The Information System on Occupational Exposure (ISOE): Present and Future Activities

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Abstract

The Information System on Occupational Exposure (ISOE) provides a forum for radiation protection experts to discuss, promote and co-ordinate international activities in the area of protection of workers at nuclear power plants.

The ISOE database, the world's largest available database on occupational exposure, contains occupational exposure data from 422 commercial nuclear power plants including 88% of the world's operating commercial nuclear reactors. These data form a perfect basis to evaluate and follow dose trends, such as the evolution of annual collective dose per reactor. In addition, the database allows performing specific studies on doses related to certain jobs and tasks in a nuclear power plant, such as steam generator replacements, refuelling or insulation work.

ISOE is organised in a decentralised form, operated through ISOE Technical Centres. The ISOE Programme is directed by a Steering Group, which is responsible for policy decisions, and the overall programme direction. The joint NEA/IAEA Secretariat facilitates the work of the ISOE Steering Group, provides and manages communication with responsible NEA and IAEA bodies and organises transfer of information and communication between Steering Group, Working Groups and Technical Centres. The Technical Centres are responsible for the management of the databases, serve as contact point for the transfer of information to the participants, prepare information sheets and organise topical sessions and annual workshops.

The ISOE programme is currently being further developed to offer more possibilities for additional studies and data analysis. The future activities of the ISOE programme will focus on,

- Ensuring the completeness of the database;
- Enhancing the usability of the database software;
- Enhancing the performance and publication of special analyses of the given database; and
- Enhancing the visibility of and participation in ISOE.

Introduction and Objective

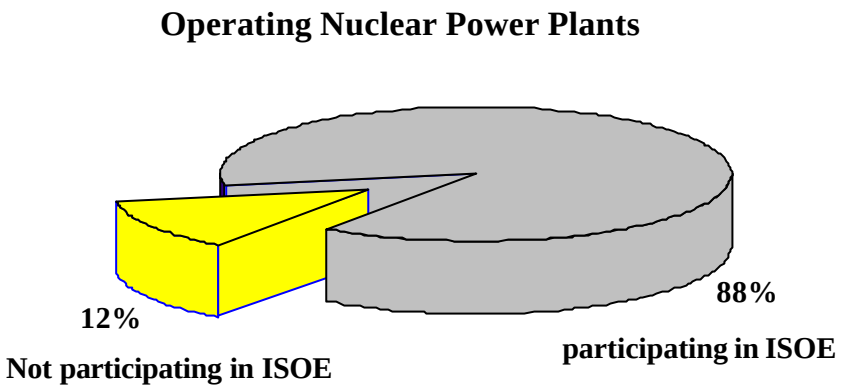
The Information System on Occupational Exposure (ISOE) was created by the OECD Nuclear Energy Agency (NEA) in 1992, as a communications network among participating utilities and participating national regulatory authorities, as well as a programme for the collection, analysis and dissemination of occupational exposure data. The International Atomic Energy Agency (IAEA) cosponsored the programme for those countries, which are not members of the NEA, and subsequently formed together with the NEA a joint NEA/IAEA Secretariat.

According to the Terms and Conditions for the operation of ISOE, the objective of the ISOE Programme is to make available to participants:

- Broad and regularly updated information on methods to improve the protection of workers and on occupational exposure in nuclear power plants;
- A mechanism for dissemination of information on these issues, including evaluation and analysis of the data assembled, as a contribution to the optimisation of radiation protection.

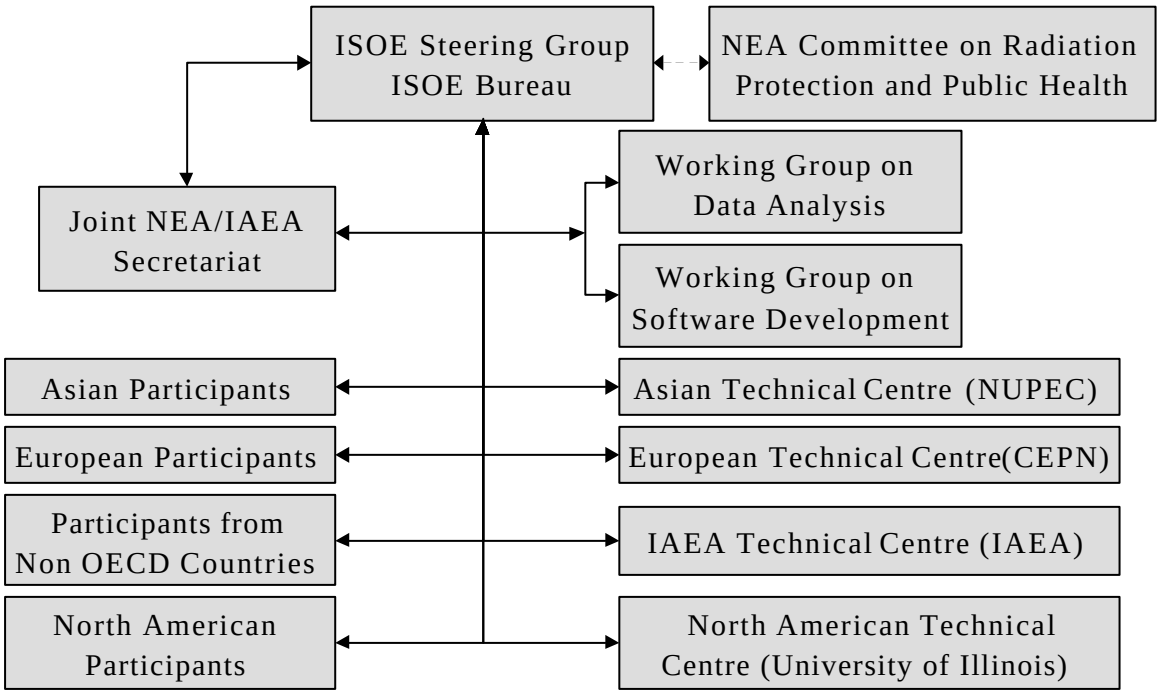
Thus ISOE is promoting and co-ordinating international co-operative undertakings in the area of protection of workers at nuclear power plants, at the same time providing a forum for communication between radiation protection experts

The ISOE databases include information on occupational doses for 422 reactors, both operating and in cold shut down or in some stage of decommissioning, operated by 77 utilities in 26 countries, as of December 1999. National regulatory authorities from 23 countries also participate in the ISOE programme. The participation of 383 operating commercial nuclear reactors in the ISOE programme represents 88% of the world's operating commercial nuclear reactors (total of 434). The largest blocks of reactors not participating in the programme are in the Russian Federation (29 units) and India (10 units).



ISOE Management

ISOE is organised in a decentralised form, operated through ISOE Technical Centres. The ISOE Programme is directed by a Steering Group, which is responsible for policy decisions, and the overall programme direction. The joint NEA/IAEA Secretariat facilitates the work of the ISOE Steering Group, provides and manages communication with responsible NEA and IAEA bodies and organises transfer of information and communication between Steering Group, Working Groups and Technical Centres. The ISOE Bureau, appointed by the Steering Group, manages the ISOE Programme, through the Joint Secretariat, between Steering Group meetings.



The Steering Group meets annually to review the work programme, creates and directs working groups to investigate specific areas and co-ordinates the work of the Technical Centres. The Working Group on Data Analysis prepares the contents of the ISOE Programme Annual Report and the data analysis presented therein, identifies topics of current interest for study and presentation as ISOE topical reports or ISOE information sheets. The Working Group on Software Development organises and co-ordinates software development necessary in connection with the ISOE databases.

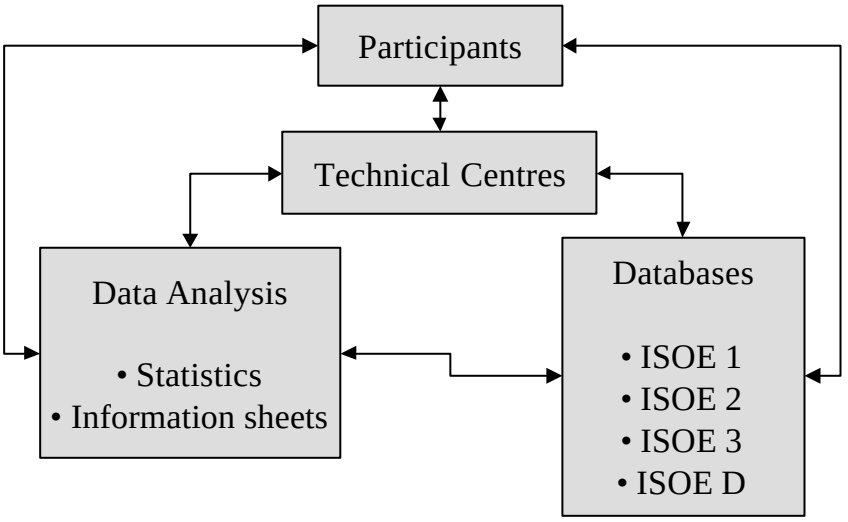
The Technical Centres are responsible for the management of the databases and serve as contact point for the transfer of information to the participants. The Technical Centres issue - as agreed by the ISOE Steering Group - ISOE Information Sheets and organise topical sessions and annual workshops, such as this *2nd EC/ISOE Workshop on Occupational Exposure Management in Nuclear Power Plants* here in Tarragona.

Organisation of Workshops and Topical meetings

Each year, an international workshop on occupational exposure management in nuclear power plants is organised alternating between the European Technical Centre, in co-operation with the European Commission, and the North American Technical Centre. The objective of these workshops is to provide a forum for radiation protection professionals from nuclear power plants as well as from radiation protection authorities for information exchange on practical experience on occupational exposure issues in nuclear power plants.

Information Flow

The ISOE communications network is an information pipeline to facilitate the real-time exchange of experience and information among participating utilities and authorities. The network consists of all ISOE participants as well as the four Technical Centres. Any participant - utility or authority - may question the network for information on a particular problem, technique, procedure, etc. The appropriate Technical Centre will perform a survey of all participants, via the other Technical Centres, collect and summarise the desired information, supply the information to the requester, and - if appropriate - prepare an ISOE information sheet for distribution to all other participants.



ISOE Databases

The ISOE database, the world's largest available database on occupational exposure, is divided into four parts including the following information:

ISOE 1: Dosimetric information from commercial nuclear power plants in operation, including for each participating unit e. g.
- annual collective dose for normal operation;
- maintenance/refuelling outage;
- unplanned outage periods; and
- annual collective dose for certain tasks and worker categories.

ISOE 2: Plant-specific information pertinent to dose reduction, such as materials, water chemistry, start-up/shutdown procedures, cobalt reduction programme etc.

ISOE 3: Radiation protection related information for specific operations, jobs, procedures, equipment or tasks:

- effective dose reduction;
- effective decontamination; and
- implementation of work management principles.

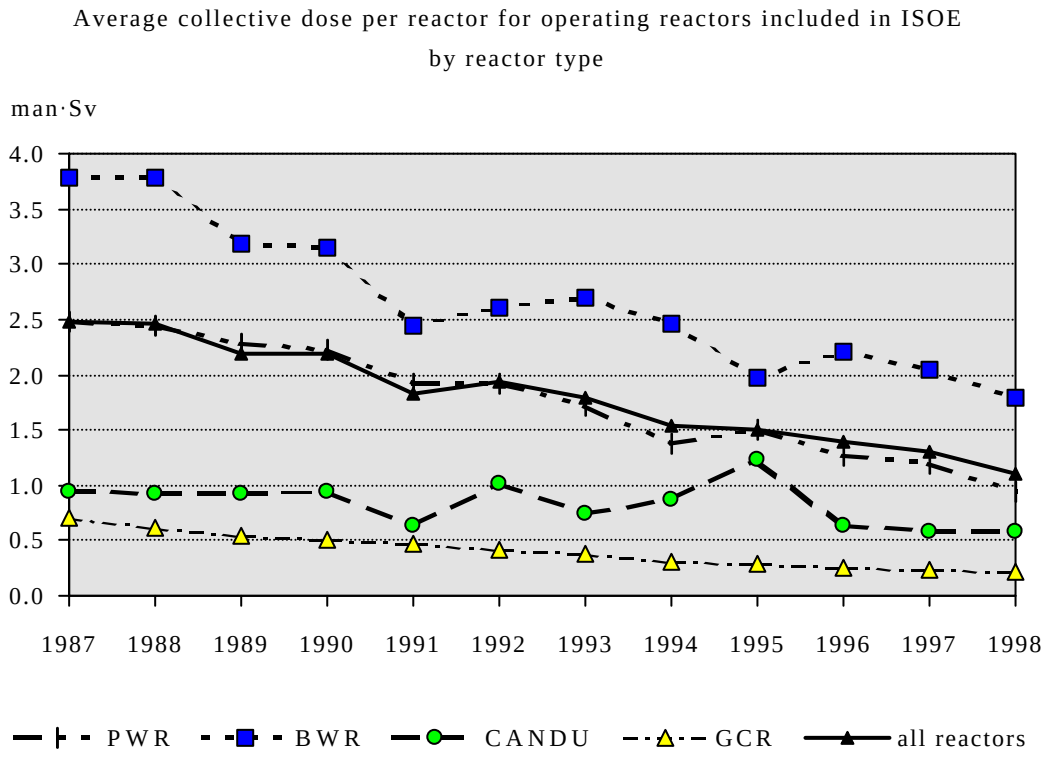
ISOE D: Dosimetric information from nuclear power plants which are shut down or in the process of decommissioning.

All information included is supplied by participating utilities, who have full access to all data. Participating authorities have access only to a reduced database, including data from utilities in their own country. Both participating utilities and participating authorities benefit from the ISOE communication network, as well as the data analysis and summary reports.

The ISOE database forms the basis for various types of data analysis and studies of occupational dose trends.

Recent dose trends

The ISOE database is used to analyse the average collective dose per operating reactor included in the database. The following figure indicates that a clear downward trend can be observed over the last decade, from 1987 to 1998 for pressurised water reactors (PWR), boiling water reactors (BWR), CANDU reactors and gas cooled reactors (GCR). More information and trends can be found in the recent publication "Occupational Exposures at Nuclear Power Plants: Eighth Annual Report of the ISOE Programme 1998," OECD, 1999.



More detailed analyses of the data can be found in the ISOE information sheets, published by the ISOE Technical Centres, e.g. studies on:

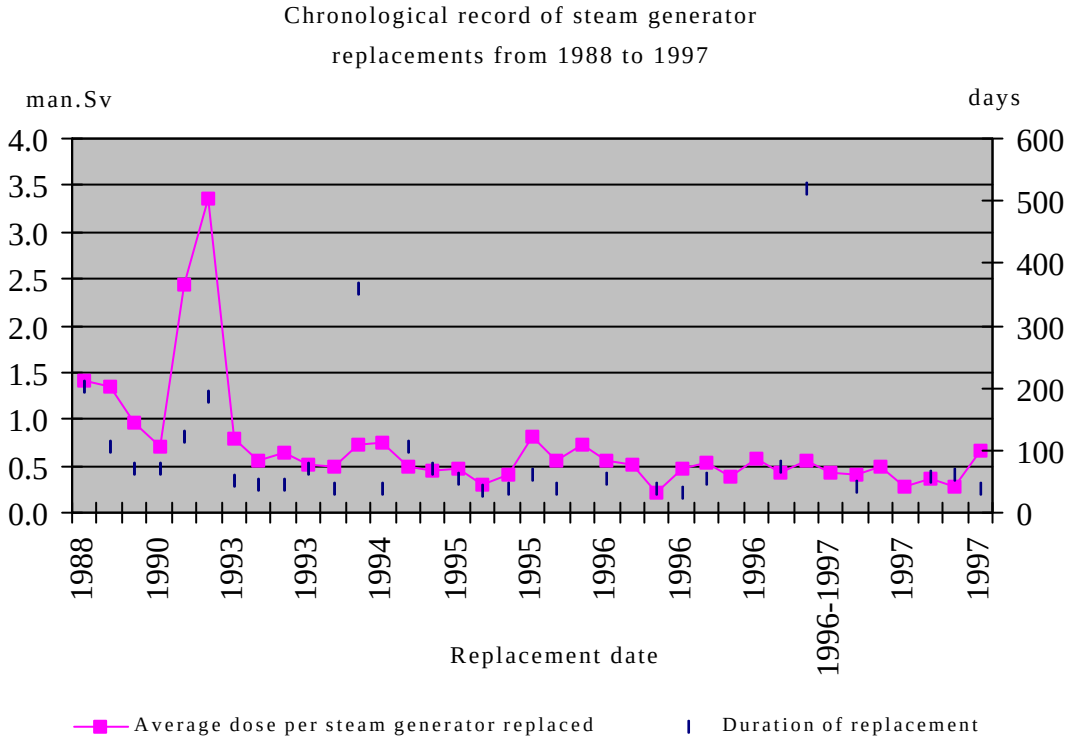
- Occupational exposure and steam generator replacements;
- Insulation works; and
- Refuelling trends.

The objective of such studies is to provide information to ISOE Participants, while at the same time, demonstrating the type of information that can be extracted from the database.

Steam generator replacement trends

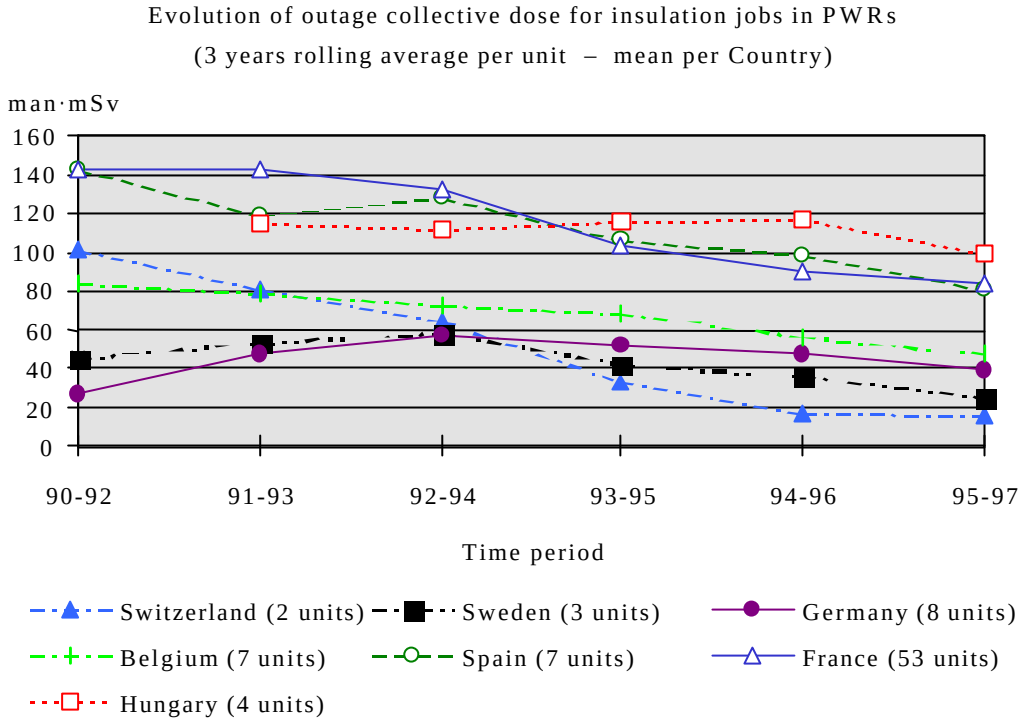
During the last ten years 35 steam generator replacements in PWRs have been performed. Based on ISOE data, a study analysed the collective exposures during steam generator replacements showing a strong decrease over the time period 1988 to 1997. Collective doses are still decreasing, although levelling off, close to 0.3-0.4 man· Sv per steam generator has been reached. Figure 2 illustrates the chronological record of steam generator replacements from 1988 to 1997.

This study confirms that, on average, the collective dose during the year of steam generator replacement is 60% higher than the average collective dose of the unit during the three prior years including refuelling outages. The study also confirms that the collective dose in the years following replacement falls to 40 to 50% of the pre-replacement collective dose and this tendency has been consistent over 8 to 10 years after replacement.



Insulation trends

The ISOE database served as a basis for an analysis of the evolution of collective doses related to insulation jobs in some European PWRs. The study is based on data from 84 units in the time period 1990 to 1997. The mean dose per country, or per sister-unit group, was calculated using the three years average collective dose of each unit belonging to the group under consideration. The collective dose due to insulation jobs represents, in general, between 5% and 7% of the annual collective dose. This percentage is relatively stable over the period under consideration. Even if some major differences still exist between the countries and between the different types and design of units, this study confirmed the global trend of decreasing collective doses for insulation jobs in nearly all plants. (Figure 3). This trend should be linked to the general decrease in the total collective dose which is observed in most countries, and also to the implementation and sharing of good practices between plants.



According to a questionnaire, distributed in 1997 within the ISOE network, the following main actions have been undertaken to reduce insulator exposures:

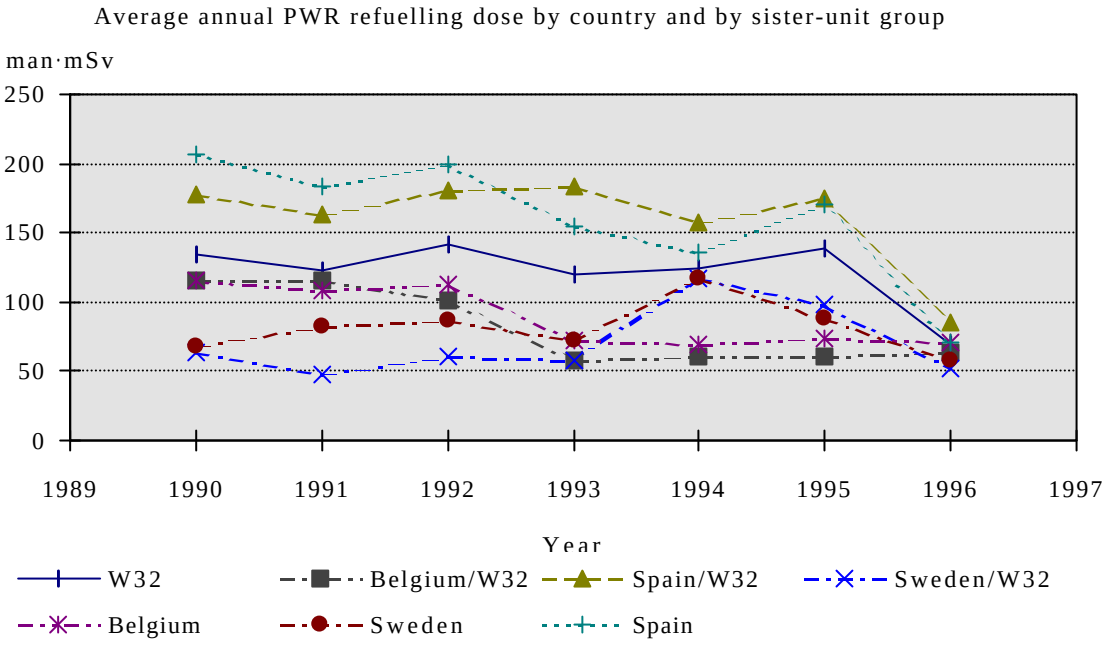
- Replacement of normal insulation by "cassette insulation" (easy to remove and replace);
- Improvement of scaffoldings (use of quick assembly scaffoldings);
- Reduction of the amount of insulation to be removed;
- Selection of the best work time period in the outage schedule;
- Specific radiation work permit;
- Improvement of insulation marking just before removal to facilitate the replacement;
- Improvement of storage to prevent damage;
- Team management; and
- Specific training on mock-up.

Refuelling trends

The ISOE 1 database has also been used to study refuelling collective doses for PWRs and BWRs, investigating the trends as a function of reactor type and generation. Since 1990, the data for refuelling in both PWRs and BWRs has been relatively stable in terms of collective dose, number of workers involved and job duration. It is also clear that the reporting of these data is not uniform regarding the definition of "refuelling". Although tendencies in collective dose, number of workers and job duration are stable, there are considerable numerical differences.

Concerning the average collective doses, doses for BWRs tend to be between 50 man· mSv and 100 man· mSv. In PWRs, the average seems to be somewhat higher, being between 50 man· mSv and 150 man· mSv.

The study clearly indicates that national practices seem to have a larger influence on refuelling doses than practices within sister unit groups. Figure 4 shows the average refuelling dose per unit for a particular sister-unit group (W32) compared to country averages (all reactors) as well as the average for the sister-unit group in one particular country. The average collective refuelling dose for the W32 sister-unit in Belgium, for example, does not track particularly well with the average for all W32 units around the world. However, the average collective refuelling dose for W32 units in Belgium tracks well with the average for all plants in Belgium. The same tendencies are seen for W32 units in Sweden and Spain, as well as for W21 plants in Belgium and Switzerland. This result suggests that shared national experience (using the same 'language') seems to be more valuable to plants than experience from sister-units in other countries.



Future activities:

The ISOE programme is currently elaborated further to offer more possibilities for additional studies and data analysis. The future activities of the ISOE programme aim to,

- Ensure the completeness of the database;
- Enhance the usability of the database software;
- Enhance the performance and publication of special analyses of the given database; and
- Enhance the visibility of the programme and increase participation in ISOE.

In a short-term perspective, the following activities are on going:

Data analysis
The trends in occupational exposure will be summarised and briefly discussed in the ISOE Annual Report 1999 which is scheduled to be published in August 2000. This report will contain a few selected studies, such as studies on Replacement of Reactor Internals and Full System Decontamination at a Japanese BWR.

The current ISOE work plan includes a list of special analyses, to be performed and published by the Technical Centres during this year:

- Job/dose analysis;
- European annual outage doses;
- Steam generator replacement update;
- Outage time reduction, fuel cycle length vs. total annual dose;
- Dose analyses for scaffolding and servicing personnel;
- Experience on implementing risk informed regulations;
- Control rod drive maintenance dose trends at BWRs;
- Shutdown cooling after steam generator replacements at PWRs;
- Dose trends with motor operated valves at CANDU plants;
- Dose constraints: what, how, when; and
- Decommissioning trends.

In addition, an ad-hoc working group will be launched to prepare a technical Report on “Radiation Protection Manager: Best Practices at Nuclear Power Plants”, to be published in 2002.

Software development
The ISOE 1 data are organised and stored with the help of the commercial database software Microsoft ACCESS. Recently, a new input module was developed, tested, quality assured and released to allow data collection directly into the database in a Microsoft ACCESS environment. This input module was translated into different languages for the purpose of collecting the 1999 data from European utilities and utilities participating through IAEA. It is hoped that this new input module will help ISOE participants to include their data and will therefore improve the completeness of the database.

During 2000, the implementation of the ISOE 2 data is scheduled, using a new agreed ISOE 2 questionnaire and finally merging with ISOE 1 to one database, called ISOEDAT. In a similar fashion the data from reactors in some stage of decommissioning, ISOE D, will be incorporated into this merged database.

For the radiation protection related information for specific operations, jobs, procedures, equipment or tasks, which is collected in ISOE 3 reports, a proposal on the implementation in the ISOEDAT database is currently being drafted.

Information exchange system
In order to provide a system for the quick exchange of information about occupational exposure, an automatic "e-mail re-mailing system" was installed at the NEA Secretariat. This automatic re-mailing system allows a restricted group of users, the ISOE participants, to send quick information, reports, questions, issuance of a new information sheet or a new ISOE 3 report, via e-mail to the NEA server, to all other participants of this restricted group.

Conclusion

After more than eight years of operation and expanding participation, the ISOE system has proved its worth in encouraging utilities to regard collective dose as a parameter to be managed. Continued growth and development of the system, together with efforts by all participants to deliver timely and useful information, will help to assure that ISOE remains an up-to date conduit for the exchange of occupational exposure experience throughout the world.

References:

"Occupational Exposures at Nuclear Power Plants: Seventh Annual Report of the ISOE Programme 1997," OECD, 1999.
"Occupational Exposures at Nuclear Power Plants: Eighth Annual Report of the ISOE Programme 1998," OECD, 1999.