

Open Government Status:

FULLY OPEN

NuSAC/SCR/07/10

HEALTH AND SAFETY COMMISSION

NUCLEAR SAFETY ADVISORY COMMITTEE

SUBCOMMITTEE ON RESEARCH

6 February 2007

UK INVOLVEMENT IN INTERNATIONAL NUCLEAR SAFETY RESEARCH
COLLABORATIVE RESEARCH PROJECTS

Paper by HSE

1. Introduction

1. This paper updates the information on international research collaboration given in NuSAC/SCR/06/12. Information from BE, BNFL, UKAEA and Nirex has also been included to give a fuller picture, although the information is not complete. Some of the activities are technical information exchange rather than research.

2. Objectives of involvement in international collaboration

2. A supporting objective of the nuclear safety research 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. Involvement in international collaboration should lead to reduced costs of national programmes, increased technical information, and dissemination and peer review of research results. 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.

3. NSD has an overall international plan for its own work. Two of the objectives are:

- expanding the technical knowledge base of NSD by the Nuclear safety research programmes. This is managed by NSD on behalf of HSE/HSC.
- carrying out a monitoring role on future reactor systems (new build), mainly in the Generation IV Forum. DTI is the main sponsor for this work.

4. Most international collaboration is likely to be related to PWR and fuel cycle 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.

5. 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. 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.

6. 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

7. 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. Details are given below.

3.1. Euratom Framework Programme

8. 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. UK participation in Euratom committees is given in Table 4a.

9. A number of FP-5 projects have recently finished, particularly in the structural integrity area (e.g. FITNET). FP-6 runs from 2002 to 2006 in principle, although projects run over into subsequent years in practice. UK participation is shown in table 1. BE are involved with the NULIFE network with Rolls-Royce, Serco Assurance and Manchester University being other partners in this project. Nexia solutions and UKAEA are participants in projects, but Magnox Electric Ltd. is not involved in FP6. Via the levy HSE funds participation in an emergency-planning project in the Radiation Protection part of the programme, and in an inspection project in the Safety part. Nexia Solutions also participates in Framework projects associated with advanced reactors such as High Temperature Gas-Cooled Reactors and Fast Reactors, in particular work on fuel performance and fuel cycles.

10. The Euratom FP7 will run from 2007 to 2011. A budget of 287M Euro has been announced, to support research in radioactive waste management, fission reactor safety and radiation protection over this period, under the 7th Framework Programme. HSE, NDA, and DoH plan to encourage UK research organisations to establish partnerships with at least two other research organisations in the EU and compete for funding from this budget. In addition HSE will encourage UK contractors to develop proposals which align with its own strategic objectives by helping to fund the set up costs of a proposal. Support from the 7th Framework Programme will be up to 75% of eligible costs for universities, not-for profit research organisations and SMEs and 50% for larger commercial undertakings. In preparation for FP7, Nirex is acting as coordinator for CARD (Coordination of Research, Development and Demonstration for Geological Disposal) whose objective is to develop the structure and modus operandi of a Technology Platform in the area of Geological Disposal, to provide a sustainable network for research cooperation, information exchange and sharing of specialised facilities and resources in the EU.

3.2. OECD-NEA

11. The UK participates in various NEA standing committees, as listed in Table 4b. 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.

12. 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. Separately from this route the UK has placed irradiation work directly with research reactors at US National Laboratories.

13. 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 currently paid for by levy on the reactor licensees.

3.3. IAEA

14. IAEA organises a limited number of research activities in its programme of Coordinated Research Projects, and UK participation in these is listed in Table 3. HSE and BE are involved in the International Graphite Database. BE has contributed to a Database on concrete pressure vessels and containments. BNFL pursues advanced reactor related interests through IAEA Technical Working Groups.

3.4. Other programmes and arrangements

15. 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 plans to join the 3-year USNRC CSARP PSA programme in 2007 and to fund its participation from the Levy.

16. In October 2006, DTI withdrew from active membership of the US Department of Energy Generation IV International Forum (GIF) charter although it still retains 'non active' status. This action reflects a refocusing of DTI's priorities following the Energy Review towards more near term objectives and means that DTI will no longer be providing the funding of up to £5M pa for UK researchers to participate in GIF. Euratom is an active member of GIF, so UK researchers could participate through the seventh Framework programme, although this will mean the researcher having to find up to 50% of the required funding for the research either from their own resources or by finding a customer on the open market, that is willing to provide these funds.

17. Although there is currently no HSE involvement with research for potential new nuclear power station build in the UK, this situation will change if and when a prospective new build vendor or licensee comes forward. HSE intends to go about the appraisal of reactor designs in advance of specific proposals for new build. Research

requirements may arise out of this if HSE considers that there are shortfalls or issues requiring verification or clarification in the supporting nuclear safety research already commissioned by the vendor.

18. The USDOE has recently proposed the Global Nuclear Energy Partnership addressing LWR safety and security issues (amongst others), which offers a new opportunity for international collaboration.

19. HSE (as opposed to NSD) also participates in generic international research in such areas as steel structural integrity. For example, HSE is a member of the EC (non-Euratom) Framework network FITNET, which is developing European fitness-for-service guidelines. BE are also members of this project.

20. Nirex participates in other international activities:

- CARL. To investigate the decision-making process relating to radioactive waste management and how social science issues affect it and how it can be developed to enable greater stakeholder involvement, while meeting legislative requirements.
- BIOPROTA. An international forum to address outstanding uncertainties of relevance to biosphere research.

21. UKAEA/WAGR and its three counterparts at Mol in Belgium, Gundremmingen in Bavaria, Germany, and Lubmin in northern Germany, share common aims and goals and engineers regularly exchange information in the progress towards decommissioning.

22. 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. Future Roles in the UK

23. The former 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. There is a risk that the lack of a central point of focus for coordinating activities means that the UK is losing out on maximising its leverage and gearing on investment. Whilst international collaboration is primarily an economic issue there is also a corresponding safety issue that the UK might be unaware of a safety issue through lack of participation in international activities. It is unclear whether the private sector could support such activities and this may be a role for the public sector.

24. The NDA is well placed to do part of this role, and HSE could cover the safety aspects. The NDA Research Board terms of reference include: identifying and promoting opportunities to collaborate and/or to coordinate with national and international programmes that will enable leverage of UK investment. Although decommissioning is not seen as a major research area, the waste management programme is the largest part of the Euratom Framework programme, and already has extensive UK participation. Once Nexia Solutions is incorporated into the National Nuclear laboratory, it could also have a role, although whether this was as owner of the strategy or purely a research supplier would have to be determined.

5. Conclusions

25. In summary:

- The DTI Guidelines for the programme require that HSE take proper account of the advantages of international collaboration, although it is open to interpretation whether this is meant primarily on economic or safety grounds.
- HSE funds PWR thermal hydraulic and fuel research projects of the OECD NEA by the levy programme.
- There is some very limited HSE and licensee involvement in the 6th Euratom Framework Programme, alongside other UK involvement. The 7th Euratom Framework Programme will run from 2007 to 2011 and HSE will encourage UK research organisations to participate.
- The Nuclear Decommissioning Authority has accepted a promoting and coordinating 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. Further requirements may arise out of the recently announced Energy Review.

6. Action

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

Table 1 FP6 Projects accepted by the European Commission (there are currently further projects under evaluation and negotiation)

Programme area	Proposal	Full title	Coordination If UK	UK participation
<i>Management of Radioactive Waste</i>	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 Nirex
	COWAM 2	Community Waste Management 2: Improving the Governance of Nuclear Waste Management and Disposal in Europe		U Lancaster Quintessa NRPB Syncho Nirex
	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		-
	FUNMIG	Fundamental migration of radionuclides		Nirex
	CATT	Cooperation and Technology Transfer	Nirex	Nirex
	ESDRED	Engineering Studies and Demonstration of Repositories Action Line		Nirex
	PAMINA	Performance Assessment Methodologies in Application		Nirex, Galson Sciences
	CARD	Coordination of Research Development and Demonstration for Geological Disposal	Nirex	Nirex

<i>Radiation Protection</i>	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 Sussex U Cambridge Imperial College Gray Laboratory Cancer Research MRC
	MSCRB	European Master of Science	Gray Cancer Laboratory	University College London
<i>Other activities in the area of nuclear technologies and safety</i>	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
	GAIN	Gap Analysis of Inspection		Mitsui Babcock
	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
<i>Nuclear Safety</i>	Computer based Systems Important to Safety (COMPSIS)		Information exchange and analysis	No – lack of resources and lack of interest
	Fire		Data collection	No – because of data ownership
	Halden Reactor Project	Halden, Norway	Fuel and Man Technology Interface	Nexia is the UK signatory. BE and HSE have agreements with Nexia in order to have access to the results. Nexia's participation is paid for equally by BE and BNFL.
	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
	Material Scaling (MASCA-2)	Kurchatov Institute, Moscow	Corium properties	No – severe accidents
	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
	SETH PKL	Framatome,	Countermeasures for	Yes. HSE Levy project, with active BE participation. The

		Erlangen, Germany	two types of Pressurised Water Reactor (PWR) accidents	PKL tests investigated two PWR safety issues: boron dilution in loss of coolant accidents and boron dilution during mid-loop operation (shutdown conditions). There is a follow-on PKL project, which HSE has joined.
	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 are 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 Integrity Project	Studsvik, Sweden	Advanced fuel cladding behaviour test	Yes – HSE Levy project, relevant to BE
<i>Radioactive waste management</i>	The International Co-operative Programme on Decommissioning (CPD)		Information exchange on projects	Yes UKAEA – WAGR and Co precipitation plant, Sellafield 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
<i>Radiation protection</i>	OECD Information System on Occupational Exposure (ISOE) Project	Cosponsored with IAEA	Information exchange and analysis	Yes, HSE has withdrawn from this, but BE participates
<i>Nuclear development (economic and technical aspects of the nuclear fuel cycle)</i>	International Advisory Group for the Jules Horowitz Reactor Project		Supporting the establishment of the JHR, providing international advice on the design	No

Table 3 IAEA Coordinated Research Projects and other activities

Topic	UK organisation
On Chemical Durability and Performance of Spent Fuel and High Level Wastes Under Simulated Repository Conditions.	Nirex (CRP)
Use of selected safety indicators in the assessments. This project aims to contribute to the assessment of the long-term safety of radioactive waste disposal by means of additional safety indicators based on the observation of natural systems.	Nirex (CRP)
Factors affecting public and political acceptance for the implementation of geological disposal. To improve the understanding of what factors (conditions) affect (increase or decrease) public and political acceptance for implementing the disposal of long-lived radioactive waste in a deep underground repository.	Nirex
Wastes from decommissioning	BNFL Nexia Solutions (CRP)

Table 4a Euratom Advisory Committees

<i>Committee</i>	<i>UK Membership</i>
Consultative Committee Euratom-Fission	DTI, HSE-NSD (Dr P Storey - chair), DoH, DEFRA
Consultative Committee Euratom-Fusion	Prof C Llewellyn Smith, UKAEA Culham (chair)
Scientific and Technical Committee Euratom	Dr Susan Ion (BNFL), Dr Derek Pooley (ex AEA), Dr Allan Duncan (ex EA) Dr Andrew Spurr (BE).

Table 4b OECD Nuclear Energy Agency Standing Committees

<i>Committee</i>	<i>UK Membership</i>	<i>Comments</i>
Committee on the Safety of Nuclear Installations (CSNI)	NSD	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)	HSE-NSD, EA, HPA-RPD ¹	
Radioactive Waste Management Committee (RWMC)	Defra (Head of delegation), EA, Nirex	EA also attends the RWMC Regulators Forum EA, Nexia Solutions, Nirex participate in the RWMC's Forum for Stakeholder Confidence (FSC) UKAEA and Nirex participate in the WP on Decommissioning and Dismantling (WPDD) HSE-NSD has participated in this and the WP on Human Factors in Decommissioning, but this is currently in abeyance
Nuclear Science Committee (NSC)	BNFL, HSE	HSE contracts NPL to attend as HSE oversees UK access to the NEA Databank BNFL contracts Serco to attend
Nuclear Development	DTI, BNFL	

Committee (NDC)		
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¹Health Protection Agency – Radiation Protection Division was formerly the NRPB