The NEA Data Bank

The NEA Data Bank acts as an international centre of reference for its participating countries with respect to basic nuclear tools, such as computer codes and nuclear data, used for the analysis and prediction of phenomena in the nuclear field. It offers a direct service to its users by providing the means to develop, improve and validate these tools, distributing them in accordance with international rules, and organising training and education activities to support nuclear knowledge management.

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The 21st Century NEA Data Bank

Modelling and understanding nuclear systems requires a combination of basic physics data, simulation tools and carefully preserved experimental data that can be used for validation. These topics must be continually developed to address new needs, such as novel reactor designs, unexpected phenomena and demands for greater accuracy and operating margins. Working together, countries can not only pool resources in shared data, but establish international standards and peer-review practices that play an essential role in international nuclear energy co-operation.

Since its formation in 1977, the Data Bank has championed international collaboration on basic nuclear data, computer software for modelling and simulation, and integral experiments used for validation. The Data Bank supports these activities by managing scientific projects, disseminating controlled software packages, developing technical services and databases that are international standards for data and code development and validation, and organising training and educational activities to preserve nuclear knowledge. The Data Bank continually evolves its services to promote modern approaches and facilitate collaboration between the interdependent code, data and benchmark communities that work with the NEA.

Software, data and benchmark services

Computer program services

The Data Bank has collected over 1 000 packages over more than four decades, including a large number of computer codes used to perform calculations ranging from Monte Carlo particle transport to thermal-hydraulics, nuclear resonance analysis to radiological safety and accident simulation. The Data Bank receives several thousand requests per year to access these materials, and rigorously processes these before disseminating in compliance with all relevant rules and regulations. With the launch of a new NEA GitLab in 2022, the Data Bank is migrating projects to the new platform to offer users the opportunity to interact directly with code developers, propose new features and code, and test cases for real-world use.

Nuclear data services

Nuclear data, the knowledge of nuclear reactions and all nuclear phenomena necessary for modelling nuclear systems, must be carefully evaluated based on cutting-edge basic physics experiments, nuclear theory and data science techniques that draw insights from large-scale nuclear systems. Since 1986, the Data Bank has hosted the world's largest international effort on nuclear data evaluation, the Joint Evaluated Fission and Fusion (JEFF) project. The Data Bank has played the central role in establishing stand-ards for preserving data and the knowledge surrounding its creation and use. The Data Bank champions the application of Findable, Accessible, Interoperable and Reproducible (FAIR) practices, and engages with delegates and other NEA Committees to create data preservation plans. Staff of the Data Bank contribute directly to the largest database of basic nuclear reaction measurements, EXFOR, in collaboration with the International Atomic Energy Agency, and develop novel applications, such as the Java-based Nuclear Information System (JANIS), that

Core tank exterior of the Inherently Safe Subcritical Assembly (ISSA), Lawrence Livermore National Laboratory, United States.
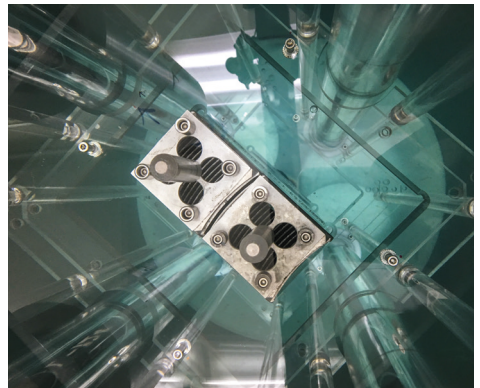
The NEA Data Bank and the Argentine National Atomic Energy Commission (CNEA) co-organised a training session on the Particle and Heavy Ion Transport code System (PHITS) on 5 March 2020 in Buenos Aires, Argentina.

are widely used to teach students and young professionals about nuclear physics and data.

Benchmarks and integral experiments

In close partnership with NEA Standing Technical Committees, including the Nuclear Science Committee, the Committee on the Safety of Nuclear Installations, the Radioactive Waste Management Committee, and others, the Data Bank manages the development of international benchmarks and associated relational databases, as well as the controlled distribution of these materials. These are the international gold standard for verification and validation in fields such as criticality safety, reactor physics, shielding, and fuel performance.

An integrated service for verification and validation

Providing advanced data for modelling and simulation

Physics data, computer codes and validation benchmarks are interdependent. With new technology platforms and working paradigms, the Data Bank is delivering new systems to improve its ongoing projects and services. In 2022, the Data Bank launched a new GitLab service with on-site computing infrastructure to support data pipelines that provide cutting edge nuclear physics data for the software distributed by the Computer Program Service.

International benchmark models and tools

The international benchmark experiments evaluated by experts under the aegis of the NEA are used to validate modelling and simulation systems across the world. The Data Bank supports this effort by collecting models and associated analysis tools to simulate these benchmarks with the most widely distributed modelling codes available at the Data Bank. These are organised in collaborative GitLab environments with a framework to verify the models using codes containerised on the NEA datacentre.

Engaging stakeholder needs through data analytics

The primary goal of data and code development is to address the needs of stakeholders that rely upon accurate modelling and simulation. To understand their requirements, the NEA has assembled a large collection of system sensitivity profiles and an interfacing Nuclear Data Sensitivity Tool (NDaST) that analyses user experiments and provides inferences directly to the nuclear data community. The Data Bank is spearheading the collection of sensitivities and related data through stakeholder engagement to strengthen the guidance for physics data and software developers.

Education, training and outreach

As an international centre for nuclear knowledge management, the Data Bank has organised training and educational activities for decades, inviting experts from around the world to give courses in Paris or in satellite locations. Due to the COVID-19 pandemic, the Data Bank has completely reformed its approach to support virtual and hybrid training, as well as more traditional in-person events.

New NEA eLearning management system

In 2022, the Data Bank launched a new eLearning system to collect training materials and build a catalogue of educational content that can be delivered through synchronous or asynchronous tuition, with students co-located or remotely engaging with teachers. The system is built on the Canvas Learning Management System (LMS) and gives students the opportunity to engage online and offline with controlled course materials, exercises, trainers, and other members of training cohorts.

Blockchain-based digital certificates

Building on the eLearning system at the Data Bank, a new digital certificates system gives course participants a durable and shareable digital credential that provides a record of the training event, outcomes and participation of the recipient. Directly integrated into the eLearning system, training course participants can automatically receive and post their certificates after completing the necessary exercises in their course. The digital badges connect natively to social media to increase awareness and inform potential trainees of the services offered through the Data Bank, and are backed by a blockchain verification system to ensure authenticity anywhere in the world.

Further resources:

https://oecd-nea.org/databank
https://git.oecd-nea.org
https://oecd-nea.org/tools/abstract/list
https://oecd-nea.org/tools/ie/list

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NEA Data Bank participating countries

Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Korea, Mexico, the Netherlands, Norway, Poland, Portugal, Russia (suspended), the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

The Nuclear Energy Agency (NEA) is an intergovernmental agency under the framework of the Organisation for Economic Co-operation and Development (OECD) headquartered in Paris, France. Its main objective is to promote international co-operation assisting member countries in maintaining and further developing the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes.

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