

**HEALTH AND SAFETY COMMISSION
NUCLEAR SAFETY ADVISORY COMMITTEE
SUB-COMMITTEE ON RESEARCH**

**Minutes of the 39th Meeting of the
Nuclear Safety Advisory Committee Sub-Committee on Research
3rd October at HSE, Rose Court, London**

Present:

SCR Members

Prof N Moray (Chair)

Dr P Haigh

Prof R Dolby

Prof R Grimes

Prof R Bloomfield

HSE

Dr P Storey

Dr H Starkie

Mr V Coleman

Licensees

Dr R Ainsworth, BE

Dr P Harston, BNGSL

Mr S Daniell, Magnox Electric Ltd.

Ms J Lloyd, UKAEA

Others

Dr N Smart (NDA)

Apologies:

Mr S Walsgrove, DTI

Graphite Presentations

Mr A Steer, BE

Dr D Lever, Nirex

Dr N Smart, NDA

Dr R Taylor, SCR

1. Welcome to New Members and Apologies for Absence

1.1 The Chair welcomed new member Prof. Robin Bloomfield to the SCR.

1.2 Apologies for absence were received from Steven Walsgrove and Richard Taylor.

2 Approval of Minutes: 38th Meeting on 4th April 2006

2.1 Subject to adding the words 'and Strathclyde' to the end of the first sentence of Paragraph 8.2.1, the SCR approved these Minutes.

3. Matters Arising from Previous Meeting

3.1 All Actions from the previous meeting have been completed except Action 06/9.

3.2 The SCR Chair remarked that Profs. Sue Parry and John Knott had stood down from both NuSAC and the SCR. He expressed his thanks on behalf of the SCR to both of them for their work on these committees over the past years and asked that the SCR Secretary write to them to express the Sub-Committee's gratitude and best wishes (Action 06/11). The meeting also noted that Alex Miller had moved to a new post in NSD and wished him well in his new job.

3.3 The Chair added that the next meeting of the SCR should be in February 2007 so that the HSC Programme for 2007-08 can be discussed and recommendations sent up to the main NuSAC meeting in March 2007. The Chair of NuSAC would then be able to advise the HSC at the beginning of the next financial year so that the HSC can approve the 2007-08 programmes.

3.4 The Chair reminded members of the SCR that they should declare to him any business interests that could give rise to a conflict of interest with their roles on the SCR (Action 06/12).

4. Evaluation of the 2005-06 Programmes

4.1 Evaluation of the 2005-06 Levy Programme Paper NuSAC/SCR/06/18

4.1.1 Peter Storey reported that expenditure on the HSE Levy Programme was to budget. He added that HSE had not had to use its Levy powers to pay for work that the Licensees had declined to support. The programme had a strong international orientation with the Levy being used to enable the UK to buy into a number of international research programmes. Peter warned that HSE's access to independent technical capability was coming under pressure in particular in the Chemical Processes area. This issue could potentially be

addressed by making more use of the Health and Safety Laboratory (HSL) in Buxton.

4.1.2 The SCR commented upon the lack of user friendliness of HSE's arrangements for getting access to Levy Reports. An action was placed upon NSD to report on its plans to put Levy reports on the HSE website and make them easy to find (Action 06/13). Vic Coleman offered to discuss with Peter Storey what help the Chief Scientist's Unit could give to achieve this (Action 06/14). Neil Smart suggested that the proposed National Nuclear archive could provide an alternative way of finding reports. The SCR raised the issue of how new build would affect the cost of the Levy Programme. Peter Storey replied that there were no arrangements in place to extend the Levy programme to new build. The need to do so would depend upon what research a prospective vendor had done already. The Chair asked that arrangements for new build should be discussed at the next meeting of NuSAC/SCR (Action 06/15). The SCR commented that there were a number of emerging issues related to new build such as the levels of diversity in new designs.

4.2 Evaluation of the BE 2005-06 Nuclear Safety Research Programme Paper NuSAC/SCR/06/19

4.2.1 Bob Ainsworth reported that British Energy had 96 projects running. 26 had been closed out during the year. The company had spent more on its NRI projects than originally planned, especially on some of those involving collaboration with Magnox Electric.

4.2.2 The SCR asked if British Energy had a Research Coordinator for each technical area. Bob Ainsworth confirmed that they had. The SCR asked what work had had the most beneficial impact this year. Bob Ainsworth nominated the residual stress work in the Structural Integrity area. The company could now use numerical simulation rather than bounding values when making structural integrity assessments to support safety cases.

4.3 Evaluation of the Magnox Electric 2005-06 Nuclear Safety Research Programme Paper NuSAC/SCR/06/20

4.3.1 Steve Daniell opened his presentation by describing the ongoing station closure programme and the organisational changes the company was going through before splitting into two smaller SLCs. He then reported that Magnox Electric had undertaken about 50 projects during 2005/06 to address the NRI. The biggest area for research was Graphite, especially related to resolution of safety case issues prior to the restart of Oldbury. The company completed the 2005/06 programmes slightly under budget having funded the programme from its NTWP to the NDA. He added that, following discussions with NSD, it had been agreed that it was now appropriate for Magnox Electric to move from Research Arrangements for generating Licensees to arrangements applicable to decommissioning licensees such as UKAEA.

4.3.2 Peter Storey added that any new safety research issues related to Oldbury and Wylfa would be pursued through the regulatory route rather than the research arrangements, on account of the short-term nature of such research needs. For any research needed to support the safety of the decommissioning stations, NSD would go through the route of developing research strategies, such as those used for the Sellafield arrangements, rather than using the NRI. He added that technical dialogue with Magnox electric would remain in place and NSD would oversee the Magnox Electric programmes with the same rigour as previously.

4.3.3 The SCR asked what the NDA Strategy meant. Peter Storey answered that there was a need to get NDA SLCs to collaborate on research where they had interests in common. The SCR then asked where we can get a view of what capability was needed and where we can get it? It was agreed to defer discussion on this to another time (Action 06/16). The SCR then raised the question of what we do with archived samples. Steve Daniell replied that there was a veto on the disposal of archived samples until the National Nuclear Archive strategy is available.

4.4 BNG Sellafield Ltd 2005-06 Nuclear Safety Research Programme Paper NuSAC/SCR/06/21

4.4.1 Paul Harston reported that BNG Sellafield Ltd was also undergoing organisational changes to comply with the NDA strategy. He added that the company had made good progress over the past year in addressing issues. In future, he expected that the company's response to NSD's Research Strategy Statements would be included in the company's Technology Plans to the NDA.

4.4.2 The SCR suggested that licensees should just describe their top achievements during the past year rather than giving the full reports. The SCR added that it was not clear from the reports what achievement or progress had been made, only that work was on-going. SCR further added that licensees should also report what work had not gone right.

4.4.3 Further comment from the SCR expressed concern that the Human Factors research programme was going forward too slowly and not getting a good hold on the issues. The SCR suggested that the MoD 'traffic light' system may be useful in tracking the progress of Human Factors research programmes and suggested the need for a nuclear and major hazards industry-wide forum to review Human Factors programmes.

5 Graphite Research Presentations

5.1 Operational Reactor Graphite Research

5.1.1 Alan Steer from British Energy gave a presentation that described both the British Energy and Magnox Electric graphite research programmes. For British Energy, the principal drivers of the graphite research programme are the maintenance of margins in safety cases, the observation of graphite

degradation through AGR core monitoring and inspection, obtaining a better understanding of core degradation processes and their consequences and obtaining data on the changes of material properties with irradiation, in advance of reactor operations.

5.1.2 British Energy has divided their graphite programme into a strategically funded programme and a direct funded one. The strategically funded programme is used to establish relationships with academic institutions and is aimed at fundamental research such as atomistic modelling of graphite crystal damage by irradiation, the physical properties of the graphite, fracture mechanisms and the assessment and monitoring of graphite behaviour data. The directly funded programme is with contractors and covers programmes such as the collection of trepanned samples from AGR core fuel bricks, the measurement and modelling of graphite sample physical properties, developing improved core inspection techniques and whole-core modelling and validation. AMEC-NNC using test rigs at Risley do the validation experiments. From September 2007, the company will have an accelerated aging programme for graphite under irradiation, which will make use of the Petten high-flux Materials Testing reactor.

5.1.3 The Magnox Electric graphite programme is targeted at addressing safety case requirements for stations over their remaining operating lives. Magnox Electric is working collaboratively with British Energy on the programme to develop improved core inspection techniques and have a programme of microstructural studies on PGA graphite.

5.1.4 The SCR asked if brick to brick variation in graphite properties could be used in incredibility of failure safety cases. Alan Steer replied that brick to brick differences, such as amount of shrinkage due to irradiation, had been observed and would need to be taken into account in safety case development. The SCR next asked if there were any links between atomistic modelling of graphite behaviour and crack propagation. Alan Steer replied that there was a proposal to have work done at Manchester University on crystal-crystal interactions and the effects of dimensional changes on crack propagation. The SCR asked if the fundamental research that was being undertaken had found applications in core monitoring. Peter Storey supplemented the question by asking if anything that had been learned from the fundamental studies, could be used to mitigate the effects of core irradiation damage in future. Alan Steer answered that benefits would be obtained from using improved microstructures in new graphite moderated reactors such as HTR.

5.2 Graphite waste Treatment and Disposal Research

5.2.1 Neil Smart gave a presentation covering the NDA study into the possible options for treating graphite waste before its disposal, so as to minimise the volume of graphite sent to the repository. The UK has an estimated inventory of 80,000 tonnes of irradiated graphite that will need disposal. If all of this were to be sent to the ILW repository, it would take up 30% of the repository's capacity. Of particular concern to the disposal of graphite waste are the long-lived radionuclides ^{14}C and ^{36}Cl contained in the irradiated graphite. The

thrust of the NDA-sponsored study is to determine where these radionuclides are physically located in the waste graphite (near surfaces or evenly distributed in the graphite matrix) and how easy they would be to remove from the graphite. Graphite treatment technologies, waste volume reduction technologies, possibilities for reuse of the graphite and alternatives to deep geological disposal for the graphite are being considered.

5.2.2. The SCR asked about an MSc on graphite waste treatment optioneering that NDA was sponsoring. Neil Smart answered that the MSc student was being supervised by experienced people and was working in NDA's offices.

5.2.3 Following Neil Smart's presentation, David Lever gave a presentation on the Nirex programme to address the issues surrounding the disposal of graphite wastes. These issues are principally ^{14}C , ^{36}Cl and Wigner energy. ^{14}C is a significant problem if it is transported to the biosphere as methane gas, because this gas could be metabolised by microbes and enter the food chain. Nirex has a research programme to characterise ^{14}C -containing wastes (irradiated metals and organics as well as graphite) and any gases that may be released from them in a repository environment, to see if methane is produced. The ability of different geological environments to retard gas migration is also being investigated. ^{36}Cl can be transported to the biosphere in groundwater but Nirex believe that its risk targets for an ILW repository can be met, in an appropriate geological environment. The issue with Wigner energy is that it could be released and the heat given out could accelerate corrosion processes or change the mineralogy of the repository backfill. Wigner energy release is a particular problem from graphites irradiated at temperatures below 100°C . Annealing graphite, to release the Wigner energy before disposal, is being considered. In conclusion, David Lever stated that continuing dialogue between Nirex, waste producers and NDA was needed.

5.2.4 The SCR commented that both of the graphite waste presentations were interesting before adding that the UK was not the only country with graphite issues and enquiring if there was dialogue with other countries. Neil Smart answered that there were dialogues with EdF (all research), South Africa (HTR graphite) and Russia (under ISTC). Peter Storey added that Nexia solutions had prepared a submission in collaboration with France, Germany and Spain for a programme on the disposal of graphite for the EU sixth Framework Programme. This submission had failed but they will try again under the seventh Framework.

6 Revision of Ways of Working of NuSAC/SCR Paper NuSAC/SCR/06/14

6.1 The Chair of SCR expressed the view that NuSAC/SCR needed to be repatriated into its parent NuSAC as another Review Group, since the existing sub-committee actually reports to NuSAC rather than the DTI. [*This view is consistent with the conclusions of the discussion under item 12, on the revision of DTI guidelines, as reported below*]. The Chair's proposed revised

terms of reference for the SCR, as listed in Appendix 2 to the above paper will be presented for discussion to the NuSAC meeting in November. He added that no severe criticisms were made of his proposals when he put the Draft of Paper 14 out to comment. However, under Ways of Working in Appendix 2, he proposed adding a twelfth way of working that would read 'Establish success criteria for the outcome of the work of the Review Group'.

6.2 The SCR commented that under the first bullet point of Way of Working number 10, '...in the next five years' should be replaced by '...on an appropriate timescale', to be less prescriptive. The SCR then asked if the Review Group would still have detailed presentations on specialist areas if it were working at a more strategic level than the SCR. The Chair replied that it would. The SCR next commented that the new Review Group could either function as the SCR does now or just undertake strategic reviews of the research programme. The Chair responded that the new Review Group would have to have some element of strategic review on the nuclear safety research programme, because when the NDA and MoD licensees come into the programme, it will not be possible to examine all the work in the present detail. He suggested that the Review Group could 'sample' programmes such as the HSE Levy, to see how the work is being done.

6.3 The SCR then commented that if Review Group members were expected to do the deep reviews themselves, a greater commitment of time and effort would be needed from them. It was suggested by the SCR that the licensees themselves could do most of the drafting for such reviews, with the Review Group providing only the 'final polish'. The SCR noted that the SCR had to adapt its methods of working as the industry itself evolves. Peter Storey considered that the current ways of working had become untenable. The way the SCR worked was difficult enough when only the power reactor programme was considered. Now that the programme has widened, it would not be possible for the SCR to look at all the details of every programme. Peter Storey suggested using NSD Key Business Activity 5 (Research) as a starting point to build a framework that the Review Group can interrogate to satisfy itself that arrangements are working.

7. Report from the NDA Research Board

7.1 Neil Smart reported that the NDA Site Licensee Companies (SLCs) had presented their latest Technology Plans to the Research Board. These were well received by the Board but they commented that greater consistency between the presentations was needed. The Board also pushed for the establishment of technical exchange groups through which SLCs could share experience and best practice. In particular, it was noted that there were research areas such as waste product longevity and graphite that were common across many SLCs. Research in these areas needed to be coordinated. Neil added that SLC Technology plans should share best practice between SLCs and that change control procedures need to be made effective. Peter Storey commented that the Technology Plans were good but needed to clearly identify those safety issues that NII had raised.

8. Update on any significant changes in 2006-07 HSC Co-ordinated Programme of Nuclear Safety Research. No Paper

8.1 No problems or changes were reported.

9. Inputs to 07-08 Programmes

9.1 Haydn Starkie presented a summary of the 2006 update to the NRI and the Sellafield Nuclear Safety Research Strategy statements. The SCR commented upon the use of 'soft' words in the research strategies. Peter Storey explained that NSD's treatment of each technical area in a consistent and proportionate manner meant that some technical areas did not need to go through a review each year. Bob Ainsworth added that making the NRI more strategic in its overview would help in identifying those technical areas that needed less frequent review.

10. Human Factors Programme Paper NuSAC/SCR//06/16

10.1 Haydn Starkie reported that in spite of the severe shortage of Human Factors resource in NSD, the Human Factors Section of the NRI had been reviewed and updated as judged necessary to reflect the outcome of the March 2005 Human Factors Workshop at HSL in Buxton. The SCR expressed disappointment that NSD had not been able to address its shortage of Human Factors resource and suggested it try to recruit extra staff through the Ergonomics Society. [*Secretary's note: This suggestion was put to one of NSD's Human Factors Specialists. The response was that the Ergonomics Society is good only for recruiting new graduates, not the people with nuclear industry experience that NSD seeks.*] Peter Storey added that NSD needed to get the Human Factors resource at HSL to play a bigger role in providing support.

11. University Research Alliance and EngD

11.1 Discussion on this topic was deferred to the next meeting (Action 06/9 continued).

12. Revision of DTI Guidelines Paper NuSAC/SCR/06/22

12.1 Peter Storey expressed the opinion that DTI are apparently no longer interested in the Nuclear Safety Research Programme and HSC are more concerned about nuclear safety. He added that HSC did not need to look at an adequate and balanced programme across the UK, choosing instead to make sure that a 'reasonably practicable' programme was being undertaken. He added that the National Nuclear Laboratory might take on the responsibility of seeing that the programme was adequate and balanced.

12.2 Neil Smart commented that the National Nuclear Laboratory would be used as a repository of skills that the industry might not be able to support long-term. He expected the licensees to support the skills they needed for their own needs in parallel. Peter Storey commented that the proposed guidelines revision refocuses the research programme on what it needs to do and how this will be achieved. The proposed revisions fit in well with the proposed revised TORs for the SCR [*discussed under Item 6.*].

12.3 The SCR observed that discussions with DTI might be needed before these revised guidelines could be implemented.

13. Relationship of HSE and HSL

13.1 Peter Storey reported that NSD was seeking to build stronger relationships with HSL as a source of in-house support to NSD. He was also looking at building up relationships with the Dalton Institute at Manchester, especially for research related to new build and Gen IV. Vic Coleman added that the new Chief Executive at HSL was enthusiastic about going out to the market place, to find out what work needs doing and aggressively looking for business.

14. AoB

14.1 The meeting agreed to look into the possibility of allowing the NDA representatives to attend future meetings by videoconference on account of the long journey from West Cumbria (Action 06/17).

15. Date of Next Sub-Committee Meeting

15.1 Tuesday February 6th 2007 was agreed as the date for the next meeting. The specialist topic for the meeting will be new build research.

Actions

06/9 SCR to prepare a paper on University Research Alliances from the universities' perspective for the next meeting.

06/11 SCR Secretary to write to Profs. S. Parry and J. Knott thanking them for their work on the SCR.

06/12 Members of SCR to declare to the Chair any business interests that could lead to a conflict of interest with their roles on NuSAC/SCR.

06/13 NSD to report on its plans to put Levy reports on the HSE website and make them easy to find.

06/14 Vic Coleman to discuss with Peter Storey what help the Chief Scientist's unit could give to help NSD put its Levy Reports on the HSE website.

06/15 SCR Secretary to place new build on the agenda of the next NuSAC/SCR meeting.

06/16 SCR Secretary to place the NDA Research Strategy and capabilities needs on the agenda of the next NuSAC/SCR meeting.

06/17 NSD 4A to investigate the practicality of NDA contributing to SCR meetings by videoconference.