Use of IRS and OSMIR Database – Lessons Learned

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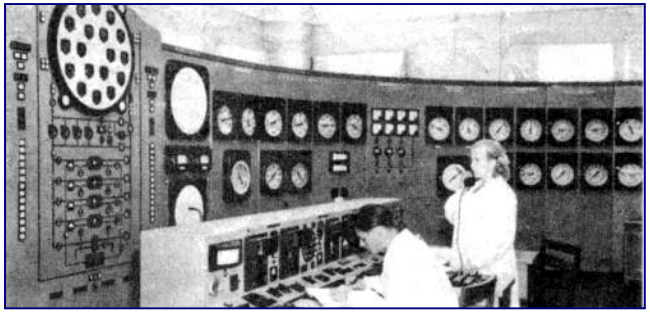
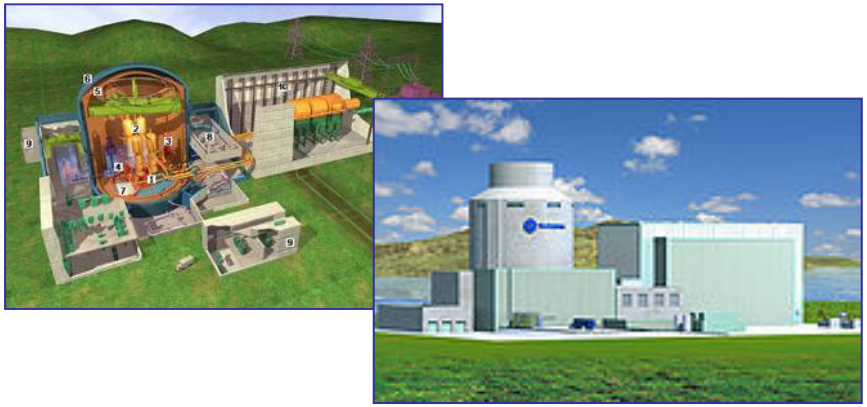
Introduction

- The design of reactors either Generation III e.g. operational ABWRs or Generation IV takes into account experiences gained by operators.
- Altogether around 7000 years of reactor operational experiences are available today.
- A first NPP reactor, Obninsk NPP, started with the operation in 1954.





time

Legal requirements

- The requirements to collect and analyse operating experiences are a part of national legislation of countries with nuclear installations.
- Convention on Nuclear Safety (Article 19) explicitly tackles programmes to collect and analyse operating experiences. The cooperation between different parties involved in safe operation of a nuclear installation is required.

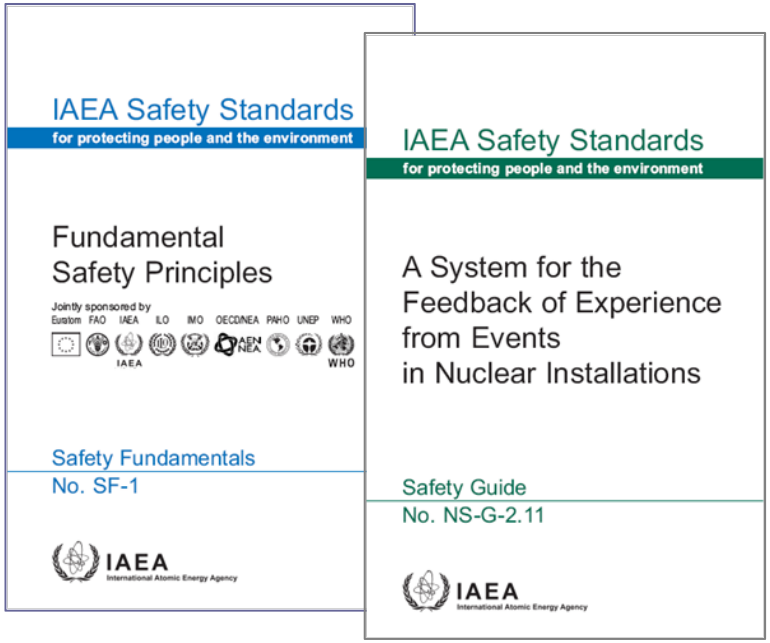
  - operators
  - manufactures
  - research organisations → safe operation
  - designers
  - service providers (TSO)…

Safety Principles

- IAEA Fundamental Safety Principles No. SF-1 (2006), 3.16

…A safety assessment for facilities and activities should take into account the feedback of operating experience…

The assessments demonstrate to the satisfaction of the regulatory body that the safety measures remain adequate.



Introduction

- Strong commitments require suitable tools in order to enable
  - analyses of operating experiences
  - distribution of lessons to be learned.

- Among others such tools are

databases of events

related to nuclear facilities or nuclear activities.

Databases (2009)

- Incident Reporting System - IRS
- Operational Safety Review Team Mission Results (OSMIR)

Other databases:

- International Nuclear and Radiological Event Scale (INES - NEWS)
- European Nuclear Assistance Consortium (ENAC)
- ISOE
- WANO…

The European Commission will establish *European Clearing House for NPP Operational Safety Feedback*– CEOF (March 2010).

IRS - Incident Reporting System

- The database was the initiative of the OECD/NEA (1978).
- The information reported is assessed and analysed by the reporting country.
- The ultimate objective is reducing the frequency as well as severity of safety significant unusual events at NPPs.
- The database is operated by the IAEA.

IRS
Incident Reporting System

IAEA

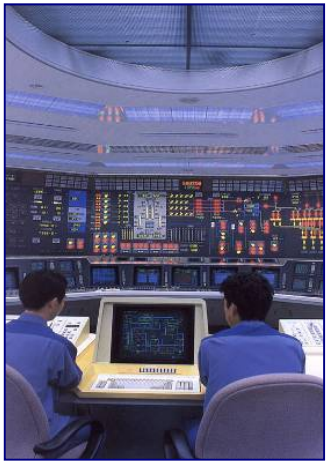
AEN
NEA

IRS database - Incident Reporting System

- The IRS is designed to be used by technical experts and the access to the database is restricted.

  https://irs.iaea.org/

- Today more than 3500 reports exist within the system.
- Structure of the database contains nine "categories" regarding specification of an event e.g.
  - reporting categories
  - plant status prior an event
  - failed/affected systems
  - failed/affected/components
  - cause of events.



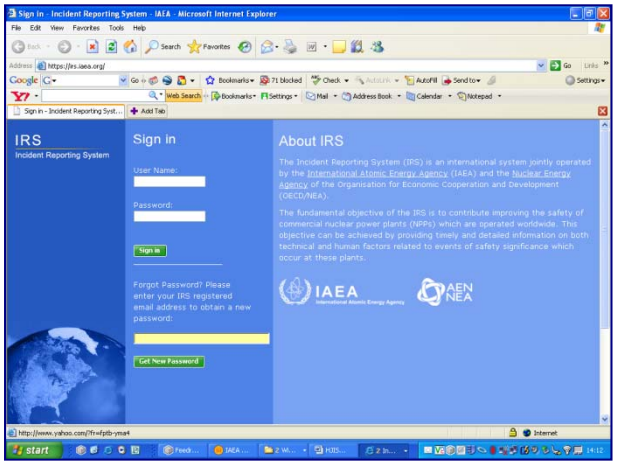
Each "category" is refined with a list of "subcategories" e.g. unplanned or significant radiation exposure.

IRS database - Incident Reporting System

- The IRS contains also:
  - analyses of information reported in a specific period of time
  - topical studies based on the reported events.

  Analysis of Events Related to Interaction between the Grid and the Nuclear Power Plants (2008)

  Maintenance Events involving Quality Assurance, Human Factors and Procedural Issues (2007)



OSMIR - Operational Safety Review Team Mission Results

- Operational Safety Review Team (OSART) was created in 1982 as a mission programme of the IAEA.
- Information are given and analysed by the IAEA experts.
- The objective of the OSART programme is enhancing the operational safety of NPPs.
- The OSMIR database is operated by the IAEA.

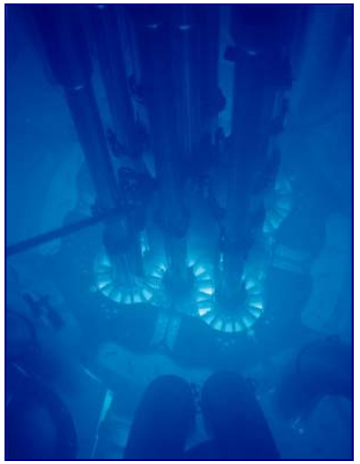
IAEA.org International Atomic Energy Agency

OSMIR database - Operational Safety Review Team Mission Results

- The OSMIR is designed to be used by technical experts and the access to the database is available through the IAEA.
- The database is provided on a CD using MS Access.
- Till 2009 around 140 OSART missions and follow up missions took place.

- Structure of the OSMIR database:

  - recommendations
  - suggestions
  - good practices.



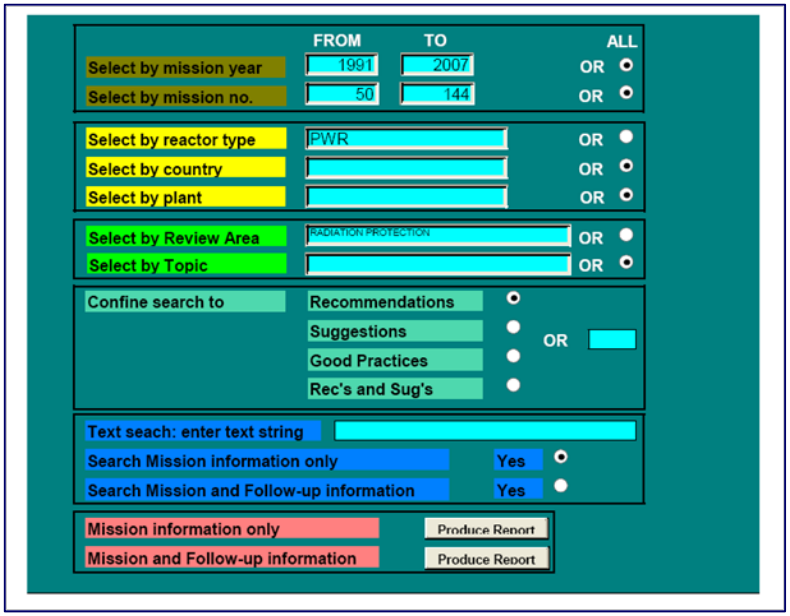
The expert team assesses ten "review areas" e.g. *maintenance*, *radiation protection*, *training*.

OSMIR database - Operational Safety Review Team Mission Results

Each "review area" is structured using "specific topics" in order to tackle a specific issue related to the "review area".

An example: "review area" *training* has 12 "topics", e.g.:

- *radiation protection personnel*
- *training programmes for control room operators and shift supervisors*.

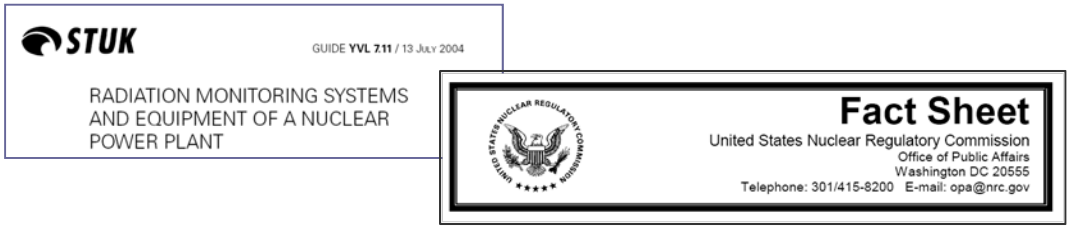


Events related to radiation monitoring systems

- Radiation monitoring systems in NPPs enable a control of dose rates and releases on or off site.
- One of the most challenging issues concerning the siting of a new NPP is control of effluents in all life phases of an NPP.

Events related to radiation monitoring systems

- Required characteristics of radiation monitoring systems are described in licensing or other documentation (TS…).
- As a rule Web sites of national regulators contain such information.



- Control of effluents is very often related to:
  - occupational exposure
  - control of other radioactive material including radioactive waste
  - transfer of radioactive material waste from site to a storage….

IRS database and radiation monitoring systems in PWR NPPs

- 1700 reports related to PWR NPPs
- 300 events occurred in the period 1999 - 2009 (01.01.2009)
- 160 events in the period 2004 - 2009

↓

- Eight events are related to the "category"

  1.1 Unanticipated release of radioactive material or exposure

  7 events - unanticipated release of radioactive material

  1 event - unanticipated exposure to radiation for site personnel

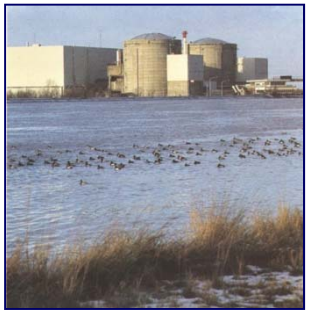
  0 event - exposure to radiation that exceeds the prescribed dose limits for a member of the public
- A list of lessons learned is prepared by the reporting country.

Unanticipated release of radioactive material (2004 - 2009)

- Two events are related to degradation mode of U-bend tubes of SGs and primary/secondary system leak (Cruas 4 NPP (2006), Fessenheim 1 NPP (2008), both France).

Lesson learned:

Operators in France studied the North Anna NPP incident which had occurred in 1987 and installed appropriate N-16 monitors.



http://www.icjt.org/plants/index.html

Unanticipated release of radioactive material (2004 - 2009)

- Two reported events are related to leakages in NPPs in Japan (Mihama 1 NPP (2005), Takahama 3 NPP (2006)).

  Lesson learned:

  Technical specifications of an NPP should be carefully controlled, degradation of elements in an NPP should be followed, e.g. seal rings, as well as programmes used, e.g. feedwater flow control.

TAKAHAMA-3 from http://www.icjt.org/plants/index.html

Unanticipated release of radioactive material (2004 - 2009)

- One event is related to unauthorised discharge of tritium into the environment, namely in 2007 at Temelin 1 NPP, Czech Republic.

  Lesson learned:

  Responsibilities and procedures of an NPP should be well established as well as implemented.

http://www.cez.cz/en/cez-group/media/downloads/photo-gallery/power-plants/11.html

Unanticipated release of radioactive material (2004 - 2009)

- One event is related to cleaning procedure of the SG 1 performed by a subcontractor. Unpredicted discharge of the radioactive fluid occurred at the Borssele NPP, the Netherlands, in 2004.

Lesson learned:

Procedures of a subcontractor activities as well as design of equipment and NPP systems used during such activities should be controlled.

http://www.icjt.org/plants/index.html, http://en.wikipedia.org/wiki/Borssele_nuclear_power_plant

Unanticipated release of radioactive material (2004 - 2009)

- One event is related to fuel handling when radioactive particles (^{60}Co…) were discharged through ventilation system of the Asco 1 NPP, Spain in 2008. The event is categorised INES 2.

  Lesson learned:

  A design of radiation monitoring system should be controlled.

http://en.wikipedia.org/wiki/Asc%C3%B3_Nuclear_Power_Plant

Unanticipated exposure to radiation for site personnel – 1 event (2004 - 2009)

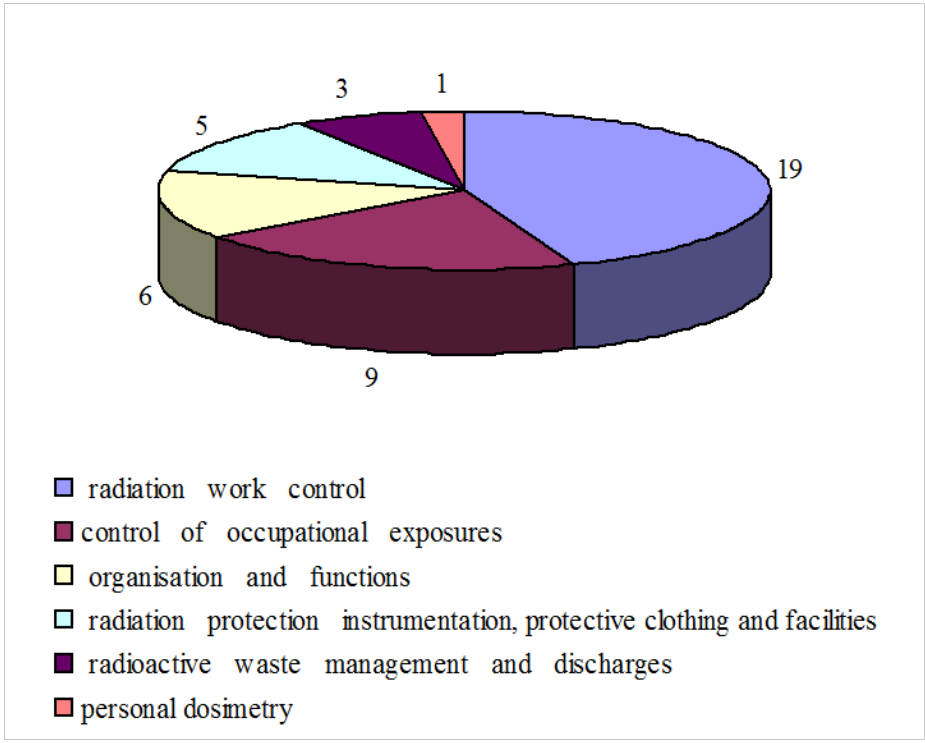
- A single reported event related to exposure of personnel occurred in Fessenheim 1 NPP, France, in 2004. Due to human error release from the demineralizer into the primary circuit caused substantial contamination leading to a hot shutdown state of the NPP. Later the NPP was shut down for more than 5 months. The exposure was 0.5 mSv.

Lesson learned:

A control of internal contamination including its prevention is still a very challenging issue during operation of an NPP.

Lessons learned - case studies (OSMIR)

- In a period 1997 - 2007 altogether 43 recommendations were issued to the PWR NPPs in the area of radiation protection.
- The recommendations were issued to altogether 20 NPPs.



Lessons learned - case studies (OSMIR)

Lessons learned from the OSMIR database:

1. Experts identified more than 60% of all shortcomings in everyday radiation work and control of occupational exposure.
2. Regarding a fact that in a topic "radiation protection instrumentation" only five recommendations were issued it can be concluded that radiation monitoring instrumentation is as a rule properly routinely calibrated, maintained and controlled. Nevertheless a design of appropriate monitoring system should be under a strict review.

Conclusions

- The events reported in the IRS database show that lessons learned given in the database were very successfully applied in some cases by operators.
- In general, if the lessons learned are related to technical solutions, as for example the installation of radiation monitors, operators can quite soon find the benefit of such lessons learned database. In cases where lessons learned feedback is related to organisational and administrative issues the benefits are usually not visible so soon.
- As given in *Improving Nuclear Regulation* (OECD, 2009) a regulatory body must have its own operating experience programme and a capability for assessing "the full scope of operating experience issues", e.g. new research results, broad industry trend information.

Conclusions

- The international operating experiences database related to events in NPPs, the IRS, as well as the OSMIR database can be successfully used as complementary databases to the ISODAT *global occupational exposure database* prepared by the participants of the ISOE programme.
- In the light of renaissance of nuclear technology and taking into account a change of generation at present NPPs as well as long life of future NPPs, i.e. around 60 years, the importance of maintaining a high quality of databases containing operating experiences is even more evident.