Information System on Occupational Exposure (ISOE)

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ISOE Objective

- To provide a forum for RP professionals from nuclear electricity utilities and national regulatory authorities worldwide to share dose reduction information, operational experience and information to improve the optimization of radiological protection at nuclear power plants.

"... 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, 2008-2011)

ISOE Program

- ISOE facilitates occupational exposure management at NPPs through collection and analysis of worker dose data and trends worldwide:
  - World's largest occupational exposure database for commercial NPPs
  - An information exchange program for sharing dose reduction information and operational experience
- ISOE products support:
  - Dose trend analyses, benchmarking, technique comparisons
  - Application of ALARA and good work management in local radiation protection programs
  - Continuous effort for data collection and analysis, and information exchange

ISOE Background

- Created in 1992 by OECD/Nuclear Energy Agency (NEA)
  - Promoted and sponsored by NEA and IAEA
- Four ISOE technical centers support local/regional members
  - Asia, Europe, North America, IAEA
- 18th year of ISOE program

Official Participants under ISOE Terms and Conditions **(May 2010)**		
65 Participating Utilities in **28** countries	**319** operating units; **40** shutdown units	Participating Regulators of **23** countries

North American Participation in ISOE

- Participation through North American Technical Center (NATC)
  - NATC is located at the University of Illinois, within the Department of Engineering
  - NATC led by Dr. David Miller and NATC Board
    - NATC Board comprises utility representatives from the US and Canada and, NRC and CNSC as regulatory observers
- Participation is also available through the other 3 technical centers, if desired

North American Official Participants under ISOE Terms and Conditions **(May 2010)**		
15 Participating Utilities in **3** countries	**72** operating units; **6** shutdown units	Participating Regulators of **3** countries

What is in the ISOE Occupational Exposure Database?

- **ISOE 1:** Dosimetric information from commercial NPPs in operation, shut down or in some stage of decommissioning, including:
  - annual collective dose for normal operation
  - maintenance/refueling outage
  - unplanned outage periods
  - annual collective dose for certain tasks and worker categories
- **ISOE 2:** Plant-specific information relevant to dose reduction, such as materials, water chemistry, start-up/shutdown procedures, cobalt reduction program, etc.
- **ISOE 3:** 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

Who Can Access the Database?

- ISOE Participants can access the database on-line (through the ISOE website) and on CD-ROM (Microsoft ACCESS)
  - Web version is routinely updated
  - CD-ROM is distributed annually after all data received
  - A set of pre-defined data queries facilitates trend analysis, benchmarking between plants, sister units, etc.

➢ Participating Utilities:
  - Full access to global database (ISOE 1, 2, 3)

➢ Participating Authorities:
  - Full access to ISOE 1 data from national licensees
  - Limited access to ISOE 1 data from other countries
    - General information, annual dose statistics, information about external and internal dose
    - Current discussion to allow full database access

ISOE Databases: Data Collection and Analysis

- **Data Collection:** ISOE Occupational Exposure Database (ISOEDAT)
  - Database: occupational exposure data for 471 reactor units in 29 countries (395 operating units; 76 under decommissioning)
    - Data Input: Annual collection of operational dose data at the site, unit, job and task level
  - Web-enabled data entry modules were completed in 2009 and implemented on the ISOE Network in Jan 2010 for on-line data submission

- **Data analysis**: Working Group on Data Analysis (WGDA)
  - Mandate: identify, perform and report on analyses of ISOE data, experience in for operating/decommissioned units, recommend, undertake follow-up action

ISOE Databases: Data Collection and Analysis

Trend results from database (2008):

- 2008 average annual collective doses per reactor maintain the low levels reached in last few years

	2008 average annual collective dose (man·Sv/reactor)	**3-year rolling average for 2006-2008 (man·Sv/reactor)**
Pressurised water reactors (PWR/VVER)	0.69	0.72
Boiling water reactors (BWR)	1.35	1.38
Pressurised heavy water reactors (PHWR/CANDU)	1.27	1.07
All reactors, including gas cooled (GCR) and light water graphite reactors (LWGR)	0.86	0.86

- Data for 2009 currently being collected

ISOE Databases: Analyses and Benchmarking

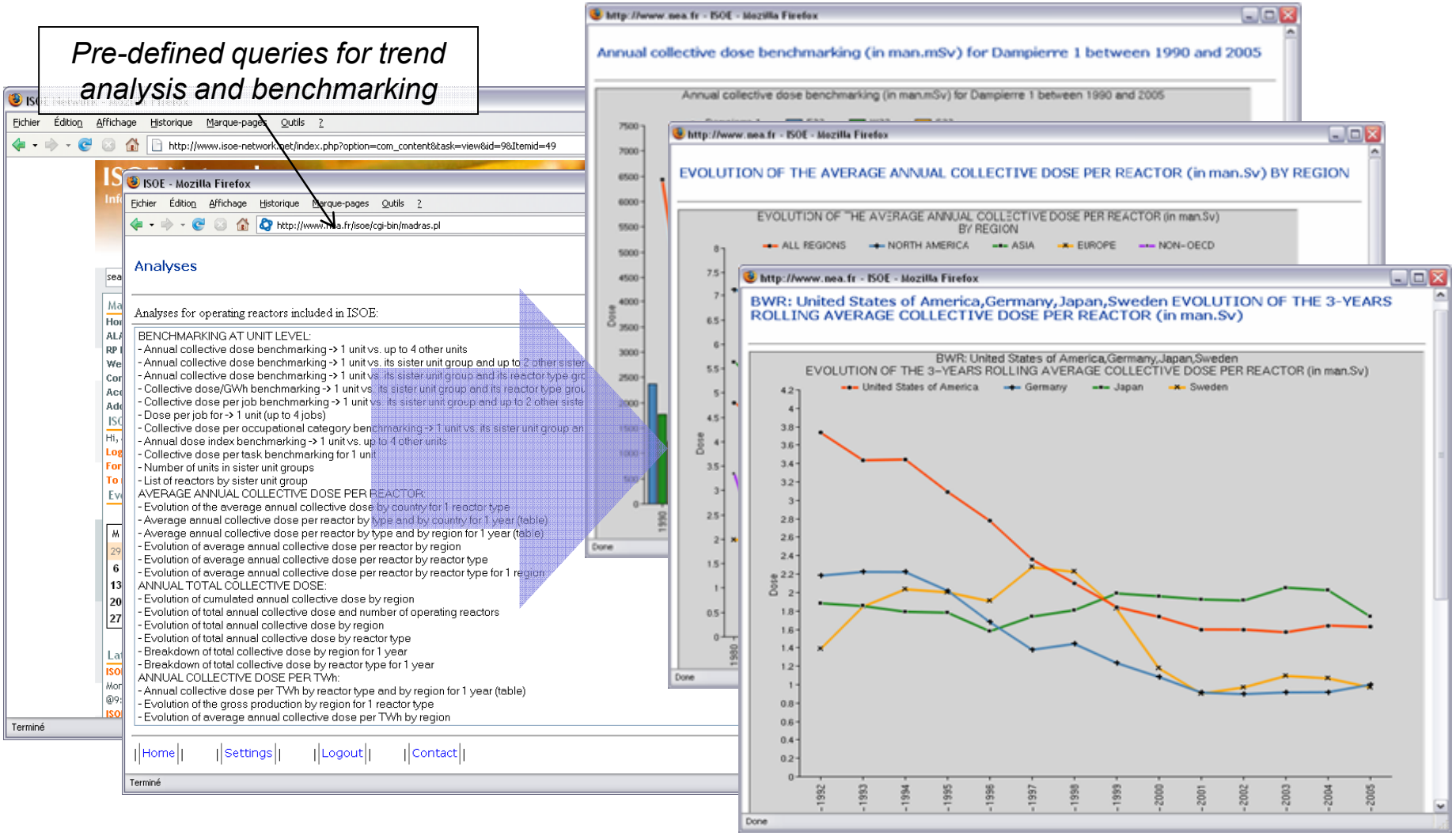
- The extensive data in ISOEDAT provides a solid basis for analyses on issues in operational radiation protection such as dose trends, doses related to certain jobs and tasks, identification of good performance, and sharing of best ALARA practices

- 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) For more complex analyses: Direct access to database, requests to the technical centers, RP forum, other activities

MADRAS Data Analysis Module

- Summary of pre-defined categories of queries
  - Benchmarking at unit level
  - Annual average collective dose per reactor
  - Annual total collective dose
  - Annual collective dose per TWh
  - Contribution of Outside Personnel and Outages to Total Collective Dose
  - Evolution of the Number of Reactor Units
  - 3-yr Rolling Average Collective Dose per Reactor
  - Miscellaneous Queries

MADRAS Data Analysis Module (cont.)



Using ISOEDAT as a Benchmarking Tool

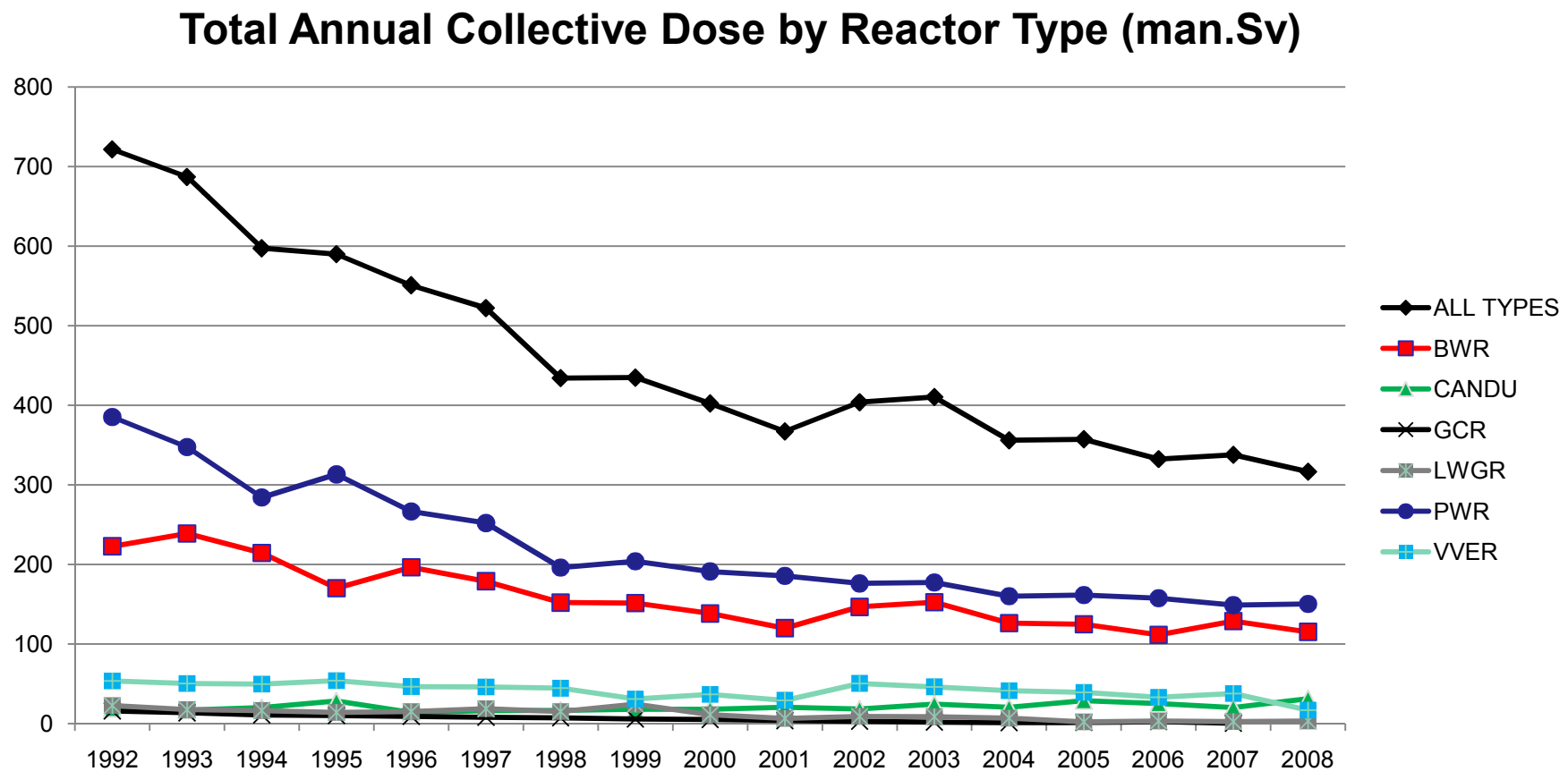
- Analyses at country or regional level:

  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 3-yr rolling average
  - Within a country: Specific unit against another unit or by type of reactor
- Analyses at utility level: benchmarking of reactors within a utility
  - Specific unit against another unit
  - Specific unit against its sister group / reactor type
- Analyses at unit level
  - Specific unit against another unit / sister group / reactor type
  - Benchmarking at the job and task level

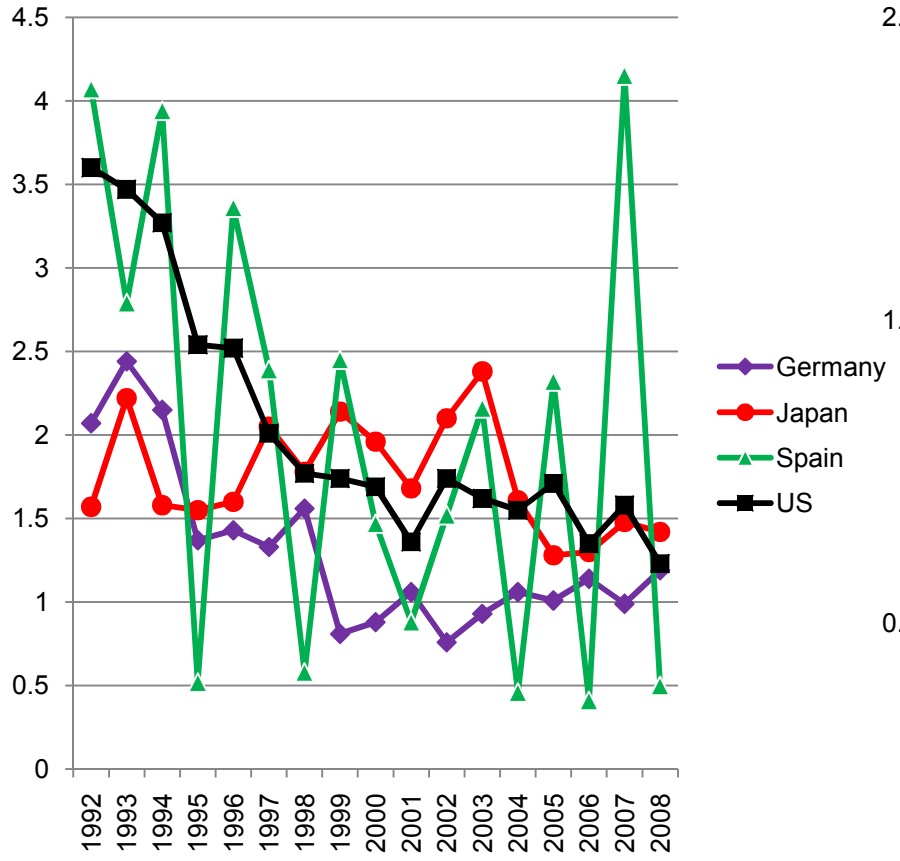
Example 1:
Global Dose Trends by Reactor Type: 1992-2008

- For most reactor types, the annual collective dose per operating reactor has consistently decreased over the time period covered in by ISOE

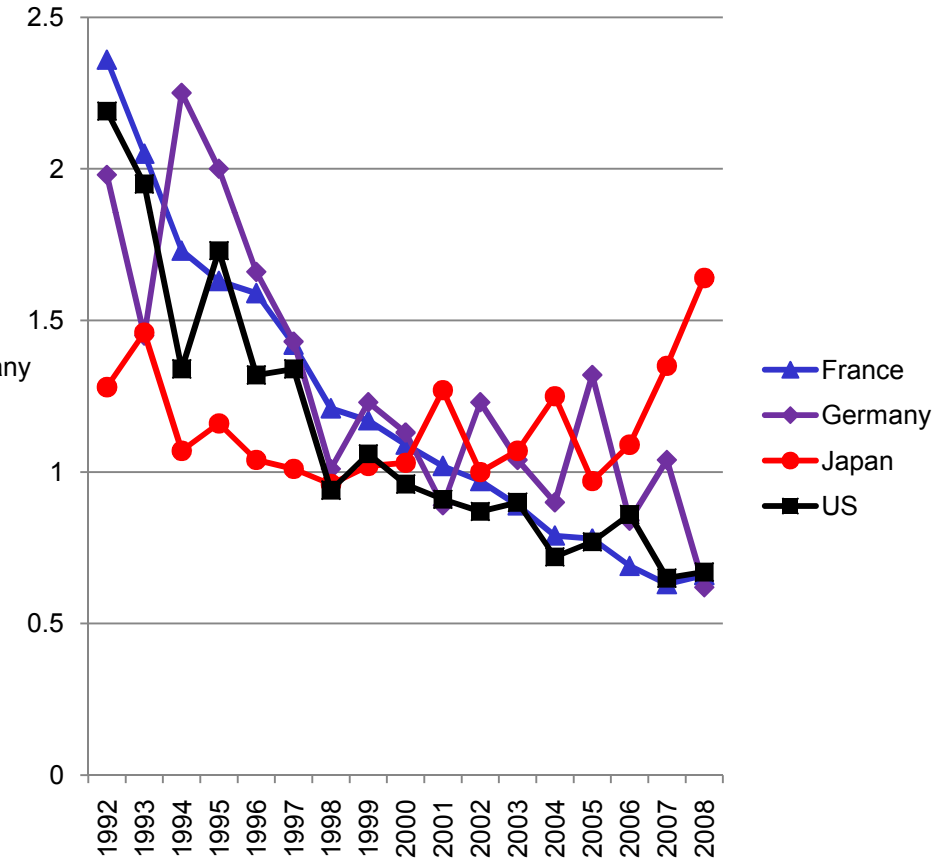


Example 2:
Dose Trends by Country and Reactor Type

Average Annual Collective Dose per BWR (man.Sv)

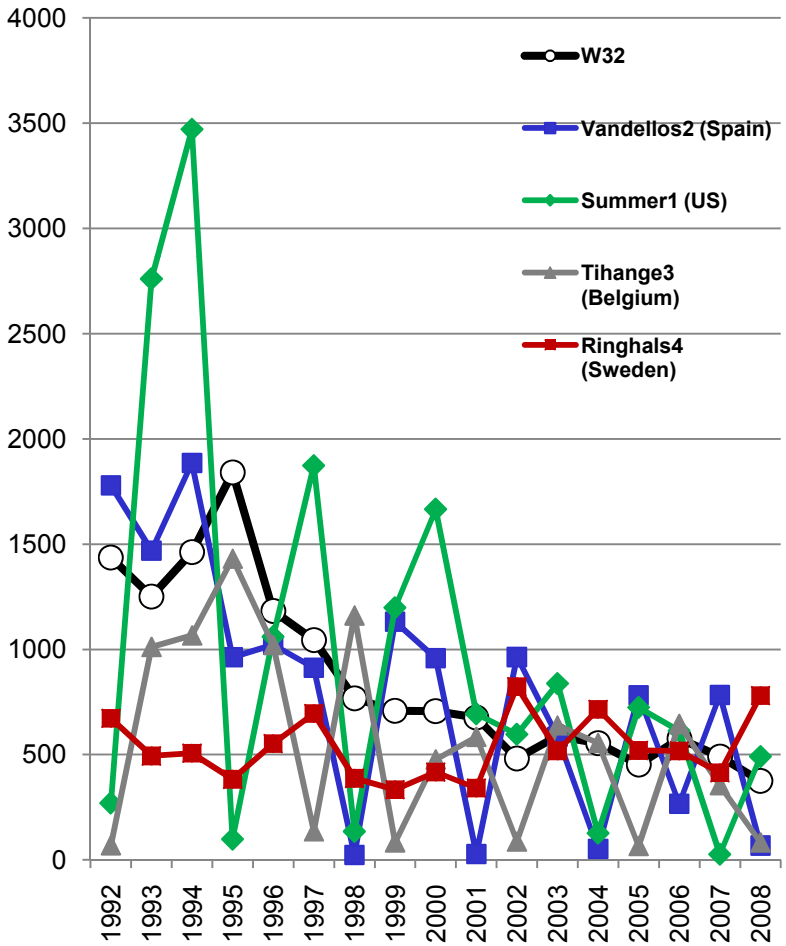


Average Annual Collective Dose per PWR (man.Sv)

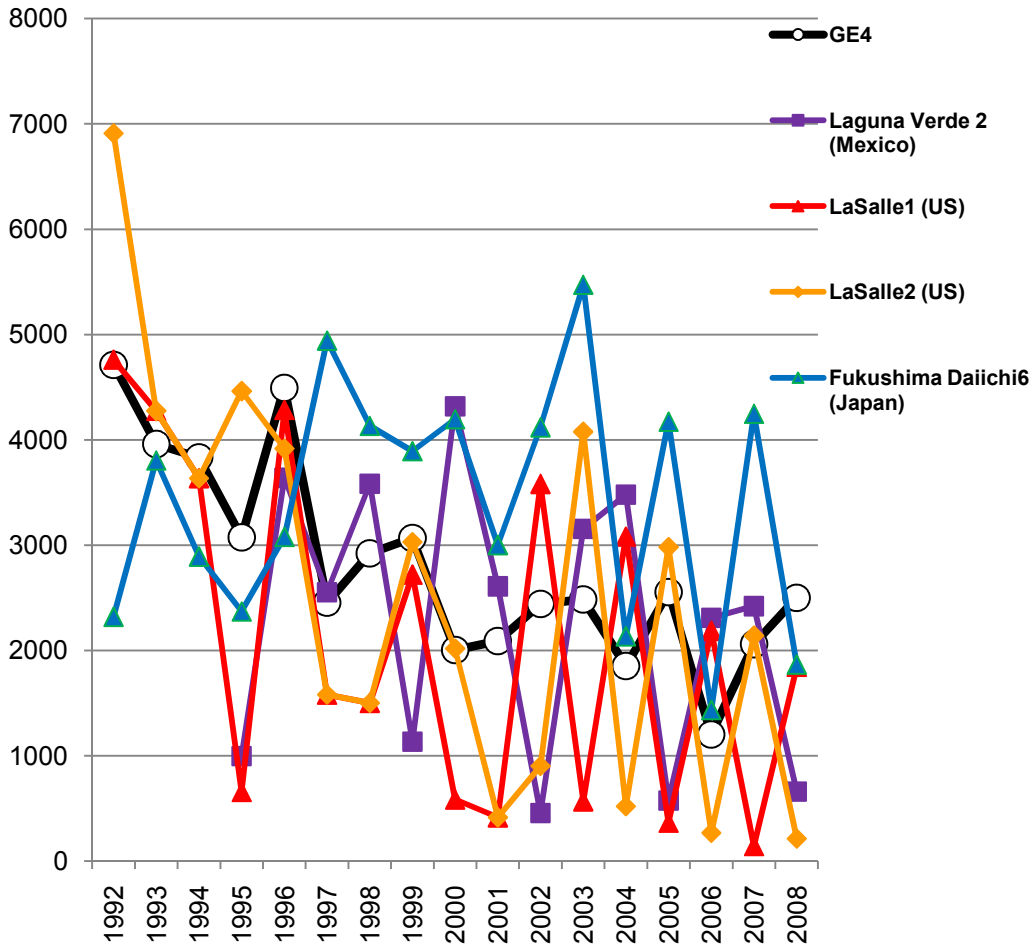


Example 3:
Dose Trends for 1 Sister Group

Annual Collective Dose for 1 PWR Unit in Westinghouse W32 (man.Sv)

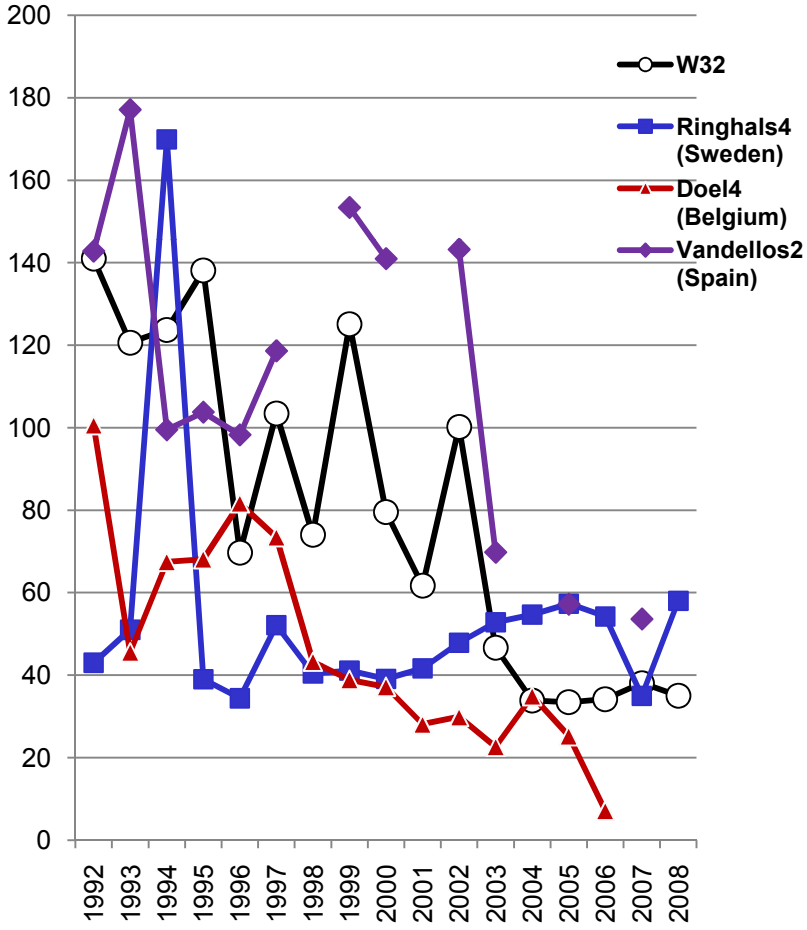


Annual Collective Dose for 1 BWR Unit in General Electric GE4 (man.Sv)

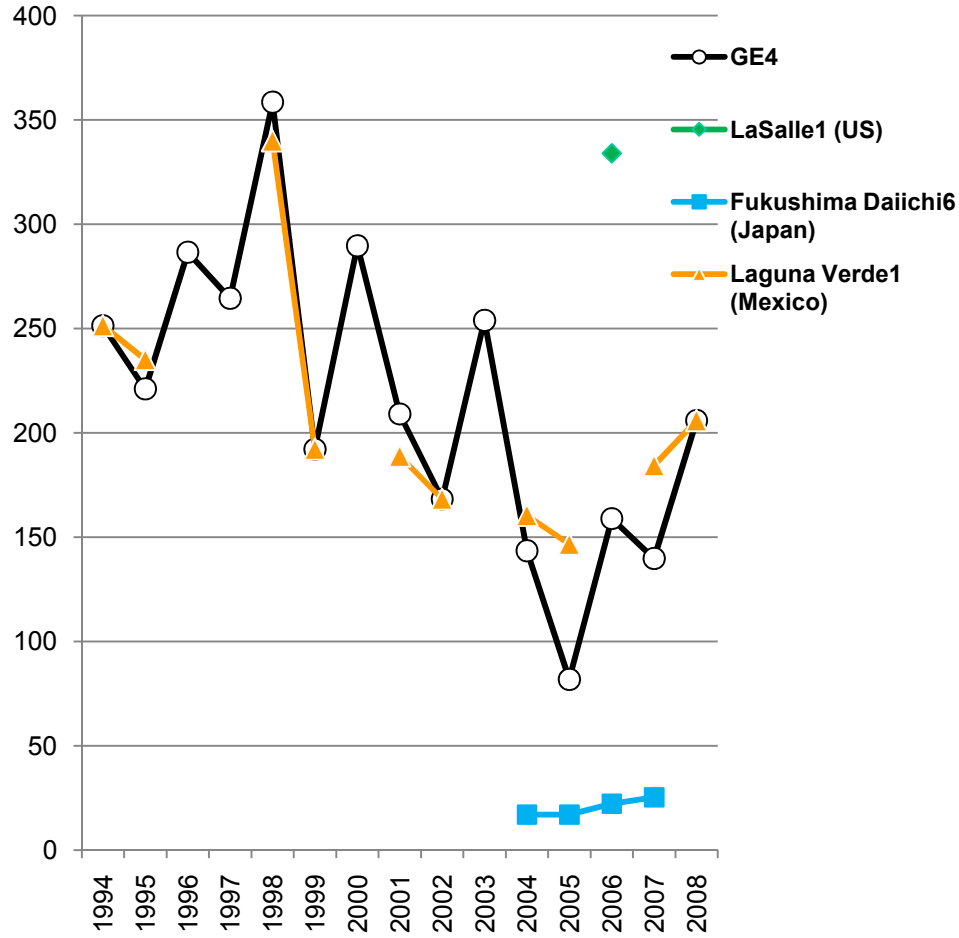


Example 4:
Dose Trends for 1 Sister Group and Job (Refueling)

Collective Dose for the PWR W32 Sister Group, Refueling (man.mSv)



Collective Dose for the BWR GE4 Sister Group, Refueling (man.mSv)



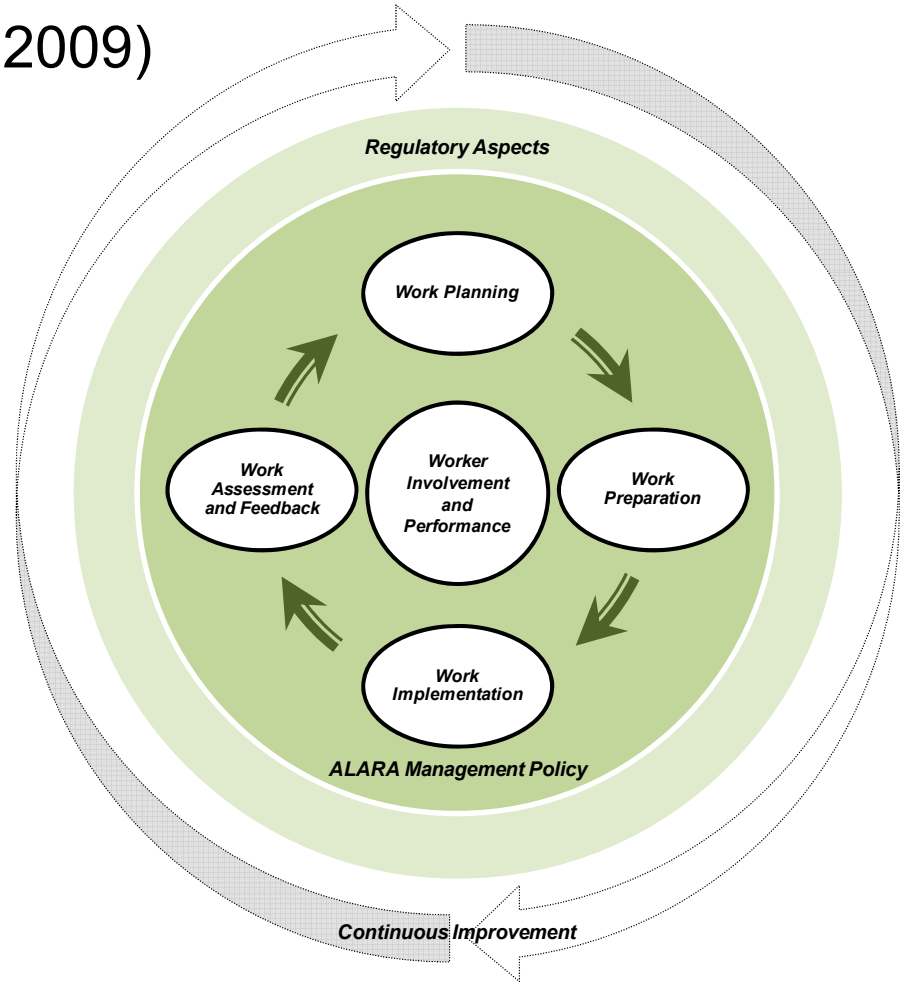
Identifying and Sharing Good Performance/Experience

- The ISOE database helps users to benchmark doses and identify possible improvements
- Users can exchange information on lessons learned and experiences
- ISOE communication channels:
  - Contact information in the database for each plant
  - RP Forum on the ISOE Network website
  - ISOE ALARA Symposium
  - Requests to the technical centers on issues in operational RP
  - Voluntary plant benchmark visits for exchange of good RP practices, dose reduction information among participants

Experience Exchange in Operational Occupational Radiation Protection

Report: *Work Management to Optimise Radiation Protection in the Nuclear Power Industry* (published 2009)

- Presents key aspects of work management to be considered in optimizing ORP at NPPs, supported by current practical examples from ISOE
- An ISOE contribution to ensure that good performance, outcomes and trends are maintained in the face of current and future challenges
- Available in English, Japanese and French



ISOE Network Website

- One-stop information website on practical ALARA resources for ISOE Participants:
  - ISOE database:
    - Data analysis
    - Data entry
  - ISOE products, resources
  - Address book / RP manager forum
  - List of events, meetings, symposia
- Facilitates a global approach to ALARA management
  - www.isoe-network.net

Activities in 2010

- ISOE will continue to concentrate on the *exchange of good practice and experience in occupational exposure reduction* at NPPs
  - Continue on-line collection of 2009 occupational exposure data, focusing on timely data submission and data completeness
  - Information exchange and shared experiences between participants through symposia, ISOE Network, publications
- ISOE will focus on *increasing the usefulness of and accessibility to* ISOE products through ongoing enhancements of the ISOE Network, to better meet user needs
  - WGDA to continue focus on
    - Integrity and consistency of ISOE data set
    - Improving data access and analysis by end users through the development of a new data tool allowing simplified, user-defined queries of the full ISOE database
    - Improving RP data collection and analysis for reactors undergoing decommissioning

Activities in 2010 (cont.)

- Regional ALARA Symposium
  - Jan. 11-14, 2010 in Ft. Lauderdale, FL
    - Hosted/sponsored NATC and EPRI
    - Presentations by utility, industry, and regulatory representatives
      - ALARA Performance Award to Browns Ferry Unit 1, SG Replacement at TMI 1, Source Term Reduction Activities/Highlights
      - NEI's Status of RP2020, INPO's Perspective on Future Direction of RP, EPRI's RP Management Program Update
      - NRC's Potential Revisions to 10 CFR Part 20, Canadian Nuclear Renaissance
  - Jan. 10-13, 2011 in FL
    - Hosted/sponsored by NATC and EPRI
- International ALARA Symposium
  - Cambridge, UK, Nov. 15-19, 2010
  - NATC to host 2012 symposium (TBD)

Conclusion

- ISOE has proved successful in helping radiation protection experts to better manage occupational exposures at nuclear power plants through its important combination of global occupational dose data, dose reduction experience, and information exchange among utilities, authorities
- ISOE facilitates the sharing of experience, and the building of linkages between ISOE members worldwide to develop a global approach to ALARA work management
- For more information on joining ISOE:
  - Visit the ISOE Network website (www.isoe-network.net)
  - Contact the ISOE Secretariat (brian.ahier@oecd.org)

OECD Nuclear Energy Agency
International Atomic Energy Agency

ISOE

INFORMATION SYSTEM ON OCCUPATIONAL EXPOSURE

For more information, please visit:

www.isoe-network.net

www.nea.fr