NEA joint projects: nuclear safety, radioactive waste management, radiological protection

Project	Participants	Budget
Behaviour of Iodine Project (BIP-2) Contact: axel.breest@oecd.org Current mandate: April 2011-March 2014	Belgium, Canada, Finland, France, Germany, Japan, Spain, Sweden, United Kingdom, United States.	€ 0.9 million
Cable Ageing Data and Knowledge (CADAK) Project Contact: axel.breest@oecd.org Current mandate: December 2011-December 2014	Canada, France, Japan, United States.	€ 40 K /year
Cabri Water Loop Project Contact: radomir.rehacek@oecd.org Current mandate: 2000-2015	Czech Republic, Finland, France, Germany, Japan, Republic of Korea, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States.	≈€ 74 million
Component Operational Experience, Degradation and Ageing Programme (CODAP) Contact: alejandro.huerta@oecd.org Current mandate: June 2011-December 2014	Canada, Chinese Taipei, Czech Republic, Finland, France, Germany, Japan, Republic of Korea, Spain, Sweden, Switzerland, United States.	€ 120 K /year
Computer-based Systems Important to Safety (COMPSIS) Project Contact: jean.gauvain@oecd.org Current mandate: January 2008-December 2011	Chinese Taipei, Finland, Germany, Hungary, Republic of Korea, Sweden, Switzerland, United States.	€ 80 K /year
Co-operative Programme on Decommissioning (CPD) Contact: wei-whua.loa@oecd.org Current mandate: January 2009-December 2013	Belgium, Canada, Chinese Taipei, European Commission, France, Germany, Italy, Japan, Republic of Korea, Slovak Republic, Spain, Sweden, United Kingdom, United States.	≈€ 69 K /year
Fire Incidents Records Exchange (FIRE) Project Contact: alejandro.huerta@oecd.org Current mandate: January 2010-December 2013	Canada, Czech Republic, Finland, France, Germany, Japan, Netherlands, Republic of Korea, Spain, Sweden, Switzerland, United States.	≈€ 84 K /year

NEA joint projects and information exchange programmes enable interested countries, on a cost-sharing basis, to pursue research or the sharing of data with respect to particular areas or issues in the nuclear energy field. The projects are carried out under the auspices, and with the support, of the NEA. All NEA joint projects currently under way are listed below.

At present, 17 joint projects are being conducted in relation to nuclear safety, two in support of radioactive waste management, one in the area of nuclear science (advanced fuels) and one in the field of radiological protection. These projects complement the NEA programme of work and contribute to achieving excellence in each area of research.

Objectives
• To obtain a more detailed and mechanistic understanding of iodine adsorption/desorption on containment surfaces by means of new experiments with well-characterised containment paints and paint constituents and novel instrumentation (spectroscopic methods). • To obtain a more detailed and mechanistic understanding of organic iodide formation by means of new experiments with well-characterised containment paints and paint constituents and novel instrumentation (chromatographic methods). • To develop a common understanding on how to extrapolate confidently from small-scale studies to reactor-scale conditions.
• Establish the technical basis for assessing the qualified life of electrical cables in light of the uncertainties identified following initial (early) qualification testing. • Investigate the adequacy of the safety margins and their ability to address the uncertainties.
• Extend the database for high burn-up fuel performance under reactivity-induced accident (RIA) conditions. • Perform relevant tests under coolant conditions representative of pressurised water reactors (PWRs). • Extend the database to include tests done in the Nuclear Safety Research Reactor (Japan) on BWR and PWR fuel.
• To collect information on passive metallic component degradation and failures of the primary system, reactor pressure vessel internals, main process and standby safety systems, and support systems (i.e., ASME Code Class 1, 2 and 3 or equivalent), as well as non safety-related (non-code) components with significant operational impact. • To establish a knowledge base for general information on component and degradation mechanisms such as applicable regulations, codes and standards, bibliography and references, R&D programmes and pro-active actions, information on key parameters, models, thresholds and kinetics, fitness for service criteria, and information on mitigation, monitoring, surveillance, diagnostics, repair and replacement. • To develop topical reports on degradation mechanisms in close co-ordination with the NEA/CSNI Working Group on Integrity of Components and Structures (WGIAGE).
• Define a format and collect software and hardware fault experience in computer-based, safety-critical NPP systems in a structured, quality-assured and consistent database. • Collect and analyse COMPSIS events over a long period so as to better understand such events, their causes and their prevention. • Generate insights into the root causes of and contributors to COMPSIS events, which can then be used to derive approaches or mechanisms for their prevention or for mitigating their consequences. • Establish a mechanism for efficient feedback of experience gained in connection with COMPSIS events, including the development of defences against their occurrence, such as diagnostics, tests and inspections. • Record event attributes and dominant contributors so that a basis for national risk analysis for computerised systems is established.
• Exchange scientific and technical information amongst decommissioning projects for nuclear facilities.
• Collect fire event experience (by international exchange) in the appropriate format and in a quality-assured and consistent database. • Collect and analyse fire events data over the long term with the aim to better understand such events, their causes and their prevention. • Generate qualitative insights into the root causes of fire events which can then be used to derive approaches or mechanisms for their prevention or for mitigating their consequences. • Establish a mechanism for the efficient feedback of experience gained in connection with fire including the development of defences against their occurrence, such as indicators for risk-based inspections. • Record characteristics of fire events in order to facilitate fire risk analysis, including quantification of fire frequencies.

NEA joint projects

Project	Participants	Budget
Fire Propagation in Elementary, Multi-room Scenarios (PRISME-2) Project Contact: greg.lamarre@oecd.org Current mandate: July 2011-June 2016	Belgium, Canada, Finland, France, Germany, Japan, Spain, Sweden.	€ 7 million
Halden Reactor Project Contact: radomir.rehacek@oecd.org Halden contact: Fridtjov.owre@hrp.no Current mandate: 2009-2011	Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Japan, Kazakhstan, Norway, Republic of Korea, Russian Federation, Slovak Republic, Spain, Sweden, Switzerland, United Kingdom, United States.	≈€ 43 million
Information System on Occupational Exposure (ISOE) Contact: halilburcin.okyar@oecd.org IAEA contact: j.ma@iaea.org Current mandate: 2008-2011	Armenia, Belgium, Brazil, Bulgaria, Canada, China, Czech Republic, Finland, France, Germany, Hungary, Japan, Lithuania, Mexico, Netherlands, Pakistan, Republic of Korea, Romania, Russian Federation, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Ukraine, United Kingdom, United States.	≈€ 450 K /year
International Common-cause Failure Data Exchange (ICDE) Project Contact: axel.breest@oecd.org Current mandate: April 2011-March 2014	Canada, Finland, France, Germany, Japan, Republic of Korea, Spain, Sweden, Switzerland, United Kingdom, United States.	≈€ 120 K /year
Loss of Forced Coolant (LOFC) Project Contact: jean.gauvain@oecd.org Current mandate: March 2011-March 2013	Czech Republic, France, Germany, Hungary, Japan, Republic of Korea, United States.	€ 3 million
Primary Coolant Loop Test Facility (PKL-2) Project Contact: jean.gauvain@oecd.org Current mandate: April 2008-December 2011	Belgium, Czech Republic, Finland, France, Germany, Hungary, Italy, Japan, Republic of Korea, Spain, Sweden, Switzerland, United Kingdom, United States.	€ 3.9 million
Rig of Safety Assessment (ROSA-2) Project Contact: abdallah.amri@oecd.org Current mandate: April 2009-September 2012	Belgium, Czech Republic, Finland, France, Germany, Hungary, Japan, Netherlands, Republic of Korea, Spain, Sweden, Switzerland, United Kingdom, United States.	€ 2.7 million
Sandia Fuel Project (SFP) Contact: radomir.rehacek@oecd.org Current mandate: July 2009-June 2012	Czech Republic, France, Germany, Hungary, Italy, Japan, Norway, Republic of Korea, Spain, Sweden, Switzerland, United Kingdom, United States.	€ 4 million

Objectives

- Answer questions concerning smoke and heat propagation inside a plant, by means of experiments tailored for code validation purposes.
- Perform tests on smoke and hot gas propagation through a horizontal opening between two superposed compartments.
- Provide information on fire spreading to cables and electrical cabinets and on cable damage.
- Generate useful data and information on fire extinction phenomena using various extinguishing systems.

Generate key information for safety and licensing assessments and aim at providing:

- extended fuel utilisation: basic data on how the fuel performs, both under normal operation and transient conditions, with emphasis on extended fuel utilisation in commercial reactors;
- degradation of core materials: knowledge of plant materials behaviour under the combined deteriorating effects of water chemistry and nuclear environment, also relevant for plant lifetime assessments;
- man-machine systems: advances in computerised surveillance systems, virtual reality, digital information, human factors and man-machine interaction in support of control room upgradings.

- Collect, analyse and exchange occupational exposure data and experience from all participants.
- Provide broad and regularly updated information on methods to improve the protection of workers and on occupational exposure in nuclear power plants.
- Provide a mechanism for dissemination of information on these issues, including evaluation and analysis of the data assembled and experience exchanged, as a contribution to the optimisation of radiation protection.

- Collect and analyse common-cause failure (CCF) events over the long term so as to better understand such events, their causes and their prevention.
- Generate qualitative insights into the root causes of CCF events which can then be used to derive approaches or mechanisms for their prevention or for mitigating their consequences.
- Establish a mechanism for the efficient feedback of experience gained in connection with CCF phenomena, including the development of defences against their occurrence, such as indicators for risk-based inspections.
- Generate quantitative insights and record event attributes to facilitate the quantification of CCF frequencies in member countries.
- Use the ICDE data to estimate CCF parameters.

To perform three integral tests in the high-temperature engineering test reactor (HTTR) in order to:

- provide experimental data to clarify the anticipated transient without scram (ATWS) in the case of an LOFC with occurrence of reactor re-criticality;
- provide experimental data for validation for one of the most important safety aspects about reactor kinetics, core physics and thermal-hydraulics;
- provide experimental data to verify the capabilities of these codes regarding the simulation of phenomena coupled between reactor core physics and thermal-hydraulics.

- Investigate safety issues relevant for current PWR plants as well as for new PWR design concepts.
- Focus on complex heat transfer mechanisms in the steam generators and boron precipitation processes under postulated accident situations.

- Provide an integral and separate-effect experimental database to validate code predictive capability and accuracy of models. In particular, phenomena coupled with multi-dimensional mixing, stratification, parallel flows, oscillatory flows and non-condensable gas flows are to be studied.
- Clarify the predictability of codes currently used for thermal-hydraulic safety analyses as well as of advanced codes presently under development, thus creating a group among OECD/NEA member countries who share the need to maintain or improve technical competence in thermal-hydraulics for nuclear reactor safety evaluations.

- Address potential accident conditions and perform a highly detailed thermal-hydraulic characterisation of full-length, commercial pressurised water reactor (PWR) fuel assembly mock-ups.
- Provide data for the direct validation of appropriate codes.
- Address applicability to other fuel designs, also considering that BWR data will be made available to project participants.

NEA joint projects

Project	Participants	Budget
Source Term Evaluation and Mitigation (STEM) Project Contact: axel.breest@oecd.org Current mandate: July 2011-June 2015	Canada, Czech Republic, Finland, France, Germany, Republic of Korea, United States.	€ 3.5 million
Steam Explosion Resolution for Nuclear Applications (SERENA) Project Contact: jean.gauvain@oecd.org Current mandate: October 2007-March 2012	Canada, Finland, France, Germany, Japan, Republic of Korea, Slovenia, Sweden, Switzerland, United States.	€ 2.6 million
Studsvik Cladding Integrity Project (SCIP-2) Contact: axel.breest@oecd.org Current mandate: July 2009-June 2014	Czech Republic, Finland, France, Germany, Japan, Republic of Korea, Spain, Sweden, Switzerland, United Kingdom, United States.	≈ € 1.5 million /year
Thermal-hydraulics, Hydrogen, Aerosols, Iodine (ThAI-2) Project Contact: jean.gauvain@oecd.org Current mandate: 2011-2014	Canada, Czech Republic, Finland, France, Germany, Hungary, Japan, Netherlands, Republic of Korea, United Kingdom.	€ 3.6 million
Thermochemical Database (TDB) Project Contact: nea.tdb@oecd.org Current mandate: 2008-2012	Belgium, Canada, Czech Republic, Finland, France, Germany, Japan, Republic of Korea, Spain, Sweden, Switzerland, United Kingdom, United States.	≈€ 441 K /year
Thermodynamics of Advanced Fuels – International Database (TAF-ID) Project Contact: jim.gulliford@oecd.org Current mandate: January 2012-December 2014	Canada, European Commission, France, Japan, Netherlands, Republic of Korea, Sweden, Switzerland, United States.	≈€ 100 K /year

Objectives

Improve the general evaluation of the source term, and in particular:

- Perform experiments to study the stability of aerosol particles under radiation and the long-term gas/deposits equilibrium in a containment.
- Conduct a literature survey on the effect of paint ageing.
- Perform experiments to study ruthenium transport in pipes.

- Provide experimental data to clarify the explosion behaviour of prototypic corium melts.
- Provide experimental data for validation of explosion models for prototypic materials, including spatial distribution of fuel and void during the pre-mixing and at the time of explosion, and explosion dynamics.
- Provide experimental data for steam explosions in more realistic, reactor-like situations to verify the geometrical extrapolation capabilities of the codes.

- Generate high-quality experimental data to improve the understanding of the dominant failure mechanisms for water reactor fuels and devise means for reducing fuel failures.
- Achieve results of general applicability (i.e. not restricted to a particular fuel design, fabrication specification or operating condition).
- Achieve experimental efficiency through the judicious use of a combination of experimental and theoretical techniques and approaches.

To address remaining questions and to provide experimental data relevant to nuclear reactor containments under severe accident conditions:

- atmospheric flow and graphite dust transport in high-temperature gas reactors;
- release of gaseous iodine from a flashing jet;
- deposition of molecular iodine on aerosol particles;
- hydrogen combustion during spray operation;
- onset of passive autocatalytic recombiner (PAR) operation under extremely low oxygen conditions.

Produce a database that:

- contains data for elements of interest in radioactive waste disposal systems;
- documents why and how the data were selected;
- gives recommendations based on original experimental data, rather than on compilations and estimates;
- documents the sources of experimental data used;
- is internally consistent;
- treats all solids and aqueous species of the elements of interest for nuclear waste storage performance assessment calculations.

- Make available a comprehensive, internationally recognised thermodynamic database and associated phase diagrams on nuclear fuel materials for the existing and future generation of nuclear reactors.