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UK INVOLVEMENT IN INTERNATIONAL NUCLEAR SAFETY RESEARCH COLLABORATIVE RESEARCH PROJECTS

Paper by HSE

1. Introduction

1. This paper follows on from paper NuSAC/SCR/04/9, which discussed HSE/reactor licensee involvement in the Euratom, OECD-Nuclear Energy Agency (NEA) and International Atomic Energy Agency (IAEA) joint projects in the context of the HSC co-ordinated nuclear safety research programme. This paper updates this information, and includes discussion of waste management research and the role of the Department of Trade and Industry (DTI), BNFL and the Nuclear Decommissioning Authority (NDA). NSD is developing an international plan, which will set out the priorities of NSD's international activities, including research.

2. There is much activity by BNFL and others on international advanced reactor research involving OECD-NEA, IAEA, US Generation IV and the Euratom Framework programmes that are not addressed here, as HSE has no remit for new build.

2. Objectives of involvement in international collaboration

3. Involvement in international collaboration should lead to reduced costs of national programmes, increased technical information, and dissemination and peer review of research results.

4. With UK nuclear safety research likely to decrease as the UK nuclear power stations are closed, it is important to take advantage of international activities to obtain research information for the UK in a cost effective manner. However the reactor licensees query the appropriateness of benefits for the UK being paid for by the reactor levy programme.

5. Most international collaboration is likely to be related to PWR issues and significant financial benefit can be obtained from such collaboration. It is important that in defining and commissioning the programme, proper recognition is made of the extensive PWR research that is undertaken abroad. Currently, technical areas of the programme involved in international activities include: plant life management; PSA; severe accident; thermal hydraulics; fission products; C&I, external hazards, civil engineering and reactor physics. UK expenditure on PWR research has decreased with consequent reductions in spending in the above technical areas. This is a consequence of the considerable international safety research that has been carried out in support of PWR operations.

6. There is also an objective of maintaining international facilities such as material testing reactors or research reactors with instrumented facilities that no longer exist in the UK. This helps to ensure that the UK has access should it be needed in the future for problems related to existing plant. This issue is of concern in many countries and has been the subject of several reports and recommendations by the OECD NEA Committee on the Safety Nuclear Installations. Recent developments in this area are the decision to shut the Studsvik Material Testing Reactors and transfer the irradiation tests to Halden, and a project in FP7 to study the French proposal for a new Material

Testing Reactor, the Jules Horowitz Reactor. This objective is consistent with NSD's strategic goal of promoting the maintenance of essential nuclear safety infrastructure. The licensees maintain that implementing risk mitigation activities related to existing plant is a matter for the plant operators to decide, but the regulators tend to look on a longer timescale.

7. A supporting objective of the programme as given in the DTI Guidelines is to ensure that proper account is taken of the advantages of international collaboration in furthering the primary objectives.

8. Secondary advantages achieved through these contacts are to assist in the dissemination of UK research and to demonstrate that the regulator is well informed on international developments and moving towards being a world class nuclear safety regulator (benchmarking). Through the working groups organised by the OECD NEA Nuclear Safety Division, HSE maintains awareness of international issues.

3. Mechanisms of involvement in international collaboration

9. Access to international nuclear safety research information can be achieved in a number of ways, e.g. participation in international research ventures and international agency committees, membership of research "clubs" where research is shared, sponsorship of and representation at meetings and seminars and through exchange agreements. Sections 4-7, respectively, provide more detail of international collaboration in:

- Euratom Framework Programme
- OECD-NEA
- IAEA
- Other Programmes.

10. HSE also participates in generic international research in such areas as steel structural integrity. For example, HSE is a member of the Framework network FITNET,

which is developing European fitness-for-service guidelines. BE are also members of this project.

11. The industry has its own access to international information through such channels as the World Association of Nuclear Operators, Electrical Power Research Institute, Westinghouse Owners' Group, Institute of Nuclear Power Operations, Framatome-ANP customer information meetings, and a European utilities fuel group (The Users Group). The industry makes submissions under Euratom Article 37 on plans for radioactive waste disposal. It also participates in international standards work such as ISO and the International Electrotechnical Commission. This information is not directly accessible to HSE. The industry can and does also participate directly in the activities of EU FP, NEA and IAEA projects, European networks, RILEM (partly a concrete testing association), IGRDM (International Group on Radiation Damage Mechanisms), etc. Inclusion of projects in the HSE Levy programme means that HSE has independent direct access to all the results, and not just those that the industry chooses to submit in safety cases. It also means that HSE may have the possibility to influence the course of the project if appropriate.

4. Euratom Framework Programme

12. HSE-NSD participates in Euratom Framework Programmes for the same reasons as in other international programmes, and also to benefit from the (typically 50%) funding supplied by the EC. HSE-NSD participates in (and currently provides the chair of) CCE-Fission, a consultative committee that advises the EC on the content of the Euratom Framework Programme.

4.1 FP6

13. FP-5 projects were reported in the previous paper. Although these are mainly completed, a small number of projects are continuing particularly in the structural integrity area (e.g. FITNET, SMILE, ECCC). FP-6 runs from 2002 to 2006. UK participation is shown in table 1. BNFL and UKAEA are participants in projects, but BE and Magnox Electric Ltd. are not involved in FP6. HSE funds NNC to participate in an

emergency planning project in the Radiation Protection part of the programme, and will provide levy funding for GAIN, a non-destructive inspection project currently under negotiation. BNFL also participates in Framework programmes associated with advanced reactors such as High Temperature Gas-Cooled Reactors and Fast Reactors, in particular work on fuel performance and fuel cycles.

4.2 FP7

14. Negotiations are in progress on the content of FP7. It is probable that fission safety will be included in FP7. As part of HSE's membership of the consultative committee CCE-Fission, HSE participated in a Working Group on Existing and future reactor systems. The Department for the Environment, Food and Rural Affairs (DEFRA) participated in a parallel WG on Radioactive Waste Management. HSE and DEFRA funded NNC to carry out a UK consultation to provide input to the WGs. HSE also participated in a WG on 'horizontal aspects' (cross-cutting issues, choice of funding instruments etc) and the Department of Health contributed to the Radiation Protection WG. The WGs reported back to CCE Fission with member countries' advice to the EC on the content and organisation of FP7. The UK consultation report (covering reactors and WM) has been placed on the HSE website. HSE has also contributed to a UK consultation on FP7 carried out by DTI Office of Science and Technology.

5. OECD-NEA

5.1 Committees

15. HSE-NSD participates in OECD-NEA activities. In contrast with EU activities, NEA offers access to information from USA and Japan. The UK participates in various NEA standing committees:

- Committee on the Safety of Nuclear Installations (CSNI), on which NSD is represented. This oversees nuclear safety research projects. NEA reactor

safety activities tend to concentrate on LWRs because of the members common interests.

- Committee on Radiation Protection and Public Health (CRPPH), on which HSE-NSD, the Environment Agency (EA) and the National Radiological Protection Board (planned to become part of the Health Protection Agency) are represented.
- Radioactive Waste Management Committee (RWMC), on which EA is represented. This has a Regulators Forum, on which EA is represented. HSE-NSD has participated in activities such as the WP on Decommissioning and Dismantling and Human Factors in Decommissioning, but this is currently in abeyance.
- Nuclear Science Committee (NSC), on which BNFL and HSE are represented. HSE attends as it oversees UK access to the NEA Databank, although these arrangements are under review.
- Nuclear Development Committee (NDC), on which DTI and BNFL are represented.

The future role of BNFL in such committees remains to be decided. BNFL through its work on advanced reactors also participates in working groups on Pu disposition, fuel cycle analysis and fuel burn-up; but these are not covered in further detail here.

5.2 Projects

16. The NEA nuclear safety projects are listed in Table 2 with details of UK participation. Through these projects the UK supports activities in and obtains access to research reactors abroad (Halden, Cabri), as there are no major UK research reactors any longer. HSE has joined two new projects in the last year: ROSA on thermal hydraulics and the Studsvik Cladding Integrity Project.

17. By agreement with DTI, HSE organises UK membership of the NEA Databank, giving access to nuclear data (the Joint Evaluated Fission and Fusion data) and nuclear codes. Commercial organisations pay a fee and non-commercial organisations

(mainly universities and hospitals) are given free access. The former Industry Management Committee used to organise this, but with the demise of the IMC, HSE took over the role. The balance of the UK membership fee is paid for by levy on the reactor licensees.

6. IAEA

18. IAEA research activities are limited. HSE and BE are involved in the International Graphite Database. BE has contributed to a Database on concrete pressure vessels and containments. BNFL participates in a Coordinated Research Project on wastes from decommissioning and pursues advanced reactor related interests through IAEA Technical Working Groups.

7. Other programmes and arrangements

19. HSE is a member of the CAMP agreement (Codes Applications and Maintenance Programme) run by the US Nuclear Regulatory Commission. This gives UK access to thermal hydraulic codes, mainly RELAP and TRAC. These can be used to give an independent check of the results from UK codes. The cost is shared between the Ministry of Defence and BE. HSE has withdrawn from the agreements with USNRC on severe accidents and PRA.

20. DTI has signed the US Department of Energy Generation IV International Forum charter, and HSE is a member of the Policy Group to support DTI on technical and safety issues. This is HSE's main involvement with potential research for new build. HSE has also been invited to be a member of the International Advisory Group for the French Phebus test reactor future programme, as the current fission product programme is finishing.

8. Future Roles in the UK

21. The IMC and BNFL used to take a leading role in participation in the Euratom Framework programme. With the demise of the IMC, the reduction of the reactor research programme and the restructuring of BNFL, there is no 'national champion' for the UK. Although decommissioning is not seen as a major research area, the waste management programme is the largest part of the Framework programme, and already has extensive UK participation. HSE believes that the NDA should take over a

role, as national coordinator of participation in international waste management R&D. Coordinating access to the NEA Databank could also be a role for NDA. BNFL currently plays a large role in funding research for new systems, but the way forward with DTI funding still has to be agreed.

22. NDA has expressed some preliminary views in this area, which are reproduced verbatim here.

Role of NDA in international links

There are a number of good opportunities for co-ordinating international links across the scope of work for the NDA. There are numerous links into the IAEA through the different contractors, which may not necessarily be co-ordinated at best. There is an intention is to utilise the Research Board to provide a focus for co-ordination of national and international programs.

In addition, whilst the NDA does have a role to ensure there is some level of co-ordination on these sorts of initiatives, this does not preclude contractors participating in European initiatives where there is the potential for cost savings, leverage etc for NDA programs of work. This would be considered good proactive contractor behaviour as it could offer better value for money to the customer on appropriate scopes of work.

Reasons for co-ordinating international programs

The main driver, from an NDA perspective, is to provide opportunities to leverage UK investment through these international programs. This would be useful for a range of things such as introduction of new tools, techniques, approaches, collaborating on issues of common interests, benchmarking and promoting best practice, supporting long term skills and capability requirements etc….

Timescales

The international programs probably lend themselves to longer-term initiatives. NDA also needs to consider how to influence future European initiatives.

9. Conclusions

23. In summary:

- The DTI Guidelines for the programme require that HSE take proper account of the advantages of international collaboration. The current proposed HSE guidelines to replace the DTI guidelines will require HSE through the programme to take account of the advantages of international collaboration.
- HSE has joined 2 new OECD-Nuclear Energy Agency projects in fuel and thermal hydraulics in the last year as part of the Levy programme.
- There is some very limited HSE and licensee involvement in the 6th Euratom Framework Programme, alongside other UK involvement.

- HSE has participated in consultation for the content and organisation of the 7th Euratom Framework Programme. It carried out a UK consultation in parallel.
- HSE believes that the Nuclear Decommissioning Authority should take a coordinating and sponsoring role for the UK in waste management research in areas such as the Euratom Framework Programme and OECD-NEA activities.
- BNFL currently funds much new systems research. The way forward has to be agreed with DTI, determining the requirements for Keeping the Nuclear Option Open and the appropriate actions to take in order to underwrite critical capability within the regulator and industry

10. Action

24. The SCR is invited to note and comment on the information presented in this paper.

Table 1 FP6 Projects accepted by the European Commission

Programme area	Proposal	Full title	Coordination If UK	UK participation
Management of Radioactive Waste	RED-IMPACT	Impact of Partitioning and Transmutation and Waste Reduction Technologies on the Final Nuclear Waste Disposal		NIREX BNFL
	NF-PRO	Understanding and physical and numerical modelling of the key processes in the near field and their coupling for different host rock and repository strategies		U Wales U Sheffield Immobilisation Science Lab NERC Serco Quintessa Galson Sciences
	COWAM 2	Community Waste Management 2: Improving the Governance of Nuclear Waste Management and Disposal in Europe		U Lancaster Quintessa NRPB Syncho
	ACTINET-6	P&T and other concepts to produce less waste in nuclear energy generation		U Manchester Imperial College
	EUROPART	European research programme for the partitioning of minor actinides and some long term fission products from high active wastes using from the reprocessing of spent nuclear fuels		BNFL U Reading
	SAPIERR	Support Action: Pilot Initiative for European Regional Repositories		-
	ESDRED	Engineering Studies and Demonstration of Repositories Action Line		NIREX

Radiation Protection	ERICA	Environmental Risk from ionising Contaminants: Assessment and Management		NERC EA Westlakes U Liverpool
	EURANOS	European Approach to nuclear and radiological emergency management and rehabilitation strategies		NRPB NNC (HSE levy funded)
	RISC-RAD	DNA damage responses, genomic instability and radiation induced cancer: the problem of risk at low and protracted doses		Brunel U U Susses U Cambridge Imperial College Gray Laboratory Cancer Research MRC
	MSCRB	European Master of Science	Gray Cancer Laboratory	University College London
Other activities in the area of nuclear technologies and safety	SARNET	Sustainable Integration of European Research on Severe Accident Methodology and Management		NNC
	PERFECT	Prediction of Irradiation Damage Effects on Reactor Components		Serco, funded by MOD University Liverpool University Edinburgh HSE is negotiating to fund participation by BNFL NSTS BE will join User Group
	NEPTUNO	Nuclear European Platform of Training and University Organisations		University Manchester MOD
	HOTLAB	European network on Hot Laboratories		BNFL
	JHR-CA	Jules Horowitz Reactor Coordination Action		-
	CETRAD	Coordination Action on Education and Training in Radiation Protection and Radioactive Waste Management	U Wales	NIREX
	EUNDETRAF-II	European Nuclear Decommissioning Training Facility		UKAEA RWE Nukem

	EURAC	Securing European radiological protection and radioecology competence to meet the future needs of stakeholders	Middlesex U.	Westlakes

Table 2 OECD-NEA Projects

	Project	Location	Addressing	Participation
Nuclear Safety	Bubbler Condenser Project		VVER Severe Accidents	No – VVER
	Fire		a data collection project	No – because of data ownership
	Halden Reactor Project	Halden, Norway	Fuel and Man Technology Interface	BNFL is the UK signatory. HSE has an agreement with BNFL in order to have access to the results, and pays its share out of the levy. The problem with cracking in the pressure boundary has been resolved. The fuels part of the project is regarded as being useful, but the value of the Man Technology Organisation side is contested.
	International Common Cause Failure Data Exchange (ICDE)		Common Cause Failure	Yes – HSE levy project with industry cooperation
	OECD-IRSN Cabri Water Loop	Cadarache, France	Fuel Reactivity Insertion Accidents	Yes – HSE Levy project
	Melt Coolability and Concrete Interaction (MCCI)		LWR severe accident	No – severe accident
	OPDE		Piping failure data collection	No – because of data ownership

	PLASMA		For VVERs	No – VVER
	PSB-VVER		For VVERs	No – VVER
	Lower Head Failure	Sandia, USA	LWR severe accident	No – Severe accident
	SETH PKL	Framatome, Erlangen, Germany	Countermeasures for two types of Pressurised Water Reactor (PWR) accidents	Yes. HSE Levy project, with active BE participation. The PKL tests investigated two PWR safety issues: boron dilution in loss of coolant accidents and boron dilution during mid-loop operation (shutdown conditions). The results are being incorporated into the Sizewell B safety case. NEA and Framatome are proposing a follow-on project PKL-2, and HSE has expressed an interest in participation.
	SETH PANDA	PSI, near Zurich, Switzerland	Gas flow distributions relevant to in-reactor containments (with focus on simulated hydrogen distribution)	Yes. The experiments are to provide data on containment three-dimensional gas flow and distribution issues that are important for code prediction capability improvements, accident management and design of mitigating measures. These experiments will be conducted on a large scale in multi-compartment geometries in order to provide data suitable for the improvement and validation of safety analysis codes.
	ROSA	JAERI, Japan	Thermal hydraulic tests to validate codes	Yes – HSE Levy project, relevant to BE
	Studsvik Cladding	Studsvik, Sweden	Advanced fuel cladding	Yes – HSE Levy project, relevant to BE

	Integrity Project		behaviour test	
Radioactive waste management	The International Co-operative Programme on Decommissioning (CPD)		Information exchange on projects	Yes UKAEA – PFR BNFL – B204 Former Magnox reprocessing plant BNFL - Co-precipitation plant from Magnox Plutonium finishing line

	Sorption Project		Migration of radionuclides in geosphere, benchmarking of modelling approaches	Yes – NIREX participates
	Thermochemical Database (TDB) Project		Review and recommend data for safety assessment of radioactive waste disposal systems	Yes – NIREX participates
Radiation protection	OECD Information System on Occupational Exposure (ISOE) Project	Cosponsored with IAEA	Information exchange and analysis	Yes, HSE has withdrawn from this, but BE participates
Nuclear development (economic and technical aspects of the nuclear fuel cycle)	International Advisory Group for the Jules Horowitz Reactor Project		Supporting the establishment of the JHR, providing international advice on the design	No