25 YEARS

From 1992 to 2017 and Beyond…

Credits

- Aleksandr Rakhuba – NEA-OECD
- Halil Burçin Okyar - IAEA
- The International System on Occupational Exposure – an ALARA Success Story Relying on Strong Individual Commitments, Effective International Feedback and Exchanges, and a Robust Database - 20 Years of Progress. NEA-OECD – Paris, France(2013).
- http://www.isoe-network.net/

ISOE Management Board – December, 2016

Origins

- At the end of the eighties, the Nuclear Power Plants from many countries reached in terms of collective exposure [annualy] more than 8 manSv per reactor for the US LWR) and individual exposures, exceeding regularly several tens of mSv a year and even 50 mSv. Improvements were strongly expected and required. Favouring exchanges on problems to be solved and spreading good practices had already appeared as a promising solution and a way to implement the ALARA principle, recommended by ICRP (ICRP Report No:26) and introduced as a new requirement in the regulations of many countries.

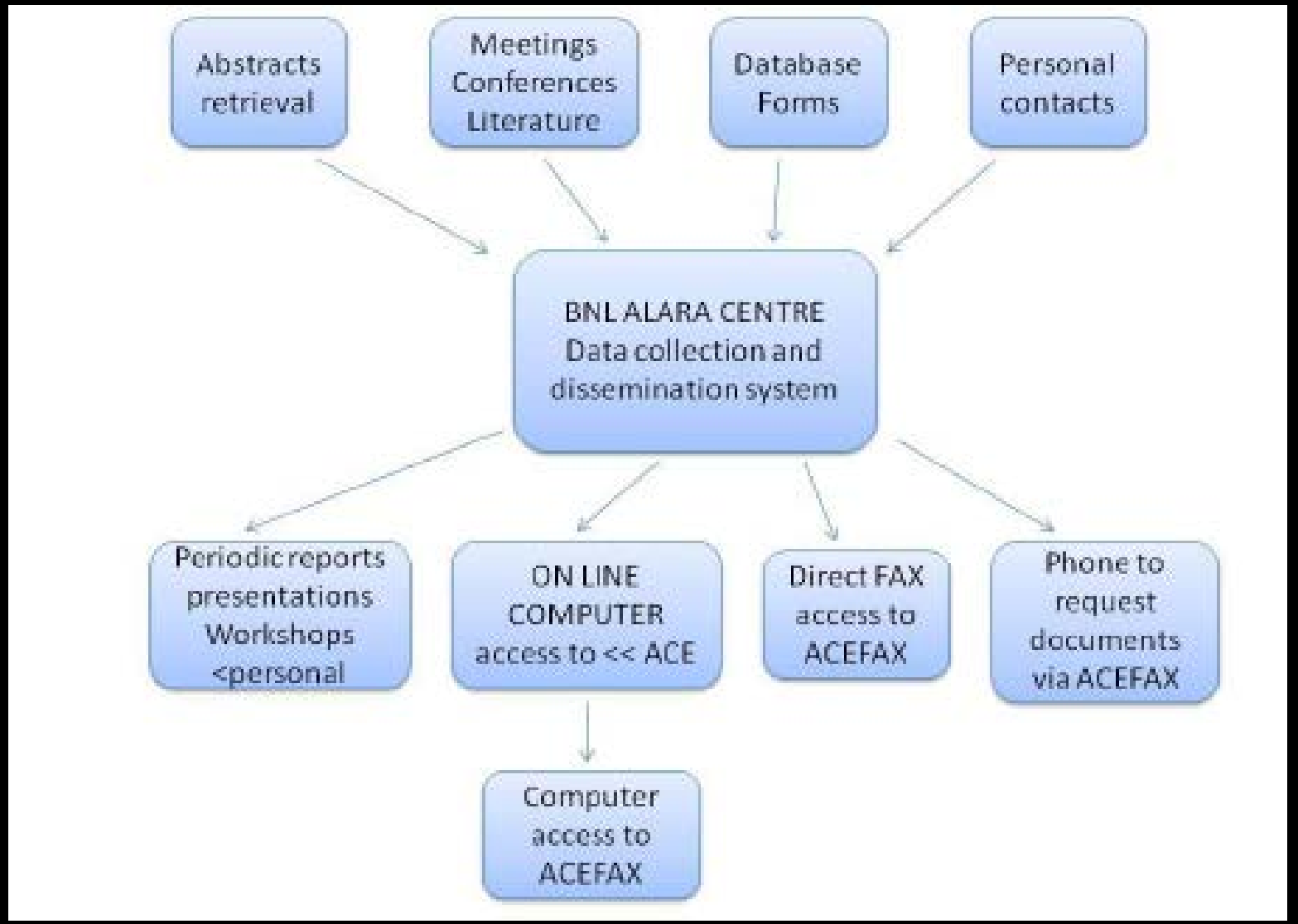
Origins

- The Brookhaven ALARA Centre at the request of the US Nuclear Regulatory Commission “We suggested, and the NRC agreed to set up in 1984 the BNL ALARA Centre” (JB),
- The European Commission “We started to share with the EC RP experts group” (BL),
- and EDF “What will happen to our workers, when the circuits will become polluted, corroded and contaminated?” (JL) had set up international feedback systems relying on different types of databases.
- The first two systems gave rise to feedback and information exchange workshops or annual meetings for the radiological protection specialists from the plants, while the third focused on benchmarking visits with peers of the best plants as pointed out through the database.

The US experience with Brookhaven ALARA Centre in the USA

- LWRs collective dose per reactor was up to 8 manSv per year: *"However, annual collective doses of 10 and more manSv in a year at individual reactor sites have been frequent and doses of the order of 30-40 manSv in a year have not been uncommon." (NEA, 1986)*
- First steam generator replacement at Surry 2 in 1979 cost 21.41 manSv for a three loop reactor.
- John Baum, who organised the BNL ALARA Centre, indicated that: *"The NRC was very concerned because US plants had the largest collective doses per plant of any developed country…*
- *"During the ALARA Centre life we organized three international workshops (1984, 1989 and 1994). They were designed to bring together nuclear reactor radiation protection specialists from as many countries as possible, to exchange information on dose control practices and equipment. We invited the international community as we had so much to learn from them. The three seminars gave rise to NUREG reports."*
- BNL ALARA Centre, under the management of Tasneem Khan, set up several bibliographical databases. The data sheets and all ALARA Centre reports were made accessible (1992) through a direct or computerised fax system. During the decade where it existed, the BNL ALARA Centre produced around one hundred very informative reports on dose reduction techniques and dose management tools. It had started to build a kind of a net for the professionals mainly in North America (with both utility and regulatory authority representatives), but also with the participation of some European radiological protection managers. **We can say that with no doubt the ALARA centre input has largely contributed to the American LWRs dose decrease during the late 80s (from 8 manSv to 3.3 and 2 manSv respectively per LWR in 1990 and 1995).**

Origins



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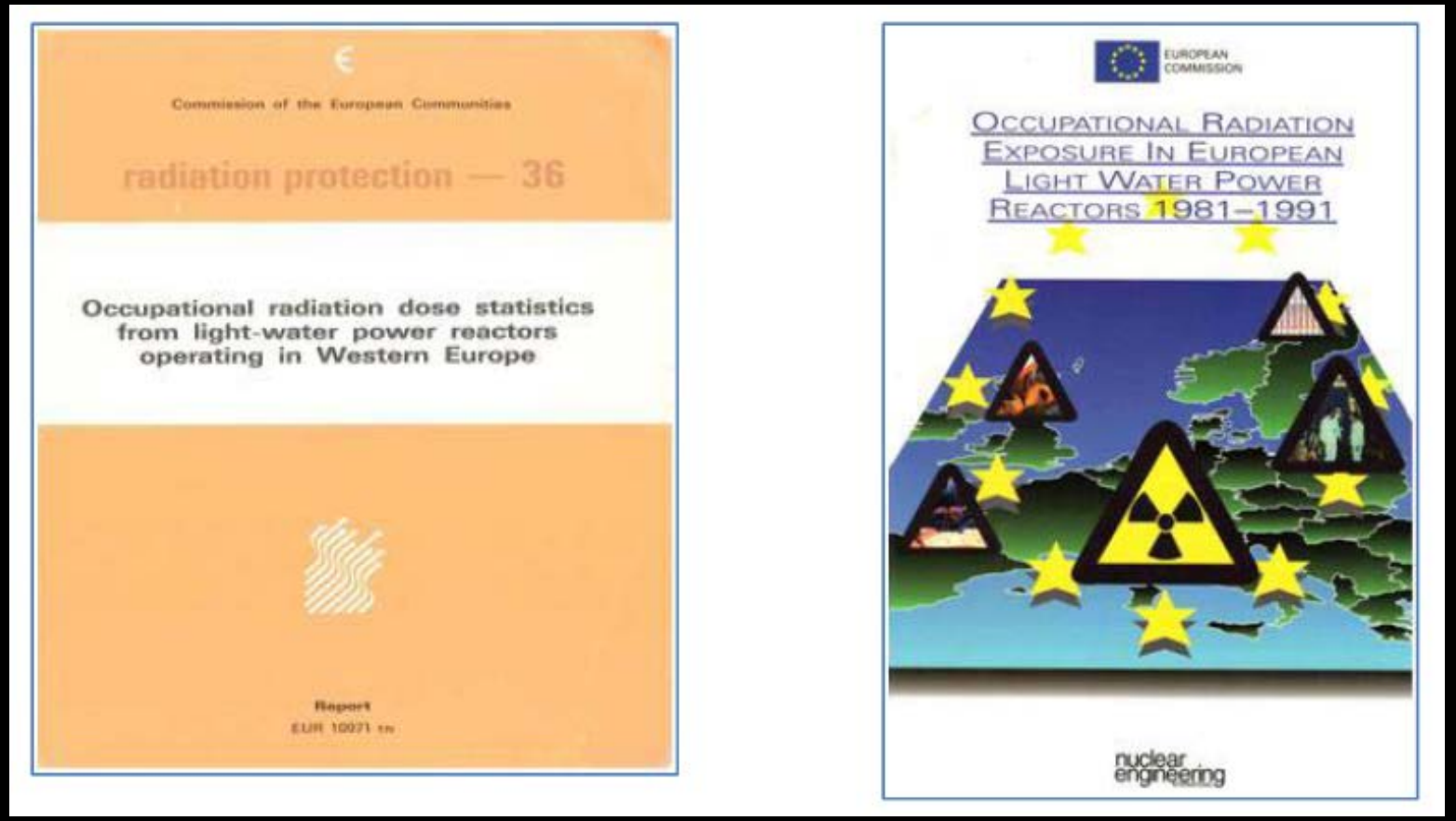
The European Commission Club of Radiological Protection Experts

- At the beginning of the 80s the Radiation Protection Division from the Directorate General for Health from the European Commission was advised by the "Advisory Committee for Health and Safety at Workplace" a tri partite Committee composed of trade unions, employers, and regulatory authority representatives, as well as by an expert group set up under Article 31 of the Euratom treaty.
- *"...in particular in Germany, showing the increase of individual and collective doses outages in the LWR. The partial published information available show same cases for contract workers going from plant to ... also big differences of collective doses between plants ... it should be worthwhile to give to all European NPP radiation protection managers, the opportunity to better implement ALARA in discussing regularly with each other, and in performing benchmarking analyses on exposures per job. For the start of this idea into practice our Division addressed European BWR and PWR plant managers, proposing a platform for information exchanges under the auspices of the CEC without any regulatory authority participating." (Klaus Schnuer).*

The EC club

The European Commission Club of Radiological Protection Experts



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The Electricité De France worldwide PWR database

- EDF management set up a worldwide database (at the end of the 70s, beginning of the 80s) on collective doses for each reactor and organised many benchmarking site visits to plants with good results. The collection of data as well as its analysis and some benchmarking visits were subcontracted to CEPN, the French ALARA specialists' team, who confirms that the main questions to be answered to were:
- ***"What will happen to our workers, when the primary circuits will become polluted, corroded and contaminated? What lessons can we learn from foreign experiences?***
- *CEPN demonstrated in analyzing EDF and world PWRs doses and dose rates in the database that* ***dose rates*** *were absolutely* ***not the only major component explaining the doses.****" (Lochard and Pages, 1984).* From these results CEPN demonstrated that the time spent in radiation fields was also essential, and can be modified through the preparation and planning of the work, training of the workers, modification of the tools, etc… all that is today called **"Work Management"**. It became clear that acting on the exposure time has also to be considered, in particular during the operating and dismantling life of the plants, as a **major component of the ALARA programmes**. That has been all along the ISOE lifespan to date a driving force of the system.

Origins

- NEAs Committee on Radiation Protection and Public Health (CRPPH) decided in 1989 to set up a pilot project, called ISOE, aiming for interplant comparability and promoting international exchanges on optimisation of radiological protection.
- *"How to convince the other international organizations that we were not in competition but complementary and enlarging the existing system?" (CV), "It was in fact quite difficult to convince my colleagues from the plants to participate." (CGL)*

Origins

- A proposal: the system would rely on **an international nonanonymous database.** with annual collective doses for each reactor as well as job collective doses, completed with dose rate indicators and worker exposure times. This would be completed by a second database with precise descriptions of each reactor component and way of operating (chemistry…) and a third database with sheets for each interesting problem in terms of occupational radiological protection. The other characteristics of the proposal were: – the **members** should be mainly the **utilities**, but also the **regulatory authorities** and eventually the **vendors** (such as Framatome, or Westinghouse…); – the **NEA** should act as a **secretariat** and during the pilot phase as chair; – the database should be run by **CEPN** acting as **Technical Centre** for the system.
- In October 1988 the French representatives at CRPPH announced that France was ready to propose one Technical Centre.
- *"At the right beginning we did not have in mind to have more than one Technical Centre (CEPN), but soon, having contacted the NRC (as well as all the regulatory authority participants in the CRPPH), they told us then that they had a system run by BNL ALARA Centre. We entered then in contact with John Baum, and BNL proposed itself as a second Technical Centre for North America." (Christer Viktorson)*
- By the end of 1988, John Baum had joined the brainstorming group, and proposed to set up two more databases dealing with dose reduction techniques according to its experience. Therefore it was mentioned in the June 1989 proposal that *"the project is supported by two Technical Centres, the CEPN in France, and the BNL in the USA",* the first being in charge of the dose database management, the second of dose reduction techniques.

Birth

- **A lot of diplomatic efforts were needed. They allowed the positive resolution of most problems; enthusiasm overcame concerns and reservations; the pilot project was considered successful by the end of 1990; and the official launching of the system was scheduled for 1991.**
- **The first ISOE Steering Committee meeting took place on the 18th of November, 1991 and ISOE was officially launched on the 1st of January, 1992.**

Evolution

A spider net covering now nearly all NPPs in the world, with a regional type of organisation to efficiently cover the world.

- *1990-1992: the launching period*
  - ***Belgium, Finland, France, Germany, Spain, Sweden, Switzerland, and the Netherlands.***
  - French EDF provided the first ISOE chair: Philippe Rollin.
  - British GCRs never agreed to participate.
  - ***Canadian*** utilities were also immediately participating actively (Arif Khan from Ontario Hydro was the first Vice chair).
  - ***Japanese*** utilities also became official members,

Evolution

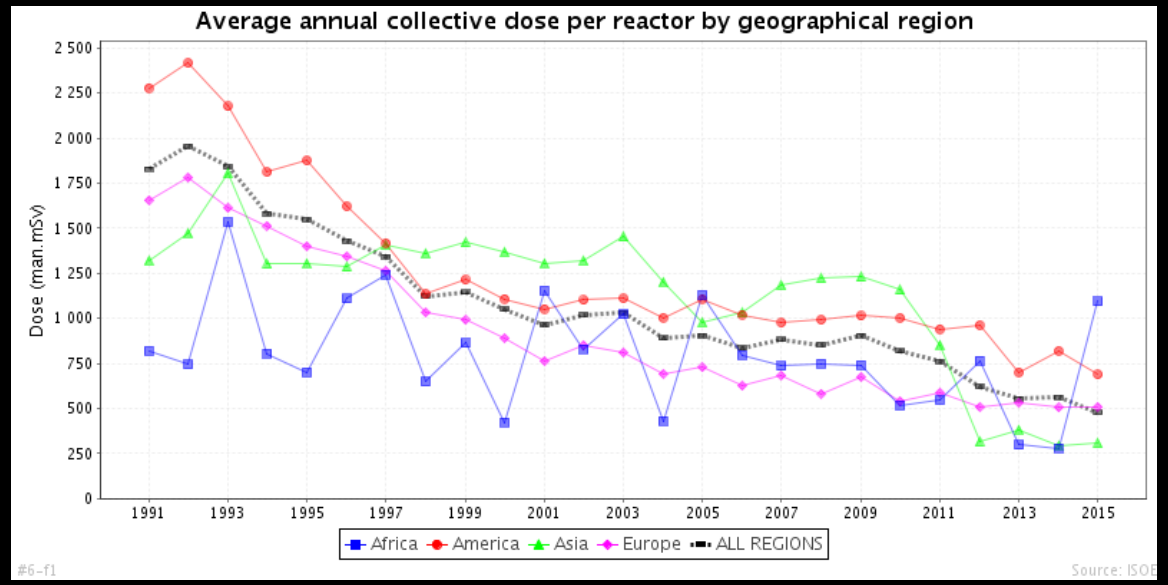
- *1993-1996 a first wave of participants through the IAEA*
  - During that period, following the action of IAEA, and particularly of Monica Gustafsson, all NPPs from the ex-eastern bloc, and potential candidates to join the European Union became participants of the ISOE: this was successively the case of ***Hungarian, Czech, Lithuanian, Slovenian, Slovakian*** and ***Romanian*** nuclear power plants.
  - Other countries belonging to the IAEA region progressively became members of the ISOE. This has been the case for ***Mexico, the Republic of China, Korea, South Africa*** *and* ***Brazil.*** During that period, the NATC action allowed the number of **US** utilities participating to grow from 0 to 25 units in 1996.
- *1996-2003 the second wave through the IAEA from the ex Soviet Union*
  - During that period, the IAEA succeeded in bringing into ISOE the NPPs from the ***Russian Federation*** and some other close countries: ***Armenia, Ukraine, and Bulgaria***. At the end of the period another country belonging to the IAEA region, ***Pakistan,*** also became a member of the ISOE. It has been the last totally new participating country.
  - Some modifications have occurred in the regional Technical centres' responsibilities according to the new membership to the OECD of several countries who first belonged to the IAEA Technical Centre and who were moved to another Technical Centre. That has been the case for Korea in 1993, Mexico in 1994, the Czech Republic and Hungary in 1996, the Slovak Republic in 2002, and Slovenia in 2011.

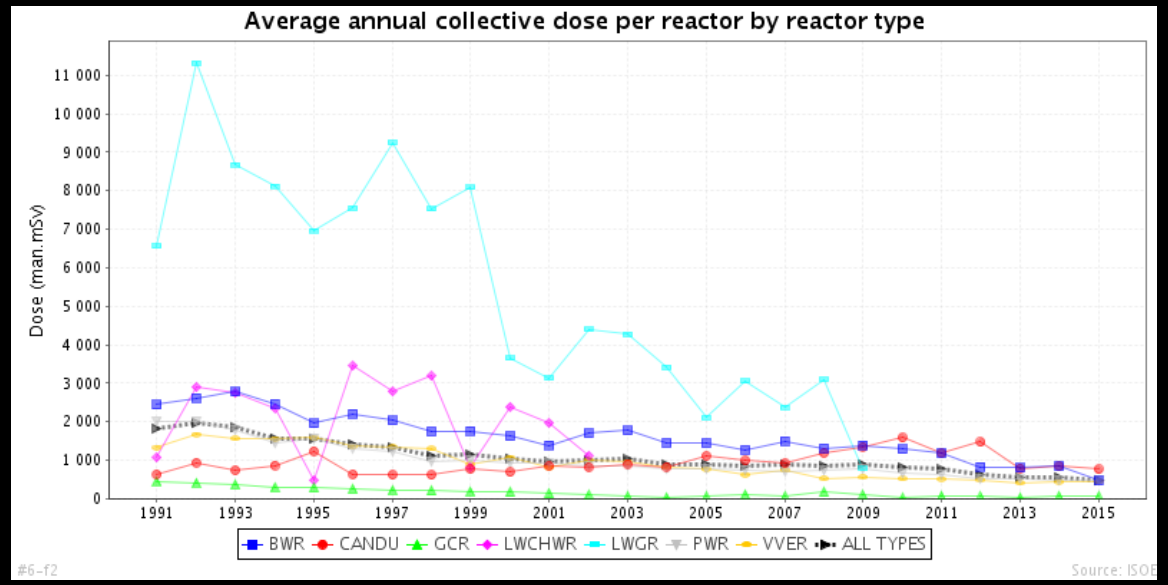
Evolution

- *Since 2004-*
  - That of the US utilities reaching in 2012, 70 reactor units among 104 participating in the system. However contrary to most other participants the US units do not yet enter the data by themselves. It was and is still considered as a task for NATC.
  - Newly commissioned plants beginning commercial operation in the above mentioned countries became participants immediately, while those units that were definitely shutdown became members of a new database dealing with units in decommissioning.

Evolution

- *After Fukushima*
  - *RP Severe Accident Management Guidelines*
  - *WGDECOM*
  - *Newcomers*
  - *TCA´s – increased the capilarity of ISOE*





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Trends

Radiation Protection Experience Reports

- Refueling Outage Reports
- Annual RP/ALARA Reports
- Specific Maintenance Job Reports
- Radiation Monitoring
- Good Practices

Plant Information related documents

- List of Reactors injecting Zinc
- Steam Generator Replacements performed in the world
- Reactor Vessel Head Replacements

Radiation Protection Management

- Guidance Reports
- RP Procedures
- Dose Reduction Programs
- RP Information Booklet
- ALARA Procedures / Organisations
- ALARA Tools

ISOE Working Group Reports

- Occupational Radiation Protection in Severe Accident Management (EG-SAM) Report (2014) ***new!***
- Radiation Protection Aspects of Primary Water Chemistry and Source-Term Management Report (2014) ***new!***
- L'organisation du travail pour optimiser la radioprotection professionnelle dans les centrales nucléaires *(translation in French of the 2009 Work Management book)*
- Work Management to Optimise Occupational Radiological Protection at Nuclear Power Plants (2009)
- Work Management in the Nuclear Power Industry (1997) *Publication on sale by the OECD*
- Optimisation in Operational Radiological Protection (2005)

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Publications

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Benchmarking

Benchmarking Visit Reports

General:

Radiation Protection Policy in the United States towards 2020 - Visit in 2007

Corporate:

Radiation Protection Management at Exelon - Visit in 2011

Nuclear Power Plants:

Country	Plant Name
Belgium	Doel
Hungary	Paks
Spain	Almaraz Asco & Vandellos Trillo
Sweden	Ringhals
Switzerland	Beznau
UK	Sizewell B
USA	Braidwood Calvert Cliffs Catawba & McGuire Cook Fermi Palo Verde & Comanche Peak Saint-Lucie Vogtle Limerick, Susquehanna, Dresden, Cook

Decomissioning

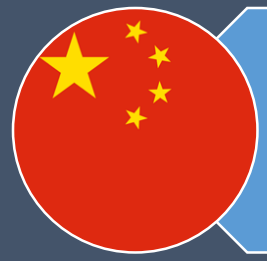
- Working Group on Radiological Protection Aspects of Decommissioning Activities at NPPs (WGDECOM)
- Meetings
- Benchmarking
- Decommissioning Documents
- Decommissioning Database
  The data regarding decommissioning plants are provided in the ISOE database (no separate database)
- WGDECOM Forum
  A group of discussion has been created. It is restricted to WGDECOM members only.

Participation

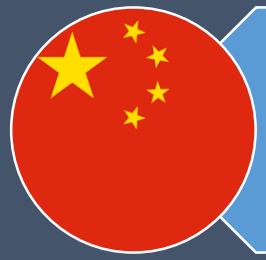
- Countries: **31**
- Participants: **102** (97)
- Utilities: **74** *(71)*
- Authorities: **28** *(26)*

- **Database**
  - **531** *(482)* units: **403** *(401)* operating and **128** *(81)* in cold-shutdown or some stage of decommissioning) in **29** countries

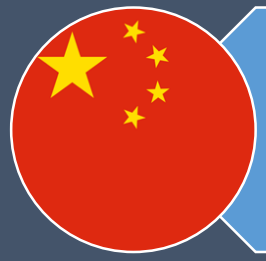
New Utility Members



CNNP Sanmen Nuclear Power Co. (2 units)



Fujian Ningde Nuclear Power Co. (4 units)



Fujian Fuqing Nuclear Power Co. (6 units)

New Authority Members

National Nuclear Regulator (NNR)

Brazilian Nuclear Energy Commission (CNEN)

Membership by Authorities only

Belarus

Germany (withdrawn)

United Arab Emirates

Membership by Utilities only

Hungary

Italy (withdrawn)

Mexico

Pakistan

Russian Federation

Potential new participants

Country	Utility / Authority	Note
China	**Utility:** Missing reactors	IAEA is keeping in touch with their Chinese counterparts to invite them to join ISOE.
Russia	**Utility:** RBMKs and Fast Breeders	Contacts with Concern Rosenergoatom continue.
	Authority: Federal Medical Biological Agency (FMBA)	**March:** NEA sent a letter to FMBA inviting them to participate in ISOE. FMBC (TSO) was also contacted in **October**.

Potential new participants

Country	Utility / Authority
Argentina	Authority
Iran	Utility and Authority
India	Utility and Authority
Turkey	Authority
Embarking countries like Egypt, Ghana, Morocco and Nigeria may be considered by the ISOE Programme as potential participants for the future	

FUKUSHIMA

FUKUSHIMA

More to Come...

- Human Performance & Training
- Documents Update
- Newcomers
- Decommissioning
- International Benchmarking
- Indicators Board
- Workshops and Symposiums
- ISOE International Task Force, why not...?

Testimonies

The ISOE Network … gives the best opportunity to regulators to upgrade knowledge related to radiation protection issues during an operation as well as decommissioning of NPPs. The ISOE databases …enable the regulators and operators to gain a broader view, recognise lessons learned in a due time and foresee possible future issues. The ISOE workshops, seminars and meetings have always been very live events enlightening also the so-called “hot topics”, for example the Davis-Besse reactor vessel head degradation, experiences with source term reduction and related application of Zn injection in PWRs, plant self-assessment programmes, control of contractors, detection and removal of hot particles, lessons from the management of the Fukushima accident etc., just to mention some of them. I strongly believe that in view of the Fukushima accident the role of the ISOE Network is even going to be enhanced.

Dr. Helena Janzekovic
Slovenian Nuclear Safety Administration (SNSA)
Slovenia

NEA Secretariat

Osvaldo Ilari	-	1976-1997
Christer Viktorson	-	1989-1993
Edward Lazo	-	1993-1998
Stefan Mundigl	-	1998-2004
Brian Ahier	-	2005-2010
Halil Burçin Okyar	-	2010-2015
Aleksandr Rakhuba	-	2015-2017

IAEA Secretariat and Technical Centre

Monica Gustafsson	-	1994-2004
Seong Na	-	1998-2002
Pascal Deboodt	-	2005-2009
John Hunt	-	2009-2010
Jizeng Ma	-	2010-on going

ISOE Bureau Chairs

Philippe Rollin - France	1992-1994
David Miller - USA	1994-1998
Pio Carmena - Spain	1998-2000
Borut Breznik - Slovenie	2000-2002
Carl Göran Lindvall - Sweden	2002-2004
Jean Yves Gagnon - Canada	2004-2006
Wataru Mizumachi - Japan	2006-2008
Vasile Simionov - Romania	2008-2010
Gonzague Abela - France	2010-2012
Willie Harris - USA	2012-2014
Tae-Won Hwang - Korea	2014-2016
Marcos Antonio Do Amaral – Brazil	2016-2018

ALARA Symposium

1997	• Orlando (USA)		
1998	• Malmö, Sweden • Fort Lauderdale, USA	• Orlando, USA	• Tarragona, Spain
2001	• Anaheim, USA		
2002	• Portoroz, Slovenia	• Orlando, USA	• Lyon, France

International
- Fort Lauderdale, USA

Regional
- Fort Lauderdale, USA

International
- Essen, Germany

Regional
- Yuzawa, Japan

International
- Fort Lauderdale, USA

Regional
- Seoul, Republic of Korea

International
- Tsuruga, Japan

Regional
- Turku, Finland

International
- Vienna, Austria

Regional
- Aomori, Japan
- Fort Lauderdale, USA

International
- Cambridge, United Kingdom

Regional
- Gyeongju, Republic of Korea
- Fort Lauderdale, USA

Regional
- Fort Lauderdale, USA

International
- Fort Lauderdale, USA

Regional
- Prague, Czech Republic
- Tokyo, Japan

International
- Tokyo, Japan

Regional
- Fort Lauderdale, USA

Regional
- Fort Lauderdale, USA
- Bern, Switzerland
- Gyeongju, Republic of Korea

International
- Rio de Janeiro, Brazil

Regional
- Fort Lauderdale, USA
- Tokyo, Japan

International
- Brussels, Belgium

Regional
- Fort Lauderdale, USA
- Fukushima, Japan

Participating utilities and regulatory authorities

NEA Committee on Radiation Protection and Public Health

ISOE Management Board

ISOE Bureau

National co-ordinators

Joint NEA/IAEA Secretariat

Working Group on Data Analysis

Working Group on Radiological Protection Aspects of Decommissioning Activities in NPPs

Specialised working groups

Technical centres

Credit: Aleksandr Rakhuba - NEA


YES, WE ALL ARE RP!
OUI, Nous sommes Tous RP
Sim, somos Todos RP!
Ja, wir alle sind Strahlenschützer
Ano, my všichni jsme RP!
Sí, todos somos RP.
Wij zijn allemaal RP
是的，我们都是辐射防护
Sì, siamo tutti RP.
예, 우리 모두는 방사선 방호입니다.
KYLLÄ, ME OLEMME KAIKKI RP
JA, TOTI SUNTEM RP!
بله، همه ما RP هستیم
はい、私たちはすべて放射線防護です。
IGEN, MI MINDANNYIAN RP-K VAGYUNK
JA, VI ÄR ALLA RP!
ДА, МЫ ВСЕ РТГ
WE ARE ALL RP
Pickering Nuclear Generating Station
Radiation Protection Department