wylfa Power Station Superheater Headers*

A planned periodic shutdown of Reactor 2 at the Wylfa power station was made in April 2000 to carry out a program of inspection and maintenance, during which there were a number of unexpected findings. This caused BNFL Magnox to shut down Reactor 1 to see if similar features were present. This was the case. The main findings were that there were indications of defects in the closure welds on the superheater header penetrations. Investigations by BNFL Magnox of the superheater header closure welds indicated that the defects were consistent with lack of fusion during the original welding, with no evidence that in-service growth of the defects had taken place. Based on these findings, BNFL Magnox developed a strategy for addressing the issue, which was accepted in principle by HSE. HSE progressively regulated the implementation of the BNFL Magnox strategy using a series of regulatory hold points. The strategy was based on two approaches. First, the use of structural integrity analysis to robustly demonstrate that each superheater header were fit for purpose without weld repairs and were unlikely to fail under normal or fault loading conditions. Second, defense in depth was to be provided by fitting external restraints to each of the 64 headers, unless there was a detriment to safety in doing so. These restraints will be capable of limiting the amount of header movement in the unlikely event of weld failure. The welds concerned were to be monitored for any signs of incipient failure and will also be subject to an ongoing inspection program.

BNFL Magnox progressed the work with the two reactors shutdown until the work was completed to HSE's satisfaction. Other safety-related findings, arising from the initial inspection, were satisfactorily addressed during the outage by BNFL Magnox.

## Advanced Gas-Cooled Reactor Issues

### *Dungeness B*

Each reactor at Dungeness B has eight boiler units inside the shell of the reactor pressure vessel. These include eight superheater headers that operate at high steam pressure. In November 1999 inspection work discovered a defective weld joining a superheater header and a tube plate on Reactor 21. [This event was rated INES (International Nuclear Event Scale) level 2 because of the severity of the defect and the fact that it was found in an unexpected place.] Both reactors at Dungeness B were shut down for further inspection and repair. After a very extensive inspection program no defects were found on reactor 22. On reactor 21, a second defect was found. BEG's weld inspection and repair program was closely monitored by a team of HSE nuclear Inspectors. Both units have been returned to service after HSE consent to do so. A program of significant safety enhancements for both of the Dungeness B reactors has been completed. It included installation of dividing walls in the circulator halls and an additional high-pressure boiler feedwater system, as well as an electrical overlay system and a carbon dioxide supply system with greater capacity.

During recommissioning of the fueling machine in April 2001, after an extensive fuel route outage, a 'link' was identified that defeated a key protection system. Investigations by the company led to the conclusion that the link had only been put on the machine a few days before its discovery and that no irradiated fuel had been handled while it was present. HSE's investigations confirmed the conclusion. The licensee also demonstrated to HSE that routine tests would always show anomalous results if links were applied across the protection system.

***Hunterston B Loss of Grid Connections***

In December 1998, all grid connections were lost to Hunterston B because of bad weather. Both reactors were tripped manually and automatic protection systems operated normally. The site was reconnected to the grid within two hours. A little later, with both reactors still shut down, the grid connection was lost again. The automatic protection system had not been reset after the first incident and a fault with a diesel back-up generator meant that problems were encountered in maintaining electrical supplies. The recovery plan restored forced cooling to both reactors. The regulatory investigation found that the cause of the incident was a combination of procedural deficiencies, a plant fault and operational weaknesses. It confirmed that the reactor conditions were stable during the incident. It also concluded that the incident had demonstrated the defense in depth of the safety case, which had provided tolerance to plant faults and human error. While there were no radiological consequences, the incident was judged important in safety terms as it identified a number of issues to be addressed that were either site specific or generic. The latter covered the availability of protection systems relevant to the safety case, a review of manual shutdown operations and the comprehensiveness of the safety case for shut-down operations. The HSE required action plans to address both the site-specific and generic issues.

***Hunterston B Boiler Tube Erosion/Corrosion***

The licensee removed Hunterston B Reactor 4 from service in November 2000 to allow inspection of its boiler tubes following a moisture ingress event in May 2000. The inspections resulted in a decision to replace a proportion of the tubes exhibiting signs of service-related degradation. The remedial work required internal access to the reactor concrete pressure vessel, which was undertaken by station and contract staff. The extent of the work required some workers to receive radiation doses above the company dose restriction level of 10 mSv for the year 2000; this step was monitored both within the company and by the HSE. In no case was a dose reported to have exceeded the statutory investigation level of 15.0 mSv, which is below the annual dose limit of 20 mSv. The boiler remedial work was completed early in 2001 and the reactor returned to service.

Inspections of Hunterston B Reactor 3 and Hinkley Point B Reactor 3 boilers, during their statutory outages in the summer of 2000, revealed no evidence of damage. Hunterston B and Hinkley Point B are nominally identical stations. Similarly, inspection of Hinkley Point B Reactor 4 in December 2000 showed no evidence of erosion or corrosion. Prior to the inspections, the boiler pressure and flow were reduced as a prudent measure (there had been no evidence of leaking boiler tubes). The cause of the damage at Hunterston B Reactor 4 has not been established.

***Magnox Management of Aging***

BNFL announced on May 23, 2000, a lifetime strategy for its Magnox nuclear power stations. The strategy provides a phased program for the cessation of electricity generation at the eight stations, most of which began operating in the 1950s and 1960s. The reactors are licensed to operate for between 33 and 50 years and this early announcement of the Company's strategy

or the lifetimes of the stations allowed operational plans to be optimized. For business reasons, Hinkley Point A was not brought back into service from its shutdown at the time. With the announcement, the Magnox station lifetimes will be planned as follows:

| Station Licensed | Lifetime | Age at Cessation of Generation | Published Lifetime |
|---|---|---|---|
| Calder Hall | 50 | 50 | 2006/2008 |
| Chapelcross | 50 | 50 | 2008/2010 |
| Bradwell | 40 | 40 | 2002 |
| Hinkley Point A | Defueling | | |
| Dungeness A | 40 | 40 | 2006 |
| Sizewell A | 40 | 40 | 2006 |
| Oldbury* | 40 | 40 | 2008 |
| Wylfa* | 33 | 38 | 2009 |

Market conditions, safety or technical issues could result in earlier closure.

* At the time of the May 2000 announcement, BNFL were considering the option of converting Oldbury and Wylfa to run on a new type of ceramic oxide fuel called Magrox, which would not need to be reprocessed in the same way as Magnox fuel. However, BNFL have decided, recently, not to pursue trials of Magrox fuel for these stations, due to a significant risk that there would be insufficient return for the high capital investment required.

***Staff Reductions***

Like other U.K. industry sectors, the nuclear industry is under commercial pressures to cut costs and is undertaking many changes. If changes in staffing levels are inadequately conceived or executed they have the potential to adversely affect the way in which safety is achieved and managed. On the other hand, changes have the potential to improve safety. The U.K. would not wish to draw a predetermined line at the limit of staffing that would be acceptable. This will vary with circumstances, for example: the balance of skills retained; the needs of safe operation of the site; and the amount of control of bought-in expertise. Nor would it be appropriate for the regulator to draw such a line, as this would be incompatible with the U.K.'s non-prescriptive regulatory regime. Licensees are responsible for safety. It is for licensees to justify such proposed changes to the regulator, demonstrating no adverse affects on safety, and for the regulator to judge the adequacy of such changes by assessment and inspection. There are sufficient powers under the licence to regulate such changes.

Attachment 5

# CURRENT NRC-HEALTH AND SAFETY EXECUTIVE (HSE) COOPERATIVE RESEARCH AGREEMENTS

We currently have cooperative agreements in the following areas:

1. Severe Accident Research

   Provides a framework for collaboration on the NRC's nuclear safety research programs; including integrated severe accident code development and assessment as well as investigations related to high burnup fuel. The Health and Safety Executive (HSE) are members of NRC international Cooperative Severe Accident Research Program (CSARP). HSE is participating in CSARP by providing $50K per year plus in-kind technical information exchange in the form of analysis and experimental data/insights in the areas of code validation and verification. The Current three year agreement with HSE will expire in December 31, 2002. Continued future participation in this cooperative research program is expected. A agreement was sent to IPSN for their review and approval last fall.

2. T-H Code Development and Assessment Program

   The NRC and the HSE are currently participating in the Cooperative Thermal-Hydraulic Code Applications and Maintenance Program (CAMP) whose objectives are to share experience on code errors and inadequacies and cooperate in resolving the deficiencies and maintaining a single, internationally recognized code(s) (i.e., RELAP5/MOD3 and TRAC-M codes). HSE is also contributing $45K per year to the CAMP program. The current agreement will expire in August 2002. Negotiations are underway to extend the agreement for an additional five years.

3. Cooperative Probabilistic Risk Assessment (COOPRA) Program

   The COOPRA agreement between NRC and HSE was signed in 1999 for a five year period. As members of COOPRA, HSE is providing in-kind technical information exchange that includes: validation of probabilistic risk assessment (PRA), development of improved PRA methods, application of PRA to operational and design problems, and derivation of data for PRA's. The current agreement will continue through August 2003.

In addition to the above bilateral cooperative activities, the U.K. is active in working with the NRC and other countries in resolving the following outstanding safety research issues:

1. High Burn Up Fuel Behavior Under Accident Conditions

   A multilateral OECD-IPSN Cabri Water Loop Project has been signed by the NRC as well as the Bi-lateral Cabri Water Loop Agreement between NRC and IPSN to conduct the tests in Caderache France. The objective of this project is to conduct an investigation of high burnup fuel under reactivity initiated accident conditions in water reactors. This agreement will remain in force through 2005. Although this agreement is for a five year duration, it is the intent of the participants to extend the agreement for and additional period, under the

same terms and conditions, to cover the duration of the whole program which will continue into 2008. The total cost of the program is approximately $64M, with NRC contributing a total of $3.5M ($500K per year).

2. Molten Reactor Fuel-Lower Head Pressure Vessel Interaction Research:

   The HSE have been an active participant with the NRC and thirteen other OECD/NEA member countries in the RASPLAV project. This project, conducted at the Kurchatov Institute, in Russia, was initiated in 1994, and was completed in June 2000. The new MASCA Project is the continuation of the severe accident research that was started under RASPLAV. The NRC and IPSN are participating in the new program. The MASCA Agreement was signed by the NRC in December 2000.

3. OECD HALDEN PROJECT

   British Energy, representing a group of nuclear research and industry organizations in the U.K., is a participant with the NRC and other organizations of the OECD member countries in the Halden Reactor Project. The current OECD Halden Project extends through - through year 2002. Negotiations (review) are ongoing for extending the programs for an additional 3-year period (2003 - 2005). Research programs include: High Burn-Up Fuel Performance, Safety and Reliability; Reactor Operation for Test Fuel Irradiation; Man-Machine Research; and, Degradation of In-Core Reactor Materials.

4. OECD MCCI PROJECT

   The objectives of this project are to investigate ex-vessel Melt Coolability and Concrete Interaction (MCCI) during a severe accident. This program will provide experimental data on relevant severe accident phenomena and provide insights by which 1) molten debris that has spread on the base of the cavity can be stabilized and cooled by water flooding from the top, and 2) long term interaction of molten mass with the concrete structure of the containment. This agreement will remain in force through December 2005.

5. OECD SETH PROJECT

   The objectives of this project are to investigate issues relevant for accident prevention and management through containment and primary circuit tests, and to provide data on containment three dimensional gas flow and distribution issues. These issues are important for analytical code prediction improvements, accident management, and design of mitigating measures. This agreement will remain in force through June 2005.

6. OECD-ICDE PROJECT (International Common-Cause Data Exchange)

   The objective of this project is to expand the common-cause failure event data available to NRC and Utilities through data exchange among the OECD/NEA member states.