Analysis of Collective Dose Trends using the ISOE Database

Lucie D’ASCENZO
ISOE European Technical Centre, CEPN

ISOE International Symposium
Tokyo, Japan (27-28 August 2013)
The ISOE Website (www.isoe-network.net)

The Information System on Occupational Exposure (ISOE) System was created in 1992 to provide a forum for radiation protection professionals from nuclear electricity utilities and national regulatory authorities worldwide to share dose reduction information, operational experience and information to improve the optimisation of radiological protection at nuclear power plants.

ISOE is jointly sponsored by the OECD Nuclear Energy Agency and the International Atomic Energy Agency.

Status on Fukushima Accident

For the latest information concerning the status of Fukushima NPP Accident, see the following websites:

- Japan Nuclear and Industrial Safety Agency
- Japan Atomic Industrial Forum
- Tokyo Electric Power Company
- Japan Ministry of Education, Culture, Sports, Science & Technology
- International Atomic Energy Agency

Welcome to the ISOE Website

Next ISOE Meetings

- ISOE Bureau
- 2013 ISOE North-American Symposium

Upcoming Events

- 2013 ISOE North-American Symposium
- ISOE Website Newsletter
Access to the ISOE Database

Welcome to the ISOE Database

You will be asked to re-enter your ISOE username and password.

The ISOE database includes occupational exposure information for 401 operating units and 81 units in cold-shutdown or some stage of decommissioning in 29 countries, covering about 91% of the world’s operating commercial power reactors.

2012 Data for operational reactors available in the current database (as of 9 July 2015)

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<thead>
<tr>
<th>Country</th>
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<td>South Africa</td>
<td>(complete)</td>
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</table>
Content of the ISOE Database

- ISOE 1: Dosimetric information from commercial NPPs in operation or in some stage of decommissioning, including:
  - annual collective dose for normal operation
  - maintenance/refuelling outage dose
  - forced outage dose
  - annual collective dose for certain tasks and worker categories
Who Can Access the Database?

- **ISOE Participants** can access the DB on-line (ISOE website) and on CD-ROM (Microsoft ACCESS)
  - Web version is routinely updated
  - CD-ROM is distributed annually after all data received

- **Participating Utilities:**
  - Full access to global database

- **Participating Authorities:**
  - Full access to ISOE 1 data from national licensees
  - Limited access to ISOE 1 data from other countries
    - No access to dose per task and job, dose per occupational category and dose rates

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1 CD-Rom needed by 3 countries: Armenia, Russian Federation and by some German plants
Database Analyses and Benchmarking

- The extensive data in ISOEDAT provides a solid basis for analyses on issues in operational RP such as dose trends, doses related to certain jobs and tasks, identification of good performance, etc.

- Several ways to use the database:
  a) MADRAS analysis package: Main trends in occupational exposure
  b) Direct access to ISOE 1 questionnaires, including contact information and complementary data
  c) Direct access to the whole database using the data extraction module
Database Analyses and Benchmarking

ANNUAL COLLECTIVE DOSE

- Total annual collective dose
  - For a plant unit:
    - Compared with other units (#U-01)
    - Compared with other units in its sister unit group (#U-20)
  - For the whole database:
    - By geographical region (#4-f3)
    - By reactor type (#4-f4)
    - Breakdown by geographical region for 1 year (#4-f5)
    - Breakdown by reactor type for 1 year (#4-f6)
  - Compared with the number of operating reactors:
    - For the whole database (#4-f2)
    - For a country (#U-15)
  - Contribution of outside personnel collective dose:
    - For a plant unit (#U-08)
    - By reactor type and by country for 1 year (#6-t3)
  - By reactor age for a plant unit:
    - Compared with other units for 1 reactor type (#U-66)
    - Compared with other units for 1 country (#U-67)
  - Cumulated dose:
    - By geographical region (#4-f1)

- Average annual collective dose per reactor
  - For a plant unit:
    - Compared with its sister unit group and other sister unit groups (#U-02)
    - Compared with its sister unit group and its reactor type (#U-05)
MADRAS Data Analysis Package

- A set of pre-defined data queries to facilitate analysis of main trends in occupational exposure, benchmarking between plants, sister units, etc.
  - Benchmarking at unit level
  - Total annual collective dose
  - Annual average collective dose per reactor
  - Rolling average collective dose per reactor
  - Total annual collective dose vs. number of operating reactors
  - Total annual collective dose by reactor age
  - Average annual collective dose per TWh
  - Contribution of outside personnel and outages to total collective dose
  - Dose rates
Using ISOEDAT as a Benchmarking Tool

- Analyses at country or regional level:
  - Trends in Annual average collective dose per reactor / Annual total collective dose
  - Between countries or regions: by country/region for a given reactor type, or all reactors, including rolling average over several years
  - Within a country: Specific unit against another unit or by type of reactor

- Analyses at utility level:
  - Specific utility against other utilities
  - Specific utility by reactor type

- Analyses at unit level
  - Specific unit against another unit / sister group / reactor type
  - Benchmarking at the job and task level
Global Dose Trends by Geographical Region

- The annual average collective dose per operating reactor has consistently decreased over the time period covered in by ISOE.
Country Dose Trends by Reactor Type (PWRs)

- For most countries, the annual average collective dose per operating reactor decreased over the time period.

Average annual collective dose per reactor for France compared with other countries for PWR
Focus on France

Total Dose vs. Number of Operating Reactors

- Decrease of total collective dose despite an ageing fleet and an increase of maintenance programme

**Total annual collective dose compared with the number of operating reactors for France**
Impact of the Design: Clear decrease of average collective dose per reactor by sister unit group from F31 (oldest generation) to F43 (newest generation)

3-Year rolling average collective dose per reactor for French sister unit groups
## Quartile Ranking

### 2010-2012 Average Collective Dose for France

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Plant unit</th>
<th>2010 - 2012 (man.mSv)</th>
<th>2009 - 2011 (man.mSv)</th>
<th>Percent change from 2009 - 2011</th>
<th>2009 - 2011 Quartile (if changed)</th>
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<td>1</td>
<td>Penly 2</td>
<td>338.20</td>
<td>419.09</td>
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<tr>
<td></td>
<td>Chooz B2</td>
<td>342.89</td>
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<td></td>
<td>Golfech 2</td>
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<td>311.66</td>
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<td>Belleville 2</td>
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<td>Saint Alban 1</td>
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International Benchmarking
2010-2011 Average Collective Dose Ranking

Plant unit ranking for a reactor type

Top 20 for PWRs

> German & Westinghouse reactors at top 20
if we exclude from the ranking units without outage refueling
Top 50 - 2009-2011 PWR Average Collective Dose

- In red: Framatome reactors
- In black: Westinghouse reactors
- In green: Siemens reactors
Collective Dose Trends by Sister Unit Group
Comparison Framatome – Westinghouse reactors

- **3-Loops reactors**: 1\textsuperscript{st} and 2\textsuperscript{nd} generation of Westinghouse reactors shows lower dose than respective generations of Framatome reactors

3-Year rolling average collective dose per reactor by sister unit group

The reactors from South-Africa, China and South Korea have been excluded from F32
Collective Dose Trends by Sister Unit Group
Comparison Framatome – Westinghouse reactors

- **4-Loops reactors**: 2nd generation of Framatome reactors shows lower dose than Westinghouse reactors except for recent periods

**3-Year rolling average collective dose per reactor by sister unit group**

![Graph showing dose trends](image-url)
New MADRAS Analyses

- MADRAS Analysis module is improved every year with new developments based on user feedback and requests.

- New analyses planned for 2013: A set of new queries to improve outage benchmarking.
Consideration of nuclear safety is essential in ensuring the operation of nuclear power plants. The ISOE 1 Questionnaire provides a comprehensive framework for assessing the safety performance of these facilities.

The ISOE 1 Questionnaire offers a structured approach to data collection, enabling stakeholders to gather comprehensive information. This data can be used to evaluate the safety performance of nuclear plants against established standards.

To facilitate this process, the ISOE platform provides a tool for data extraction. This feature allows users to access the data in a structured format, making it easier to analyze and interpret. The extracted data includes various parameters such as annual dose, outage duration, and reactor status, among others.

The data extraction process is straightforward. Users can select specific criteria, such as country, plant unit, and year, to filter the data according to their needs. This flexibility ensures that the data extracted is relevant and can be used for detailed analyses.

The extracted data can be used to perform various analyses, such as trend analysis, to identify areas of improvement or to compare safety performance across different plants or countries. This capability is crucial in enhancing the overall safety and reliability of nuclear power operations.

In summary, the ISOE 1 Questionnaire offers a robust platform for data extraction, which is essential for conducting comprehensive safety analyses in the nuclear power industry.
The ISOE Website and Database

Thank you for your attention!

For more information, please visit:
www.isoe-network.net