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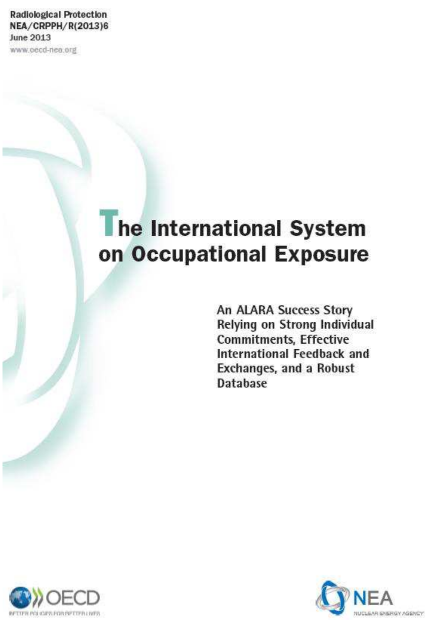
ISOE History report has just published

Why, more than 20 years ago, did there emerge the need for an International System on Occupational Exposure (ISOE)? How was it created? What were the problems and their possible solutions? Who were the main stakeholders?

These are a few of the questions that the ISOE NEA Secretariat and Bureau asked of Christian Lefaure, ex CEPN Deputy Director, to address in preparing a report on the history of ISOE and its progress. He had been directly involved in the brainstorming that preceded ISOE establishment, and he became the first head of the ISOE European Technical Centre, in charge of the world database development and management from 1991 to 2007.



For writing this report, he made use of his own souvenirs and documentation as well as of those of tens of ISOE participants, both from major international and regional organizations (OECD/NEA, IAEA, EC and BNL), nuclear power plant utilities and national regulatory authorities. He voluntarily focused not only on the technical aspects but also on the human components of that story.

This was done through personal interviews with many individuals who have played an important role at one moment of ISOE life, the analysis of answers to a questionnaire, and reviews of the minutes of many ISOE meetings that were held before and after the official establishment of the ISOE, along its lifespan to date.

It is thought that this memory work and all the outputs from ISOE will be useful in the future and that this collective protection patrimony will provide tools for continuously improving working conditions in the operation of nuclear power plants.

The report is available for downloads at http://www.isoe-network.net/index.php/publications-mainmenu-88/other-reports.html

ISOE Expert Groups

Currently, the ISOE has two active expert groups, the Expert Group on Primary Water Chemistry and Source-Term Management (EGWC) and Expert Group on Occupational Radiation Protection in Severe Accident Management and Post-Accident Recovery (EG-SAM). The EGWC is still working on the report, which includes detailed chapters on introduction of strategies and techniques, radiation field measurement techniques, measurement locations and indices, remediation of contamination during outages and radiation protection outcomes. The mandate of the expert group was extended for a year to complete some missing chapters/sub-chapters dealing with BWR and PHWR reactors during the 2012 ISOE Management Board meeting. The EGWC will meet in July and September 2013 to finalize the report.

The EG-SAM was met for the last time in April 2013. The group agreed on a work plan to finalize the interim report and prepared a proposal to organize the international workshop on 17-18 June 2014 in Washington DC, which will be co-organized with the NEI. The proposal was agreed by the WGDA in April 2013 and will be submitted to the ISOE Management Board approval during its November 2013 meeting. An informal EG-SAM meeting will be organized on 30th of August in connection with the ISOE International Symposium.

A new Case Study by the EGOE

The Expert Group on Occupational Exposure (EGOE) was formed by CRPPH at its March 2006 meeting to broadly scope out issues in occupational radiation protection that could have policy and regulatory implications, with instruction to report back to CRPPH on proposed follow-up activities. Recognising the important operational experience residing within the ISOE programme, and the potential benefits to CRPPH and ISOE of collaborative discussions, the CRPPH further instructed the Secretariat to co-ordinate with ISOE on possible involvement in EGOE activities. Requests for nominations to the EGOE were sent to the CRPPH members following the 64th meeting. At its 2006 annual meeting, the ISOE Management Board accepted the invitation to participate in the EGOE scoping exercise, offering participation through members from the utility and regulatory membership, and its further participation was approved at the CRPPH annual meeting in May 2007. After the investigations, discussions and initial scoping work by the CRPPH, the Group was tasked with work on three topical subjects in separate Case studies:

Case study 1: Occupational radiation protection principles and criteria for designing new nuclear power plants;

Case study 2: Dose constraints in occupational radiation protection;

Case study 3: Information and regulatory issues for the management of international outside workers, and integration of risk management at nuclear power plants.

Case studies 1 and 2 were completed and respectively published as an NEA publication (NEA No. 6975) in 2010, and as an NEA Report (NEA/CRPPH/R(2011)1) in 2011. Case study 3 focuses on two topics; managing compliance with dose limits applicable to and the dosimetry records of outside workers, and enhancing the integrated management of risks related to a facility's operation. The report was completed through intensive work of all Group members nominated by the CRPPH, and was accomplished during EGOE meetings through 2011-2012. In completing its report, the EGOE has ensured appropriate coordination, on the topic of outside workers, with the IAEA and with the HERCA to ensure complementarily with on-going work of these organisations. With the approval of the report by the CRPPH in May 2013, the EGOE has completed its mandate and disbanded. The report will be published as an electronic report and will be available for downloads at the NEA official website in July 2013.

The third EGOE case study report covers besides outside workers regulatory issues also integration of risk management at nuclear power plants. Risk management is one of the core businesses in nuclear industry and therefore the main text of this report is presented here below.

Integration of Risk Management at Nuclear Power Plants

Work management is a comprehensive methodology which stresses the importance of managing jobs completely from planning to follow-up using a multi-disciplinary team approach which involves all relevant stakeholders. If properly applied, work management will lead to a reduction of occupational exposures in an ALARA approach. Use of a coherent and comprehensive work management approach, in addition to contributing to good radiation protection, also facilitates safe and economic plant operation. Thus, the goals of reducing cost as well as classical safety risks and of minimizing the time required for an outage can often be simultaneously fulfilled. By engaging the worker in the phases of planning of the task being performed, the worker is more likely to be motivated to perform the job to the best of his/her abilities, and this will be reflected in lower dose jobs as well as in higher job quality.

A set of documents were already published which address a work management approach in detail and also safe plant design related to plant radiation protection practices (available in ISOE or NEA data base).

Describing Commonalities for Purposes of Risk Reduction

The establishment of a robust safety culture at a facility (and within the relevant regulatory authority) is a critical component of risk reduction for a facility. Various documents address the overall concept of establishing a safety culture in facility design and operation, and these documents is not discussed in this report. The objective here is to mention that absent a robust safety culture, risk reduction is much more difficult to accomplish.

Presuming the existence of a robust safety culture, workers are encouraged and empowered “to contribute to optimisation of protection, broadly through work planning and management”. Experience and involvement of workers is a basis using which work efficiencies are obtained, “many more aspects of worker health and safety than simply radiation protection” may be considered. Examples may be lower doses, fewer industrial safety incidents, improved equipment reliability and maintainability, and more efficient use of resources.

The objectives of work management may be achieved by several approaches. The focus is to consider relevant aspects of work selection, work planning, work scheduling, work preparation, work implementation, and work assessment (with feedback to ensure continuous process improvement).

At well-managed facilities, the topics relevant to risk elimination or reduction are discussed by the workers and their supervision, and plans are developed to timely take the reasonably appropriate steps for risk elimination or risk reduction. Examples of common elements to reduce risk across multiple factors include the following:

- Effectively designed work platforms, lighting, power supplies, and work area lay-outs
- Effectively designed ventilation and filtration systems
- Effective fluids and water chemistry control
- Use of materials which are able to be easily decontaminated
- Effectively designed access and egress to plant areas and equipment
- Use of equipment which is reliable and easily maintained
- Effectively designed shielding and remote operators for equipment in higher risk areas
- Effective procedures for fuel integrity protection
- Effective use of risk assessment and risk mitigation planning
- Effective use of human error reduction techniques
- Involvement of all relevant disciplines in job planning, scheduling, and preparation
- Effective selection of tools appropriate for job implementation
- Effective selection of crew size and crew composition
- Effective selection of protective clothing appropriate to the relevant risk agents for the job
- Effective foreign materials exclusion programme
- Effective training and qualification of craft workers to support high quality job implementation
- Effective use of management review committees, especially those evaluating risk assessment and risk mitigation planning
- Effective use of pre-job briefings for affected workers and work groups
- Effective use of in-job communications techniques among all relevant work groups
- Effective use of post-job assessment, corrective (and enhancement) action development, and feedback to job planning.

Traditionally, radiation protection was based on appropriate consideration of time, distance, and shielding. During last years also reduction of the magnitude of the radiation fields via source term reduction techniques has been introduced. The key points here are:

- The work management process may be used effectively in integrated risk management. Multi-disciplinary involvement in work selection, work planning, work scheduling, and work execution (e.g., pre-job briefings and communications during work performance) helps ensure identification and consideration of all relevant risk contributors.

- Use of a process to ensure work is performed as safely as reasonably achievable (ASARA) may be modelled on the ALARA process used regarding radiological risks. The ALARA process is a multi-disciplinary, structured, self-critical approach that is also iterative and on-going as appropriate to the work.

Recognizing Trade-offs and Balances

Realistically, most documents that have described establishment and maintenance of an effective safety culture at NPPs were written with a focus on nuclear reactor safety. A primary consideration was the prevention of nuclear accidents or other events which could potentially jeopardize the integrity of the fuel, the reactor pressure boundary, or the reactor containment. In managing emergent operational situations, the licensee (facility operator) assesses the risks to nuclear safety and acts appropriately to mitigate those risks; the regulator may independently assess risks and act to ensure potential safety-jeopardizing risks are indeed mitigated. A common action for an operator is to plan for corrective maintenance on equipment important to nuclear safety that is assessed to need such maintenance for ensuring reliability of that equipment. (Other actions may, for example, be placing additional equipment into service, replacing equipment that is deemed to be non-repairable, or deferring elective maintenance on non-critical equipment to support operations of equipment directly tied to assurance of plant safety.) The facility operator uses a process that results in informed nuclear-safety-conscious judgments that result in actions by workers to maintain equipment (or place equipment in service, and so on); that is, a judgment is reached that a certain set of actions is justified to maintain nuclear safety risks at a level which is acceptable to the facility operator and which meets the mandates of the regulator. The workers are impacted by the decision-making, in that their action in the plant environment is now needed, on a potentially expedited basis, to ensure equipment important to safety is working as desired.

For those more frequently encountered periods when emergent conditions are not an issue to be addressed, facility operators use plant and industry experience to determine when to perform routine or preventive maintenance and/or perform routine inspections on equipment important to nuclear safety to ensure system reliability. Regulators may also specify performance-based maintenance or plant-condition-based inspection on equipment important to nuclear safety. Operators then have some level of flexibility to schedule such maintenance or inspections at times when more optimal industrial or radiological safety conditions may be available (and potentially, at reduced frequency). In those cases where regulators may write more prescriptive regulations that result in inspection and maintenance at strictly controlled frequencies, that flexibility may be lost, such that worker actions may be required at times when less optimal industrial or radiological safety conditions may exist. In recent years, more regulatory agencies are using the opportunity to write performance-based rules rather than prescriptive rules, meeting the regulatory mandate to protect public and workers while also supporting the principles of effective work management.

Establishing and maintaining a robust nuclear safety culture, and by reasonable extension, a robust (nuclear, industrial, radiological, and environmental) safety culture, usually is said to depend on a series of principles such as the following, as stated in an INPO document (Principles for a Strong Nuclear Safety Culture, Behaviours and Actions That Support a Strong Nuclear Safety Culture):

1. Everyone is personally responsible for nuclear safety.
2. Leaders demonstrate commitment to safety.
3. Trust permeates the organization.
4. Decision-making reflects safety first.
5. Nuclear technology is recognized as special and unique.
6. A questioning attitude is cultivated.
7. Organisational learning is embraced.
8. Nuclear safety undergoes constant examination.

Multi-disciplinary input is sought to help ensure that the work management process is used effectively and all risk contributors are considered. Integration of input from organizations such as operations, maintenance, system engineering, radiological protection and in-service inspection, for example, is desired in planning work which considers relevant plant and industry historical information and also the applicable regulatory requirements. The principles stated above are used by each stakeholder in the process, with “craft”-specific information and perspectives brought forth by each stakeholder. That is, varying points of view are solicited to improve the end product of the work management process.

Trust among team members and maintenance of an open mind regarding insights offered by other team members may be of most help when work evolutions involving multiple risk contributors are planned. Multidisciplinary input is essential to identifying all relevant risk contributors, assessing the potential for transfers of risk or interactions between risks, and developing a risk management plan acceptable to the various work groups involved in the work management process. Pertinent questions for consideration include the following:

1. How well do we understand the risks we are balancing?
2. Have all affected work groups provided their insights regarding anticipated risks, potential consequences of proposed actions, and optimal means to reduce those risks and avoid unintended consequences?
3. Has a "radiological versus non-radiological" mentality been avoided, to ensure that complementary and balanced approaches to risk reduction have been developed?
4. Do we have leading or lagging indicators of the on-going adequacy of the work plan as the work progresses?; and
5. Do we have clear "stop-work" criteria if assessments of barriers and defences suggest they may no longer be adequate for safe completion of the work?

The consideration of performance related human factors is important in plant design and in the day-to-day work management processes.

Means to ensure consideration of all relevant contributors to risk for workers and the public are not readily described in words or in a decision-making flowchart. The consideration of relevant risk contributors is complex and results in decisions based at least partially on judgments by experienced and well-trained personnel. As described above, there are some means that plants and regulators may use to substantially improve the likelihood of their processes' resulting in effective consideration of contributors to risk. For example, are there visibly supported means for workers with differing backgrounds and perspectives to provide input to the work management process? Are inputs, objective (document-based) and informed subjective (knowledge- and values-based), used in considering risks? Are human factors engineering and human error reduction techniques built into the work management process? Are there deliberate multi-disciplinary pre-job discussions of risk contributors and adequacy of barriers to prevent unintended consequences? Does management become involved in the review of proposed job evolutions which may pose risk which may be elevated compared to most work evolutions?

Considering industrial safety, the intent should be to avoid evolutions that place the workers in a situation where there is imminent risk to the workers' health and safety. As with radiological safety, the objective should be to maintain non-radiological risks to the worker at levels which are as low as reasonably achievable. If there is non-radiological risk (e.g. high temperature environment) to the worker, time spent in the condition should be minimized to the extent reasonable practicable, consistent with high-quality job performance.

As to radiation risk, the intent should be to avoid evolutions that place the workers in a situation where anticipated dose rates and doses are very high. The objective should be to maintain radiation exposure to the worker at levels which are as low as reasonably achievable. Consistent with the typical attention to evaluating time in the radiation field during the optimization process, time spent in radiation fields should be minimized to the extent reasonably achievable, consistent with high-quality job performance.

Balanced decisions when multiple contributors to risk are involved means considering the following types of questions for the risk contributors:

1. Have reasonable actions been taken to eliminate each of the risks, without transference of risk from one contributor to another?
2. Are the consequences of exposure reasonably measureable or reasonably able to be calculated? What are the levels of uncertainty in the estimates of consequence?
3. How do the estimates of consequence compare in magnitude? This should include consequences to a single individual and groups of individuals. This should also include consideration of consequences

expected to appear in the immediate future (e.g., hours/days) as compared to the intermediate term (e.g., weeks to a few years) or the longer term (e.g., a decade or longer).

4. Can reasonable actions be taken to reduce overall risk to the relevant stakeholders, with an acceptable increase due to one (or a few) risk contributors? For example, can the work activity be deferred to a time when risks from several contributors can be reasonably reduced?

The depth of investigation into questions of such types, and the level of documentation of such investigation, should be proportional to the magnitudes of reasonably estimated consequences for the proposed work activity. A reasonable depth of investigation may involve only minutes of discussion by craft workers and their supervisors for some day-to-day activities similar to work evolutions that have been conducted in the recent past. On the other hand, deliberations regarding a proposed complex facility modification may require substantial discussion and documentation occurring over a period of months.

Key Points

- Well-balanced solutions addressing the multiple contributors to overall risk.
- Risk optimisation efforts should utilize both a) objective, history-based policies and procedures and also b) views based on a strong safety culture and the value of professional individual and group insights to safe performance of a job.
- Human error reduction techniques.
- As a part of the management information system, the attention of high level managers to adequacy of the work management process should be elevated whenever any component of risk appears to be elevated.

Schedule of ISOE Symposiums

2013

- 27-29 August 2013: International ISOE Symposium (Tokyo, Japan)

2014

- 12-15 January 2014: ISOE North American Symposium (Ft. Lauderdale, Florida/US)
- 9-11 April 2014: ISOE European Symposium (Bern, Switzerland)
- 17-18 June 2014: International ISOE Workshop on Occupational Radiation Protection in Severe Accident Management (Washington DC, US)- Proposal (co-organized by Nuclear Energy Institute, NEI) (*proposal*)

For further information, please visit ISOE websites	ISOE Network: www.isoe-network.net OECD/NEA: www.oecd-nea.org/jointproj/isoe.html IAEA TC: /www-ns.iaea.org/tech-areas/rw-ppss/isoe-iaea-tech-centre.asp NATC: hps.ne.uiuc.edu/natcisoe/ ATC: www.jnes.go.jp/isoe/english/index.html