

# The Information System on Occupational Exposure and the ISOE Occupational Exposure Database

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**Abstract.** Since 1992, the Information System on Occupational Exposure (ISOE) has supported the optimization of worker doses in nuclear power plants worldwide. A prerequisite for applying the principle of optimization to occupational radiation protection is appropriate and timely exchange of data and information on dose reduction methods. To facilitate this global approach to work management, the OECD Nuclear Energy Agency (NEA) launched the ISOE programme in 1992 with the objective of providing a forum for radiation protection experts from utilities and national regulatory authorities to discuss, promote and coordinate international co-operative undertakings for the radiological protection of workers at nuclear power plants. Since 1993, the International Atomic Energy Agency (IAEA) has co-sponsored the ISOE Programme, thus allowing the participation of utilities and authorities from non-NEA member countries. Four ISOE Technical Centres (Europe, North America, Asia, and the IAEA) manage the programme's day-to-day technical operation. The overall goal of ISOE is to improve the management of occupational exposures at nuclear power plants through the collection and analysis of occupational exposure data and trends, and through the exchange of lessons learned. A key aspect is the collection, recording and tracking of annual occupational exposure data from the ISOE participating utilities for trend analysis, benchmarking, comparative analysis and experience exchange amongst ISOE participants. The ISOE database includes information and data for 471 reactor units in 29 countries covering about 90% of the world's operating commercial power reactors. As the world's largest database on occupational exposure from nuclear power plants, the ISOE database provides an important resource for ISOE participants to perform benchmarking analyses and exposure trends at various levels. The database is available to participants on CD-ROM and through the web-based ISOE Network. This paper provides details on the products available through ISOE, including the types of data available through the ISOE database, and provides insight into their use for optimising radiation protection as part of daily occupational exposure management.

## 1. Information System on Occupational Exposure: Overview

*“... the exchange and analysis of information on individual and collective radiation doses to the personnel of nuclear installations and to the employees of contractors, as well as on dose-reduction techniques, is essential to implement effective dose-control programmes and to apply the ALARA principle...” (ISOE Terms and Conditions, 2008)*

Since 1992, the international Information System on Occupational Exposure (ISOE) has supported the optimization of radiological protection of workers in nuclear power plants worldwide. A prerequisite for applying the principle of optimization to occupational radiation protection is the appropriate and timely exchange of data and information on dose reduction methods. To assist this global approach to work management, the OECD Nuclear Energy Agency (NEA) launched the ISOE programme in 1992 with the objective of providing a forum for radiation protection professionals from nuclear power utilities and national regulatory authorities to discuss, promote and coordinate international co-operative activities for the radiological protection of nuclear power plants workers. The ISOE programme is promoted and sponsored by the NEA and the International Atomic Energy Agency (IAEA), which provide a Joint Secretariat for the programme. Four ISOE Technical Centres (Europe, North America, Asia, and IAEA) manage the day-to-day technical operations. In particular, the support IAEA provides to ISOE allows representatives from the 11 non-OECD ISOE countries to attend ISOE meetings and symposia.

Membership in ISOE includes representatives from nuclear power utilities and national regulatory authorities who participate in the system under the ISOE Terms and Conditions [1], which covers the period 2008-2011. Members supply their occupational exposure data and experience to the world-wide system, which contributes to a well-established and growing global base of radiological protection information and experience. This information base provides an important resource to members for

optimising exposure management through benchmarking comparisons, exchange of experience and networking of members.

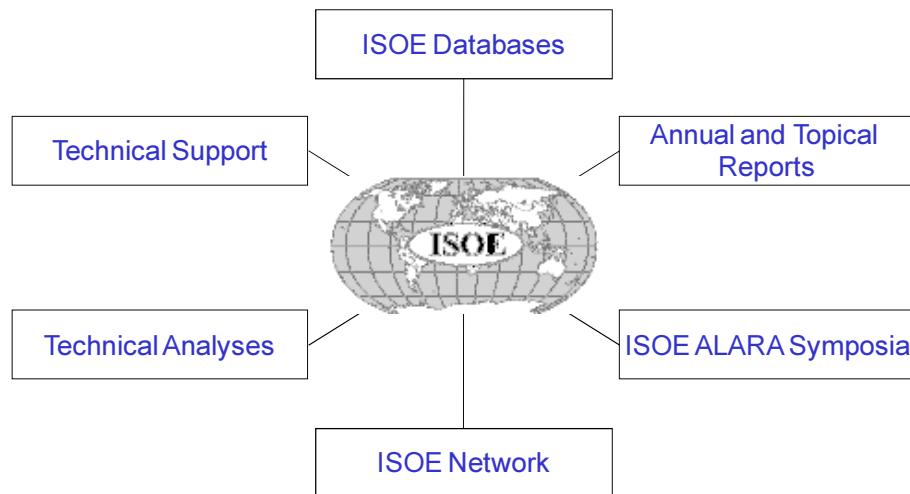
As of mid-2009, the ISOE programme included the official participation of 60 utilities comprising 277 operating units and 36 shutdown units in 29 countries, as well as the participation of regulatory authorities of 25 countries (official participation requires formal acceptance of the ISOE Terms and Conditions). This global participation facilitates experience exchange and the building of linkages between ISOE regions to develop a global approach to ALARA work management.

## 2. ISOE Products

ISOE facilitates occupational exposure management at nuclear power plants world-wide through the collection and analysis of occupational exposure data and trends, and the exchange of experience amongst participating radiological protection professionals. ISOE provides members with a comprehensive resource for optimising exposure management - through dose trend, cost-benefit and other analyses, technique comparisons, and networking through symposia, workshops and web forums - and promoting the application of the ALARA principle in local radiation protection programmes. As the world's most comprehensive source of experience and information for occupational exposure management at nuclear power plants, ISOE offers to its members a variety of products for occupational exposure management, including:

- The world's largest database on occupational exposure from nuclear power plants;
- Detailed studies and analyses on current issues in operational radiation protection;
- Support through responses to special requests and the organization of benchmarking visits;
- Annual analysis of dose trends and an overview of current ISOE developments;
- A forum for discussing occupational exposure management issues through international and regional ISOE ALARA Symposia;
- The ISOE Network ([www.isoeg-network.net](http://www.isoeg-network.net)), an international information exchange website on ALARA resources for ISOE members.

**Figure 1:** ISOE Products



### 2.1 ISOE Occupational Exposure Database

A key aspect of the ISOE programme is the collection, recording and tracking of annual occupational exposure data from the ISOE participating utilities for trend analysis, benchmarking, comparative analysis and experience exchange amongst ISOE participants. In addition to the detailed operational dose data (at the site, unit, job and task level) provided annually by participating utilities for inclusion in the ISOE occupational exposure database, data from some non-members in the United Kingdom and

United States has also been made available to the programme. The ISOE database thus includes information and data for 471 reactor units in 29 countries (395 operating; 76 in cold-shutdown or some stage of decommissioning) covering about 90% of the world's operating commercial power reactors. The ISOE database is made available to participants on CD-ROM and through the web-based ISOE Network.

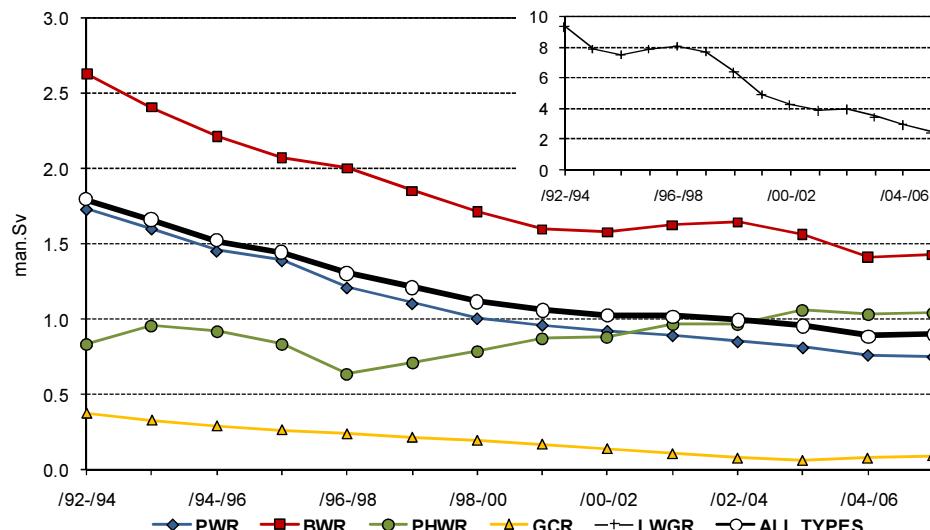
The information contained in the database includes the following data types:

- Dosimetric information from commercial NPPs in operation, shut down or in some stage of decommissioning, including:
  - annual collective dose for normal operation
  - maintenance/refuelling outage
  - unplanned outage periods
  - annual collective dose for certain tasks and worker categories
- Plant-specific information relevant to dose reduction, such as materials, water chemistry, start-up/shutdown procedures, cobalt reduction programme, etc.
- Radiation protection related information for specific operations, jobs, procedures, equipment or tasks (radiological lessons learned):
  - effective dose reduction
  - effective decontamination
  - implementation of work management principles

As the world's largest database on occupational exposure from nuclear power plants, the ISOE database provides an important resource for ISOE participants to perform benchmarking and exposure trends analyses, doses related to certain jobs and tasks, identification of good performance, etc. Results can be displayed by country, by reactor type, or by other criteria such as sister-unit grouping. The benchmarking analysis is available at various levels, such as annual collective dose and dose per job.

The global trends to 2007 as derived from the database are shown in Figure 1 [2]. This clearly shows that for most reactor types, the annual average collective dose per operating reactor unit has consistently decreased over the time period covered in the ISOE database, and that in spite of some yearly variations the downward dose trend in most reactors has been maintained.

**Figure 2:** 3-year rolling average per reactor all operating reactors included in ISOE by reactor type, 1992-2007 (man·Sv)



Note: Inset chart shows average collective dose for LWGRs.

## **2.2 Technical Analyses**

The dosimetric data and operational experience from participating nuclear power plants provide a solid technical basis for detailed studies and analyses on current issues in operational radiation protection, such as doses related to certain jobs and tasks (e.g., refuelling, steam generator replacement, insulation work, etc). These studies are performed and published by the ISOE technical centres as ISOE Information Sheets and distributed to the ISOE participants.

The ISOE Working Group on Data Analysis (WGDA), whose membership is open to all ISOE participants, provides another important mechanism for identifying, performing and reporting on various technical analyses of the ISOE data, experience, practices or issues in radiological protection relating to operating and decommissioned reactors. In addition to information from operating reactors, the ISOE database also contains dose data from 76 reactors which are shutdown or in some stage of decommissioning. An initiative was launched in 2007 to improve the data collection for shutdown and decommissioned reactors in order to facilitate better data collection, analyses and benchmarking for these reactors

## **2.3 Technical Support**

ISOE members are supported in their radiological protection activities by the four ISOE Technical Centres, who manage the day-to-day technical operations of ISOE, support the collection and analysis of occupational exposure data, perform specialized data analyses for their regional ISOE participants and respond to requests for information. As a further level of assistance, the ISOE programme now supports through the technical centres voluntary site benchmarking visits for dose reduction information exchange among participants. The intent of such visits is to identify good radiation protection practices at the host plant in order to share such information directly with the visiting plant. Follow-up reports are distributed to the ISOE participants through the ISOE Network website in order to facilitate the broader distribution of this information within ISOE.

## **2.4 Annual Reports and Special Topical Reports**

ISOE Annual Reports [2] summarize recent information on levels and trends of average annual collective dose at the reactors included in the database, provide special data analyses and dose studies, outage experience reports, summaries of ISOE Symposia, and information on principal events in ISOE member countries. While more detailed information is available to participants through direct access to the ISOE database, the Annual Reports provide a useful overview of trends in occupational radiation protection at nuclear power plants for the broader radiation protection community.

Periodically, ISOE also produces special topical reports based on the practical experience within the programme. In particular, a new report on “Work Management to Optimise Occupational Radiation Protection in the Nuclear Power Industry” [3], produced by the ISOE Expert Group on Work Management, was published in 2009. This report updates a widely adopted 1997 ISOE report on this subject. Since the first ISOE report, work management has been globally incorporated in the nuclear power industry and has shown itself of value in reducing both doses and costs. However, it is also recognized that efforts need to continue to ensure that good performance is maintained in the face of current and future challenges facing industry, and to promote and encourage continuous improvement, particularly with the prospect of new nuclear build. The broad exchange of data and experience within ISOE has provided a sound base of practical guidance for this report, which will find applicability not only among radiation protection managers but also all parts of the work organization that have a role in implementing work management practices.

## **2.5 ISOE ALARA Symposia**

Direct interaction is a vital component of information exchange within the ISOE communication network, as demonstrated by the annual ISOE International ALARA Symposia on occupational exposure management at nuclear power plants. Organized by the ISOE technical centres, these open

symposia provide a forum for radiation protection professionals to exchange practical information and experience on occupational exposure issues in nuclear power plants. The technical centres also host ISOE Regional ALARA Symposia to meet the needs of the local ISOE membership. The combination of international and regional symposium provides a valuable forum for radiation protection professionals to meet, discuss and share information, building linkages and synergies between the ISOE regions to develop a global approach to work management.

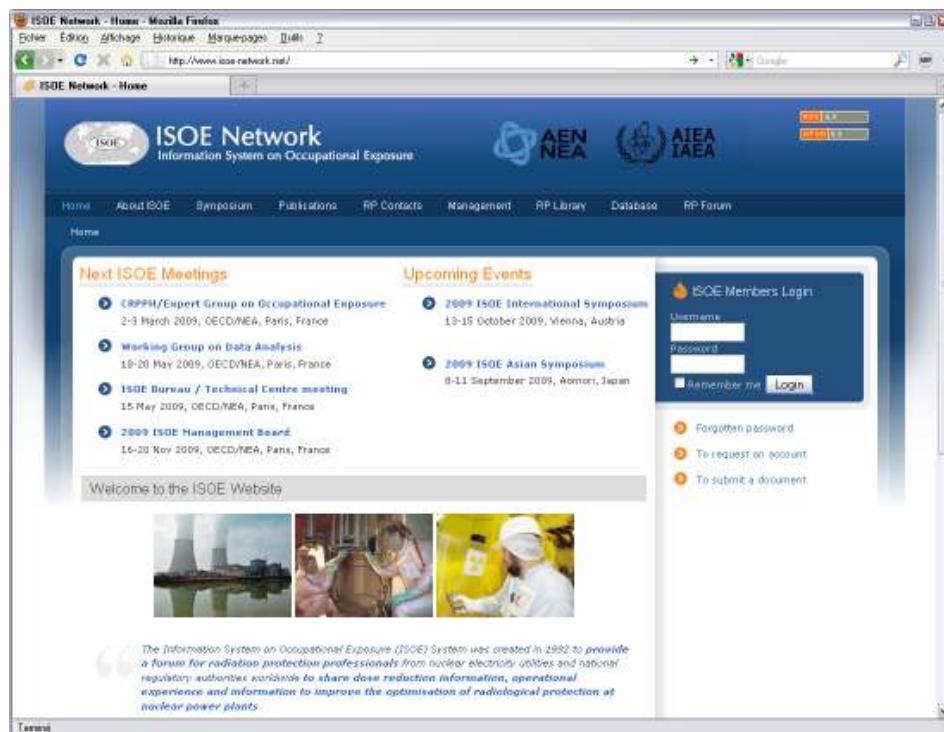
The ISOE symposia have become an expected meeting place for representatives of both nuclear power utilities and regulatory bodies, helping to build a sense of a professional community facing common issues. Such networking is a growing force in the optimization of worker radiological protection, recognized by international organizations, and reinforcing the role and importance of ISOE. This continues to highlight the importance of experience exchange at local, regional and international levels. Presentations and outcomes of the symposia are available through the ISOE Network.

## 2.6 ISOE Network

The ISOE Network ([www.isoene-network.net](http://www.isoene-network.net)) is an international information exchange website on dose reduction and ALARA resources for ISOE participants, providing rapid and integrated access to ISOE products. The Network, containing both public and restricted-access resources, provides participants with access to ISOE products including the on-line ISOE occupational exposure database, ISOE reports, publications and presentations, and web forums for real-time communications between participants on topics or questions in occupational radiation protection (Figure 2).

Using a simple web-browser in combination with an assigned user name and password, members can access the ISOE database through the internet. The implementation of the web-enabled ISOE database and benchmarking/analysis software on the ISOE Network has been an important step forward in improving participants' accessibility to the ISOE data for use in their daily management of worker doses. In 2009, the data entry modules will be implemented, allowing participants to enter their occupational exposure directly through the website. While the CD-ROM version of the ISOE database continues to be produced and distributed annually, the web-enabled version is intended to serve as the main data entry, access and analyse application for ISOE participants.

**Figure 3:** Homepage of the updated ISOE Network ([www.isoene-network.net](http://www.isoene-network.net))



## **2.7 External Collaboration**

While ISOE was established as a technical exchange programme for its participants, the many years of ISOE experience is often of relevance to other activities in the field of radiological protection. For example, as a contribution to the broad stakeholder consultation undertaken by the ICRP in developing its recent general recommendations [4], the ISOE Working Group on Operational Radiation Protection, at the invitation of the NEA, prepared a report on “Optimisation in Operational Radiological Protection” [5]. The intent of this work was to use ISOE experience to identify the key areas of operational radiation protection at nuclear power plants, particularly as they relate to optimization processes, that the group felt should be considered to improve the operational usefulness of the new recommendations.

More recently, the ISOE Management Board established an ad-hoc ISOE Group on the BSS Revision to offer ISOE operational input, through the ISOE Joint Secretariat (NEA and IAEA), for consideration in the revision process of the International Basic Safety Standards (BSS). The International Basic Safety Standards for Protection against Ionising Radiation and for the Safety of Radiation Sources [6] has served as an international benchmark for radiological safety since its approval in 1996. Six international organizations including IAEA and NEA co-sponsor this international standard, thus it is widely recognized, supported and implemented. In 2005, the IAEA launched a revision process which is being coordinated by a secretariat established by IAEA with participation of the co-sponsors. Thus, the purpose of the ISOE ad-hoc group is to review, from the ISOE perspective of good practice in operational occupational radiation protection and exposure management, the various BSS drafts as they are made available through the ISOE Joint Secretariat.

It is noted that as a technical information exchange programme established under the NEA statute, ISOE does not provide policy statements into these activities, but rather offers its experience in operational radiation protection as a contribution to the operational usefulness of such activities.

## **3. ISOE Future: Meeting User Needs and Looking Forward**

The strength of ISOE is based on its combination of occupational dose data, dose reduction experience, analyses, information exchange and its ability to provide a common forum of utilities and regulators. While the collection and analysis of occupational exposure data remains a central pillar of the ISOE programme, it is the exchange of this information and related experience that brings the full value of ISOE to its participants.

To achieve a sustainable long-term strategy to improve information flow and meet user needs, ISOE will take full advantage of web-based and other relevant technologies to deliver a cohesive, integrated and accessible portal of all ISOE assets in a forward-looking manner. The ISOE Network will play an increasingly important role in building an effective mechanism for directly reaching end users, providing participants with one-stop access to all the ISOE assets currently distributed across various media and locations, as well as those to be developed in the future, and an ability to consult, in real-time, the global ISOE membership of radiation protection professionals through the same system. An important goal of this work is to develop a programme that builds on ISOE strengths to make it a primary information source and communications network for the occupational radiation protection community.

*More information on the Information System on Occupational Exposure (ISOE) can be found at:*

ISOE Network / European Technical Centre: <http://www.isoep-network.net>

Asian Technical Centre: <http://www.jnes.go.jp/isoep/english/index.html>

IAEA Technical Centre: <http://www-ns.iaea.org/tech-areas/rw-ppss/isoep-iaea-tech-centre.htm>

North American Technical Centre: <http://hps.ne.uiuc.edu/natciso/>

OECD/NEA: <http://www.nea.fr/html/jointproj/isoep.html>

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