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Knowledge Transfer and Management of Operating Experience

Extended Special Topic Meeting
of the Working Group on Operating Experience

Paris, France
April 2010

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NUCLEAR ENERGY AGENCY

Unclassified **NEA/CNRA/R(2012)1**

Organisation de Coopération et de Développement Économiques
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NUCLEAR ENERGY AGENCY
COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES

WORKING GROUP ON OPERATING EXPERIENCE

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 34 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Republic of Korea, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 30 OECD member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, the Republic of Korea, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission also takes part in the work of the Agency.

The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes, as well as
- to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information.

The NEA Data Bank provides nuclear data and computer program services for participating countries. In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

Committee on Nuclear Regulatory Activities

The Committee on Nuclear Regulatory Activities (CNRA) shall be responsible for the programme of the Agency concerning the regulation, licensing and inspection of nuclear installations with regard to safety. The Committee shall constitute a forum for the effective exchange of safety-relevant information and experience among regulatory organisations. To the extent appropriate, the Committee shall review developments which could affect regulatory requirements with the objective of providing members with an understanding of the motivation for new regulatory requirements under consideration and an opportunity to offer suggestions that might improve them and assist in the development of a common understanding among member countries. In particular it shall review current management strategies and safety management practices and operating experiences at nuclear facilities with a view to disseminating lessons learnt. In accordance with the NEA Strategic Plan for 2011-2016 and the Joint CSNI/CNRA Strategic Plan and Mandates for 2011-2016, the Committee shall promote co-operation among member countries to use the feedback from experience to develop measures to ensure high standards of safety, to further enhance efficiency and effectiveness in the regulatory process and to maintain adequate infrastructure and competence in the nuclear safety field.

The Committee shall promote transparency of nuclear safety work and open public communication. The Committee shall maintain an oversight of all NEA work that may impinge on the development of effective and efficient regulation.

The Committee shall focus primarily on the regulatory aspects of existing power reactors, other nuclear installations and the construction of new power reactors; it may also consider the regulatory implications of new designs of power reactors and other types of nuclear installations. Furthermore it shall examine any other matters referred to it by the Steering Committee. The Committee shall collaborate with, and assist, as appropriate, other international organisations for co-operation among regulators and consider, upon request, issues raised by these organisations. The Committee shall organise its own activities. It may sponsor specialist meetings and working groups to further its objectives.

In implementing its programme the Committee shall establish co-operative mechanisms with the Committee on the Safety of Nuclear Installations in order to work with that Committee on matters of common interest, avoiding unnecessary duplications. The Committee shall also co-operate with the Committee on Radiation Protection and Public Health and the Radioactive Waste Management Committee on matters of common interest.

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Foreword

The NEA Committee on Nuclear Regulatory Activities (CNRA) believes that sharing operating experience and the National operating experience feedback programmes are a major element in the industry's and regulatory body's efforts to ensure the continued safe operation of nuclear facilities. Considering the importance of these issues, the Committee on the Safety of Nuclear Installations (CSNI) established a working group, PWG #1 (Principle Working Group No. 1) to assess operating experience in the late 1970's. In 1978, the CSNI approved the establishment of a system to collect international operating experience data. The accident at Three Mile Island shortly after added impetus to this and led to the start of the Incident Reporting System (IRS). In 1983, the IRS database became co-sponsored with the International Atomic Energy Agency (IAEA) to be operated as a joint database for the benefit of all of the member countries of both organisations. IAEA has the responsibility of database maintenance and quality checks on the input. In 2010, the IRS was re-named the International Reporting System for Operational Feedback, while maintaining the same acronym. In 2006, the WGOE was moved to be under the umbrella of the CNRA in NEA. However, the WGOE reports on a regular basis to both Committees.

The purpose of WGOE is to facilitate the exchange of information, experience, and lessons learnt related to operating experience between CNRA Member countries. The WGOE continues its mission to identify issues that should be addressed by other working groups based on their specialty area. This special topic meeting, along with many other activities performed by the working group, is directed towards this goal. The consensus from participants at previous workshops, noted that the value of meeting with people from other operating experience organisations was an important element of an effective operating experience programme.

1. Background

Based on the regulatory actions underway or being considered in different member countries concerning their ability to maintain their corporate knowledge with respect to the ageing work force, the Committee on Nuclear Regulatory Activities (CNRA) decided at its June 2009 meeting to assign the Working Group on Operating Experience (WGOE) with the task to explore the further steps in dealing with the issue. In April 2010 WGOE held a one day special topical meeting on *Maintaining and Transferring Knowledge from Operating Experience* that revealed valuable insights on tools and practices for Knowledge Management on Operating Experiences (KMOE).

Objective of the special topical extended meeting

The objective of this international special topical extended meeting was to review and discuss the tools and programs (still planned or already implemented) related to the maintenance and transfer of knowledge in the area of operating experiences. Recent discussions have shown that the knowledge – especially the so called "know-why" – derived from nuclear events and other related operating experiences is diminishing.

In the respective organisations, experts with direct personal knowledge of the events that influenced the design, licensing, construction, and operation of nuclear power plants (NPPs) have already retired or will retire very soon. Thus, the comprehensive transfer of the knowledge from these experts to less experienced personnel is necessary in order to minimize the likelihood that lessons learnt will not be forgotten, e.g. during the construction or licensing of new nuclear power plants.

This special topical extended meeting was intended to provide a forum to communicate some of the tools that are available to gather, to store and to transfer information as well as the efforts of the different organisations to combine these tools into practical programs. In the special topical extended meeting, representatives from the industry (e.g., vendors, utilities, international organisations) had the opportunity to present their efforts regarding this topic during this meeting. These presentations were intended, in part, to allow the regulatory organisations to benchmark their tools and programs with those used by the industry and vice versa. Information obtained as a result of this special topical extended meeting should provide an understanding of the topic, including good practices of regulatory implementations.

2. Organisation / Overview of the Special Topical Meeting

2.1 Planning

Preliminary development of this special topical meeting began following the recommendation by the CNRA to take on a task related to knowledge management for operating experience. The WGOE members decided that a special topical meeting would provide the most advantageous forum for completeing this task. In June 2009, the CNRA approved the approach for the task on operating experience knowledge management. Planning for the special topical meeting started immediately following this approval.

2.2 Scope, content and outline

The special topical extended meeting included an introduction, technical sessions devoted to the tools used for knowledge management and transfer. The summary of the presentations and discussions as well as the conclusions and recommendations for possible further actions by the CNRA/WGOE were prepared and made available after the special topical meeting. All the participants took part in the discussion as part of the presentations, as well suggested potential conclusions and recommendations.

2.3 Logistics and participation

Location

The special topical extended meeting was held in Paris, France, at the OECD Headquarters Conference Centre, 2, rue André Pascal, Paris, France on 13 April 2010.

Participants and Presenters

As an NEA special topical extended meeting, participation was open to experts from regulatory authorities and their technical support organisations, research organisations, NPP owners and operators, NPP designers and vendors, and industry associations and observers from OECD NEA member countries. Nominations were made through the NEA Secretariat of WGOE, (Diane Jackson, Diane.Jackson@oecd.org). Members were encouraged to invite additional participants that were involved in knowledge management from their country to attend.

All participants were requested to complete one questionnaire per country. Questionnaires were submitted to the NEA Secretariat prior to the meeting.

Organising Committee

The Organising Committee organised the sessions and the final programme for the special topical extended meeting. The following persons formed the organising committee of the special topic extended meeting:

Michael Maqua – GRS, Germany – WGOE Chair
Seija Suksi – STUK, Finland – WGOE Vice-Chair
Fred van Iddekinge – VROM, the Netherlands – WGOE Vice-Chair
Diane Jackson – OECD Nuclear Energy Agency, Secretariat

3. Overview of Meeting

The special topical meeting was comprised of four main technical sessions. Each session had a dedicated focus for the topic.

Opening

- Dr. Michael Maqua, WGOE Chair, Germany
- Mr. Uichiro Yoshimura, NEA Deputy Director for Safety and Regulation

Session 1: Strategies and Tools for Maintaining and Transferring Knowledge on Operating Experience

The purpose of this session was to present strategies and tools for knowledge management of operating experience. Presentations were made from a scientific point of view.

- Dr. David Beraha, GRS: *Knowledge Management at GRS: Strategies, Tools and Networking*
- Mr. Marc Noel: *European Clearinghouse on Operational Experience Feedback for Nuclear Power Plants*
- Mr. John Thorp, NRC: *Transfer Mechanisms for Knowledge Management of Operating Experience*

Session 2: Industry Efforts in Knowledge Management and Transfer for Operating Experiences

The purpose of this session was to gain an understanding of the industry's approach to the same challenges in knowledge management. However, it was noted during the meeting that industry may be ahead in implementing solutions or may have a different approach to the challenge than regulatory authorities.

- Mr. Peter Schimann, Areva: *Know How and Know Why*
- Mr. Franck Dubois, EdF: *To Effectively Adapt and Renew Workforce Competences*
- Mr Luis Asensio, *Amaraz Nuclear Power Plant Manager: Implementing Lessons Learn*

Session 3: Regulatory Practices on Maintaining and Transferring Knowledge on Operating Experience

The purpose of this session was to present and discuss existing or planned programs on knowledge management related to operating experience as approached by countries with a small, a medium and a large nuclear program from the regulatory viewpoint. The main emphasis was placed on good practices.

- Mr. Shinya Asahara, Japan: *Maintaining and Transferring Knowledge from Operating Experience: The JNES Perspective*
- Ms. Lauriane Giroud, France, ASN: *Knowledge Management at ASN*
- Mr. Jean Chipot, France, IRSN: *Knowledge Management in French TSO*

Session 4: Open Discussion on the Conclusions and Potential International Co-Operation between Regulators as well as between Regulators and Industry

The purpose of this session was to provide a forum to discuss international co-operation on knowledge management of operating experience, complemented by questions and suggestions from the participants. The main aim of the discussion was to develop conclusions and recommendations for the outcomes of the meeting and suggestions for opportunities for further co-operation on activities within the framework of the CNRA and Committee on Safety of Nuclear Installations (CSNI).

4. Opening and Technical Sessions

4.1 Opening Session

Michael Maqua, WGOE chair, opened the special topic meeting and welcomed participants. He provided an overview of the meeting agenda. He highlighted the request by the CNRA to address knowledge management and transfer by the WGOE. He noted the particular importance this was for new personnel to have access to and be trained in lessons learnt from important operating experience.

Uichiro Yoshimura, NEA Deputy Director in charge of Safety and Regulation welcomed the participants to the expanded special topical meeting on Transferring and Maintain Knowledge on Operating Experience. He noted that nuclear organisations are knowledge-based organisations that rely on their staffs to make sound technical decisions. He noted that knowledge management is one of the main challenges that face the nuclear regulatory bodies and is a focus area in the Joint CNRA/ CSNI Strategic Plan. The joint NEA/IAEA international incident reporting system (IRS) is an operating experience knowledge management (KM) tool that has made sense long before KM was a commonly used term. The National Operating Experience Feedback Programmes are also KM tools for every country to capture and store knowledge. He ended noting that through international co-operation and sharing of information, such as this meeting, each country could further its KM activities.

4.2 Session 1: Strategies and tools for maintaining and transferring knowledge on operating experience

Seija Suksi, vice-chair of WGOE and chair of session 1, introduced the session objective which was to present strategies and tools for knowledge management of operating experience.

David Beraha, GRS, presented *Knowledge Management at GRS: Strategies, Tools and Networking.* He stated that the driving forces for KM in GRS were the retirement of a generation of experts, shortfall of junior experts, and a lack of education and training opportunities. He noted that GRS is utilising a range of KM activities, including hiring junior staff, improving education and training, creating new and extended education modules for newcomers, and developing a KM Infrastructure called the GRS-Intranet Portal that includes team sites and portals for cooperation between other organisations.

He stated that the generation change is in full swing and was envisaged to be almost accomplished by 2013. He explained in detail about the Intranet portal which includes both a “Vertical” structure which is divided by divisions and departments with a main theme and a “Horizontal” structure that included cross-cutting themes, such as news, yellow pages, knowledge page, quality management, education, training, and the organisation‘s handbook.

He also highlighted and provided details on how GRS utilised about 12 Portals for national and international collaboration. Access to the portals from the outside of GRS are controlled by User IDs and passwords through secure links. In conclusion, he opined that many complementary efforts will have to contribute in maintaining and transferring knowledge from operating experience.

Marc Noel, EC Clearinghouse on Operating Experience, presented *The EU Clearinghouse on OEF for NPPs: a Knowledge development tool in OE*. He presented that the objectives of the EU Clearinghouse are to develop OE sharing and cooperation on OE in the EU region for optimal diffusion of knowledge, excellence (best practices) and lessons learnt from OE, and to strengthen existing resources on OE. He highlighted the complexity of the EC situation which encompasses more than 10 different national languages among the users.

In his presentation he discussed people, process and technology as the three main elements in knowledge management. He described that the European Clearinghouse's Op experience process includes utilising input data from many sources, such as IRS, national reports, technical reports and publically available information; collecting the operating experience data in a knowledge merging; processing the data through the creation of trending analyses, lessons learnt, and technical reports, and then finally, disseminating the information.

He described the database as a modern database that functions as a centralized web-based knowledge repository. Its objective is to merge elements from different databases into one large integrated database to support memory and knowledge management in the long term (knowledge merging). He noted that it had advanced and user friendly searching capabilities, analytical tools that facilitates trend analysis, and it has multi-object links between different types of objects (IRS reports, national event reports, feedback reports, topical studies, other references, etc.).

John Thorp, NRC, presented *Transfer Mechanisms for Knowledge Management of Operating Experience*. The Office of Nuclear Reactor Regulation (NRR) in the NRC has a dedicated Office Instruction to define a Knowledge Management Process which provides guidelines to ensure that the Office effectively uses knowledge management to fulfil the Office's mission.

Additionally, it describes how the Office will identify, capture, transfer, and retain critical knowledge that promotes continuous learning and transfer between subject matter experts and staff members. He highlighted a series of KM information fairs held at the NRC, several of which were on operating experience. He noted that NRC's NRR required a Training & Qualification process for new employees that includes operating experience. He added that the series of reactor regulation awareness seminars included one dedicated solely to operating experience.

He also noted that that staff conducted lessons learnt on several US operating experience events, including Browns Ferry (Fire) (1975), Three Mile Island (Core Melt) (1979), Vogtle (Loss of Offsite Power) (1990), and Davis Besse (Head Corrosion) (2002). He also provided copies of the office instruction, DVDs on the Browns Ferry fire and other knowledge management tools from the NRC.

He noted, in summary, that for operating experience, the NRC had a Position Qualification Programme for all technical employees that included technical qualification cards on the review and discussion of past OpE; that the NRC utilised the Rx OpE Information Gateway to link users to information; that the NRC utilised multiple web sites in NRC including KM and links to the Gateway; that OpE SharePoint Site included Lessons Learned; that the NRC utilised mail transmission of events & OpE reports to a large (& growing) subscriber base for timely information on recent events; that the NRC utilised Lectures/Seminars/ Conferences (RIC) to transfer knowledge to large groups; and that the NRC utilised mentoring of junior personnel, including on-the-job (OJT) and rotational assignments as a key aspect of knowledge transfer.

4.3 Session 2: Industry efforts in knowledge management and transfer for operating experiences

Fred van Iddekinge, vice-chair of WGOE and chair of session 2, stated the purpose of this session was to gain an understanding of the industry's approach to the same challenges in knowledge management. However, it may be ahead in implementing solutions or have a different approach to the challenge. The presentations will come from companies that have sufficient means for the development and implementation of comprehensive programs. He expounded on several quotes on knowledge management and provided a picture that demonstrated the concept of networking and interconnectivity between people that is needed for successful knowledge management.

Peter Schimann, Areva, presented *Know How and Know Why*. He presented the current state of the AREVA knowledge management processes and the flow paths of information within various groups in the nuclear industry including regulatory authorities, industry and vendors. It was highlighted that no horizontal exchange of information exists between authorities, operators and AREVA. He opined that this

would be a great improvement for nuclear safety to routinely share information. He described a hierarchy of retained learning and cost showing that the least expensive means, such as lectures, have the least retention and that the more costly means, such as apprenticeships have the highest knowledge retention.

He highlighted that individuals learn using a diversity of tools that incorporate both traditional and modern means; including training, mentoring, wiki-type information, and podcasts. He explained that these diverse means should encompass "Know what" (Instructions); "Know-how" (Understanding); and "Know why" (Expertise). He discussed the Top Learning Priorities for AREVA and the series of activities underway to support each priority, which are: 1) Defining Priorities, 2) Training / Technical Training, 3) People Networking, 4) Communities / Technical Networks, and 5) Documentation (« AREVApedia »).

Franck Dubois, EdF, presented *To Effectively Adapt and Renew Workforce Competences.* He presented the unique position of EDF as being the largest nuclear operator in the world, which generates 63 GW of electricity (88 % of the French generation) by 58 reactors at 19 nuclear power plants. He noted that the knowledge management needs of EDF encompasses 19,214 EDF employees, 40-percent of whom are expected to be replaced between 2008 and 2015.

EDF management is focusing on employee's skills and improvement of management skills, the safe and successful workforce renewal (by hiring new EDF employees as well as recruiting EDF internal employees from non nuclear areas), the active initial training in the field for all the newcomers (allowing them to perform their job earlier than before), and that competencies are developed with their contractors. In 2009, EDF launched their Nuclear Academy Program in 19 NPPs based on team training concept.

The training academy includes training for maintenance employees, specialty technical areas, and even first line supervisors and contractors supervisors. KM lessons learnt from the academy include: that training a new generation needs a strong process to transfer knowledge and behaviour especially in running Nuclear Power Plants; listening to an experience story is far more efficient than reading a book or watching a Power Point Presentation; that it is possible to perform a better training more quickly when done in the field, by managers and peers with effective tools; and that team building training gets new comers quickly involved in the company goals and gets the company well connected with the younger generation.

4.4 Session 3: Regulatory practices on maintaining and transferring knowledge on operating experience

Benoit Poulet, Canada, chaired the third session. He introduced the objective of this session as presentations and discussions on existing or planned programs on knowledge management related to operating experience as approached by countries from the regulatory viewpoint.

Shinya Asahara, Japan JNES, presented, *Maintaining and Transferring Knowledge from Operating Experience: The JNES Perspective.* He provided an overview of the regulatory organisation in Japan as it related to operating experience for domestic issues as well as international issues. Current OE tools and processes for sharing lessons learnt include the capture of information, monthly reporting, initial analysis and coding, storing, and future retrieving and analysing.

For current staff, his presentation showed how the JNES uses in-house seminars, on-the-job training and e-learning for training and uses a technical information portal and an accessible database for information sharing. For future staff, he emphasised that similar tools would be used and additional reliance on expert knowledge to further support the capture of information in the technical information portal would be used. He concluded his presentation noting that the JNES is preparing preliminary project planning work for improving knowledge management including the increased utilisation of advanced tools, improving the transfer or sharing the lesson learnt, and other tasks.

Lauriane Giroud, France ASN, presented, *Knowledge Management at ASN*. The presentation began with some background on who the people are that are involved for ASN. ASN has a total workforce of about 440 people. This represents an over 66-percent increase in the last six years that consists of a diverse group in both experience and qualification. For knowledge management, it was noted that ASN experiences a high turnover but that average stay at ASN is increasing. For operating experience it was noted that no one was dedicated to the subject but that at the ASN directorate level in Paris, operational experience is treated as a transverse activity rather than line activity; and in the ASN regional units, a portion of one person's workload would include an operating experience assessment.

Similar to the EdF presentation, for ASN, having one organisation operating a large number of identical or similar reactors (58) was a huge advantage for operating experience feedback. About 800 safety significant events are reported each year, in which radiation protection, environment and transport events account for 212 incidents. For the Capture and collection of information, the ASN database contains every event and their subsequent analyses by the licensee. Supplementary information is reported at quarterly meetings for a selection of events that are screened for further review by ASN, IRSN and the licensee. Additionally, information is exchanged in the context of international co-operation, through activities such as the WGOE.

And a yearly summary is written for each NPP which includes all events written by inspectors. Additionally, a national review contains a summary of all site reports. For transferring and sharing operating experience information, ASN includes two days of training specifically dedicated to Op. E. for all inspectors. The ASN utilises the IRSN staff as technical experts to give advice to the ASN inspectors. This arrangement is well suited to support ASN since IRSN has a lower turnover rate. For operating experience communication to current staff, the operating experience unit at the ASN directorate communicates to the regional units a selection of events that are deemed the most interesting for inspectors based on a weekly review and provides a suggestion of subjects to be checked by inspectors. Additionally, the Op. E. Unit provides advice to inspectors on areas such as reporting criteria, INES level, and actions for inspectors.

For both current and future staff, the ASN maintains the ASN database of events and their analysis which is accessible to all inspectors; the Op. E. Unit has an E-mail box and specific telephone number, and the ASN Op. E. unit has written guidelines on operating experience feedback which is introduced during training of inspectors on topics such as reporting criteria and the INES level.

For further assessment of events, the ASN has an Advisory Committee for Reactor Safety (GPR) which performs a periodic examination of significant incidents every 3 years for an in-depth analysis of incidents. Events are selected with the objective to put forward modifications of equipment or mode of operation. To assess the effectiveness of the ASN operating experience feedback, ASN performs periodic audits; holds meeting between the ASN directorate and regional units every three months for the directorate to explain its actions and to gain feedback from regional units.

Jean Chipot, France IRSN, presented, *Knowledge Management in French TSO*. His presentation included knowledge management by training and tutoring, the common information means in IRSN, and international relevant activities in IRSN. Training is a large portion of knowledge management for IRSN to maintain its technical competency. The two main areas are nuclear safety and radiation protection.

Within nuclear safety, there are many areas of expertise, including core physics behaviour; PWR design, operation and maintenance; PWR simulation (e.g., transients and accidents); and nuclear materials controls. Similarly, within radiation protection, training is provided for radiologists, dentists and professionals in nuclear medicine and medical physics. For IRSN, operating experience information is kept in the SAPIDE database and associated tool called, RECUPERARE, and also utilises a computer-driven tool, called PLEIADE. The SAPIDE database provides support to the analysis of problems, incidents and operation difficulties. In general, an incident that will be included in the database occurs about once per month per unit in France.

In 2008, 626 events were included and in 2009, 709 events were included. Standard database searches include, events by type of reactor, date, INES level, or reported to IRS. Additional advanced searches are also possible with additional criteria or free text searching. The "RECUPERARE" tool allows for more elaborate analysis that utilises PSA links, and barriers or defence-in-depth levels that are likely to be involved. RECUPERARE aims at studying all events among different factors, including Human factors, Technical factors, and Organisational factors.

For reporting, IRSN utilises a software tool called PLEIADE software. Also, IRSN creates GROUPE PERMANENT reports, which provide Opinions and recommendations on topics important for safety; SEREP reports about significant events; event analysis, and IRS reporting. Additionally, for knowledge management, IRSN is part of the European technical support organisation training project called ENSTTI. The goals of the project include maintaining a high level of competence in nuclear safety for all organisations in European and co-operating countries; developing a main common core to be shared by any kind of staff who would enter the nuclear safety field, and defining and developing additional specialist modules.

4.5 Session 4: Open discussion on the potential international co-operation between regulators as well as between regulators and industry

Michael Maqua chaired this session. The main aim of the discussion was to develop *conclusions and recommendations* for the outcomes of the meeting and *suggestions* for opportunities for further co-operation within the CNRA and the CSNI framework. Uichiro Yoshimura began with his observations of common themes from the presentations. He noted that all organisations used multiple means to transfer knowledge and that they included both traditional methods, such as training and mentoring, as well as multiple means of technology to store, support analysis, and disseminate information. Further discussion by participants ensued on the tools and effectiveness of the various tools that had been presented. The group agreed to some conclusions based on the discussion that are discussed in Section 6 of this report.

5. Questionnaire and Results

5.1 Questionnaire

In the questionnaire the WGOE members were requested to elaborate on the details of the knowledge management process for operating experience information. At the 7th meeting of the CNRA Working Group on Operating Experience in April 2010, a questionnaire was distributed to the participants concerning the status of managing knowledge for operating experience in their regulatory bodies (RB).

The following questions were posed:

1. What is your RB's process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?
2. What organisation or people in your RB are involved in the process of OE KM?
3. What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?
4. What are the tools utilised by your RB to transfer or share the knowledge to the current staff?
5. What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?
6. What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?
7. How does your RB measure if the methods are effective?

5.2 Participation and Coverage

The questionnaire has been filled out by 12 countries: Belgium, Canada, Czech Republic, Finland, France, Hungary, Japan, Korea, Netherlands, Slovenia, Spain, and United States. Answers range from succinct, one-line statements to comprehensive descriptions of several pages.

5.3 Evaluation Procedure

The evaluation started by reviewing the answers from all participants, and by collecting the most important assertions in a comprehensive table. In the next step, common features were clustered in order to find recurrent themes across all participating countries, and less relevant information (or information relevant to other questions) was filtered out. The outcome of this process is depicted in the table. In a summary, all answers were used to develop an outline of the overall status of knowledge management for operating experience.

In one instance, a review of the KM initiative regarding the OE environment was given, without explicit reference to the questions asked. The information contained in that document was integrated into the clustered answers and the summary.

5.4 Clustered answers to the questions

1. OE KM process	• Education – Permanent training programmes – Internal seminars – Cooperation with universities • Knowledge sharing – Informal discussions and experiences in screening meetings, storytelling, CoP-forums • Human Resource Management – Personnel development – Succession Planning • Internal operational procedures – Collection – Screening – Communication – Evaluation – Actions – Tracking • Learning – Discussions with licensees – Lessons learned – Periodic (daily, monthly) communications • Periodic inspections – Reviews and assessments • Reporting – Event reports (national/international, by NPP) • Separate processes for national/international experience
2. Organizations and people involved	• Training – Training centres, coaching, mentoring • People in different organization units – Managements – OE branch staff – Communities of Practice – Subject matter experts – Nuclear safety division – Inspectors – Independent reviewers – Resident inspectors – PSA risk evaluation – Regional units – Internal OE feedback coordinator
3. Tools for collecting lessons learnt	• Meetings of the task force on OE • Internal webpages – OE information gateway – CoP webpages and blogs – Historian publications • Databases (incl. Intranet) – Periodic reports – Event reports – Event database – Lessons learnt database – International events • Corrective action tracking system

4. Tools to transfer/share knowledge to staff	• Training and education – Mentoring, tutorials – Tailored training programme – Inspector's training – Systematic approach to training (SAT) • Communication media – Newsletters – Information gateways – Work processes – Conferences – Staff seminars – Division/department meetings – E-mail notifications • Databases – Event reports – Operational performance information – Safety reviews – OE repositories • KM programs for tacit knowledge transfer started
5. Processes/tools to transfer/share lessons learnt to future staff	• Training and education – New employee training and orientation – Coaching, mentoring – Use of databases • Competence management
6. Processes/tools to organize/store OE KM	• Databases – National/international event databases • Websites • Guidelines to effectively use KM procedures • Safety archive • Reports • Knowledge Library
7. Measuring OE KM	• Measuring training effectiveness – Audits • Performance indicators, KM dashboard – Recurrence of events – Risk significance of PSA based indicators – Monitoring the OE feedback process – Number of reports • Inspector feedback on value of information and tools • Statistical actions analysis • User satisfaction investigations • Monitoring efficiency of administrative processes

6. Conclusions

6.1 Questionnaire insights

All member organisations have a national means to capture and process operating experience. Since the examination of national and international events is a significant activity of every regulating body, it comes as no surprise that processes, methods and tools for treating operating experiences are well established in all organisations.

In most cases, many different processes, methods and tools contribute to the entire area of operational experience. These processes and tools have been acquired or developed over time whenever the need for them arose, often operating independently from each other. Therefore, an active environment in which the national and international events are analysed and evaluated has been operational long before the notion of knowledge management gained widespread acceptance.

However, knowledge management and transfer techniques allow a systematic approach to the whole process, including capturing, sharing, transferring, storing and utilising knowledge. In view of the generation gap and the need to transfer knowledge (often not documented, implicit knowledge of experts) to less experienced personnel, methods and tools developed within the frame of knowledge management promise to alleviate or solve this problem.

A formal knowledge management system for dealing with operating experience has been set up in two cases. In two additional cases, the intention to transition to a formal KM system has been expressed. For the other organisations, the KM processes involved in OE are composed of several processes within the tasks of oversight activities of the RB. In all other instances, there exist well defined internal processes for managing OE. Quality assurance of these processes has been explicitly mentioned in two cases. However, since this was not asked in the questionnaire, it does not signify that other organisations would not have quality assured OE processes.

Regarding the process (or processes) for managing knowledge of operating experience, the main features of collecting, screening, communicating and evaluating the OE knowledge are present in all organisations, as well as tracking the actions taken on the thus gained OE knowledge. Also, all organisations treat national and foreign OE separately. These databases are typically accessible to all staff.

Strong ties exist to education and training programmes and practices, in which the process is made known to newcomers in internal training programmes and seminars. Learning from OE continues in most organisations in a less formal way by discussion with licensees and periodic communications in newsletters or intranets, and in communities of practice.

The OE process usually involves all units in the organisations; in one instance, a note is made that almost everybody is involved in the OE process, which holds true for most of the other organisations too.

The tools for collecting and storing information on lessons learnt are multi-fold: mainly electronic document storage in intranet websites (sometimes dedicated to OE), and databases containing reports, event descriptions, and lessons learnt records. A system for tracking corrective actions was also mentioned by one country.

For transferring and sharing knowledge gained in the OE process to the current staff, training is used the most frequently , and includes training and mentoring programmes. Further, one response discussed the use

of a Systematic Approach to Training (SAT). Communication media are widely used for communicating "explicit" (i.e. documented) OE knowledge to staff, making use of print (e.g. newsletters) and electronic media in all its forms.

As for repositories for the data communicated, all organisations use document databases or management systems integrated in their intranets. For transferring OE knowledge to future staff, the need for transferring implicit knowledge is recognised everywhere - this has been or will be systematically tackled by the organisations with on-going or planned KM programs. In addition, training is mentioned in various forms, including training on the tools for handling OE information (databases, websites).

Storing of data usually relies on document management in databases and websites; in one instance, knowledge libraries are mentioned as a way to improve organisation of all OE-related information.

Measuring the effectiveness of the methods involved is a significant element in all OE processes, but shows great variation between organisations. The use of performance indicators which may include risk-based indicators has been mentioned by several organisations.

In summary, according to the answers of the questionnaire, the processes dealing with the knowledge from operating experiences are well established in all organisations. These processes have developed over time, and have grown mostly in a non-systematic, often informal way. Some organisations have recognised that KM methods and tools have a strong potential of making these mission-critical processes more effective in a systematic way, in particular the transfer and sharing of the tacit OE knowledge to current and future staff.

While few organisations have implemented a formal KM system (some more are in a planning phase), most organisations have adopted a variety of methods and tools associated with KM: most noticeably, communities of practice, team websites and blogs, browser-based intranets as a central access point to document repositories, or lessons learnt databases; and learning from OE is a significant element of all training and education programmes. Overall, the tendency to increasingly draw benefits from KM in OE processes was evident.

6.2 Meeting insights

Knowledge Management is a systematic approach to maintaining the corporate knowledge of organisations. Many companies have integrated Knowledge Management into their company strategies. For a business, the loss of knowledge could lead to important financial losses or insolvency. For a regulatory body and the nuclear industry, the loss of knowledge could lead to an re-occurance of a previous event.

When considering an active KM approach there are three levels to consider. These are:

- The corporate level.
- The group level.
- The individual level.

These levels include both the sources of knowledge as well as the recipients of knowledge in the knowledge transfer process. Knowledge is the combination of both information and experience. When information derived from data is applied using the experience of the individuals within an organisation and the lessons learnt from this are integrated into each of these levels, this is wisdom. Various Knowledge Management approaches use databases and networking tools as main entries. These databases must be well structured for retrieval to support newcomers in their search for wisdom. Networking among experts has to be propagated for daily use. To be effective, an active Knowledge Management approach should be integrated into day-to-day work.

6.3 Tools for knowledge management for operating experience

Knowledge management for operating experience can be divided into three different stages: knowledge gathering, knowledge transfer, and knowledge storage.

For all these stages various tools and procedures exist to facilitate knowledge maintenance. Knowledge gathering is the most difficult stage as this cannot be done during a normal handover process. Thus, it is preferable to have overlapping work periods of the experienced and the new employee. Implementing the knowledge gathering processes with a direct transfer from the experienced to the new employee are easier and seem more successful than processes that only rely on the use of written communication. However, recognizing that in some instances, such a period of overlap cannot be achieved, the following tools have been used to preserve knowledge:

- Interviews with several technical experts and KM experts to build a knowledge base by use of an ontology (topic taxonomy and links between topics) development of dossiers in areas of key expertise.
- For a direct knowledge transfer the following procedures can be applied for example:
  - Tutoring / on the job training.
  - Trainee program.
  - Lecturers.
  - Discussion groups.
  - Networking.
- The efficiency of these procedures varies. A systematic tutoring accompanied by a systematic trainee program may lead to the best results, if the knowledge is transferred from one senior expert to a younger employee. On the other hand, this is also the most time consumptive process and thus the most expensive.

Taking into account the different levels of knowledge management (corporate, group and individual level) a combination of the different knowledge transfer possibilities should be chosen. The practical examples show that regulators, TSO and industry apply all these approaches.

The most effective way to transfer knowledge is the transfer between groups. In this ideal process, a group of experienced experts give their know-how and their know-why to a group of young employees. Thus it can be ensured that the group knowledge can be saved on a long term. On the job training and intensive group internal communication are the most important transfer procedures. The internal communication is achieved by systematic approaches like lecturers and informal networking with the colleagues like common coffee breaks and lunches. These occasions should be used as opportunities especially to transfer know why.

The storage of knowledge is today mostly organised in computer based tools and databases. Portals are the most common tool to organise the storage. These following items may be typical for many applications:

- News pages.
- Yellow pages (information on colleagues – like CVs and specific expertises).
- Project related information.
- Knowledge pages, including wikis and dossiers.
- Training and refresher training courses.
- Training or qualification programmes.
- Organisation manuals.
- Process or procedure manuals.
- Basic data (significant rules and regulations as well as reports).
- Support and help (portal and non-portal content).
- Ideas forum (improvements, innovations).

Regardless of how the knowledge is captured and stored, to be successful the knowledge must have someone to have it transferred to. New employees with the right skills and interests need to be hire and retained. However, several countries are encountering difficulties in attracting or maintaining highly qualified staff for various reasons. These include high cost of living areas and higher salaries offered from the industry (vendors and operating organisations). The main cause of the difficulties might also include the limited number of students in nuclear-related sciences and thus a high level of competition between regulatory bodies, utilities, vendors, engineering companies, and research institutions for an insufficient amount of applicants.

7. Meeting Logistics Evaluation

All participants at the special topic meeting were requested to complete an evaluation form. The results of this questionnaire are summarized below. Of the thirty-four participants, 19 responses were received. Eleven questions were asked of the participants to gage their satisfaction with the information, the format of the meeting, the length of meeting, number of presentations and proposals for future topics.

Overall, the members were satisfied with the special topic meeting, believed it had met the objectives of the meeting and provided useful information. Although most felt that the duration of the meeting was appropriate, several participants felt that more discussion time following presentations was needed. Also, the format did not allow time for the questionnaire responses to be discussed. In the future, the number of presentations could be adjusted to allow more discussion time.

The objective of the meeting was to share tools and strategies for the transfer and management of knowledge on Operating Experience. Did the meeting meet this objective?

To calculate a mathematical response, responses of Yes were given a value of 2 and responses of No were given a value of 1. The average response was 1.9. This indicates a high satisfaction with the information that was shared at the meeting.

Overall, how satisfied are you with the information presented at the meeting?

To calculate the response, responses of Satisfied were given a value of 3, responses of Neutral were given a value of 2, and responses of Not Satisfied were given a value of 1. The average response was 2.7, with zero responses of Not Satisfied.

Was the number of presentations appropriate for the topic?

To calculate the response, responses of Too Many were given a value of 1, responses of Just Right were given a value of 2, and responses of Not Enough were given a value of 3. One hundred percent of the responses indicated that the number of presentations was Just Right.

Was the length of the meeting (1-day) appropriate for the topic?

To calculate the response, responses of Too Long were given a value of 1, responses of Just Right were given a value of 2, and responses of Too Short were given a value of 1. The meeting commenced at 9h00 and terminated at 18h00. The average response was 2.1. Only one response indicated the meeting should have been shorted, while in balance two responses indicated it was too short.

Was there sufficient time for discussion?

To calculate a mathematical response, responses of Yes were given a value of 2 and responses of No were given a value of 1. The average response was 1.7. Five responses indicated additional time for discussion would have been an improvement.

Did you attend the special topic meeting as a special attendee or part of your regular attendance to the WGOE meeting?

This questionnaire was just to gage the other responses for an indication if further discussion at a future WGOE meeting would be beneficial.

Overall, how satisfied are you with the organisation and format of the meeting?

To calculate the response, responses of Satisfied were given a value of 3, responses of Neutral were given a value of 2, and responses of Not Satisfied were given a value of 1. The average response was 2.8, with zero responses of Not Satisfied.

Which speaker(s) or presentation(s) were the most informative?

This open question was to look for any trends in the responses. Just about every speaker received an indication of a good presentation. However, the most informative presentations were given by industry presenters and also presentations that discussed specific tools.

Was there a topic that was not addressed in the meeting that should have been included?

Responses included:

- Unclear what has been done with the survey responses.
- To network and better coordinate with other CNRA/WGs. I suggest one rep from other WGs attend, WGOE meetings.
- Would have been interesting for more details on how exactly KM has to be done.
- KM should not include training programmes.
- Risk of mistakes by overconfident young employees.
- Too many presentations about training. Tools for KM of OE would have been more interesting (not KM in general).
- Principles on the most effective way for KM - presentation from the expert of the field.
- HR strategies would have been of interest.

Do you have any suggestions or comments for improvements for a future meeting?

Responses included:

- The proper balance between the presentations and discussion is always a challenge, especially when there are >30 participants.
- To keep up with the planned schedule, time limited discussion sessions should be considered.
- Strict control of timing of sessions/ presentations.
- How NPPs use Op Exp in a practical way.
- Try to use formal presentations better than verbal communications.
- Less slides.
- Summary of each session and total day summary to be given.
- Continue the idea of workshops within the WGOE framework.
- Smaller countries should present, and IAEA should have presented.

Are there topics associated with Operating Experience (Op Exp) that you would be interested in for a future meeting or workshop?

Responses included:

- Regulatory practices specific to dealing with international op exp (organisational and technical solutions).
- Including oversight of nuclear industry practices.
- Significant Op Exp events with implications on new reactors designs or construction.
- Common cause failures.
- How RBs carry out their inspecting on Op Exp in detail.

- Effective corrective actions.
- The inspection of Op Exp programmes.
- Follow-up on topics in 3 - 5 years.
- Use of Op Exp to improve inspection practices.
- Op Exp in commissioning stage.
- Non-compliances.
- Approaches to identify and reduce repeat events.
- Different methods used by other countries for sharing op Exp with the public and all licensees.
- Especially in both high safety significant events and low SS events with high public attention.
- Any new development on trending tools and how they've been used to produce useful trends.
- Outcome of INSAG comments in Op Exp and IRS.
- Practical use of IRS database and search features, feedback on problems with use.

Appendix A.

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Appendix B

Country Responses to Questionnaire
Maintaining and Transferring Knowledge on Operating Experience

Belgium

(Completed by Bel V)

What is your RB's process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

Domestic OE:

Events that occurred in Belgian facilities are screened and selected by the resident inspector or by request of his area manager or by the OE coordinator. Information is captured in a dedicated incident file by the inspector and consecutively introduced in a database by the OE coordinator.

Particular events are identified for further analysis by Bel V (based on information provided by inspectors and licensee event reports).

The root causes of these events and lessons learned are evaluated from technical, human and organisational performance perspectives. This information is also stored in the database. This analysis includes as well an applicability review for other Belgian installations. Additional actions are identified on the basis of this analysis and discussed with the inspection department. Any staff member has access to this database.

The domestic OE feedback coordinator identifies the domestic events that should be subject to the establishment of an IRS report and coordinates this activity.

International OE:

Selection of foreign events and capturing of relevant information in dedicated databases is performed by the external OE feedback coordinator. The output of the screening and selection of foreign events is completed with information on Belgian events when this is considered relevant for producing a more complete inventory on similar occurrences. Quarterly reports are established to share this information with other Bel V staff.

In some cases a more in-depth analysis of potential implications to Belgian facilities is performed and followed up in a formal way by requests for actions to the licensees.

What organisation or people in your RB are involved in the process of OE KM?

- Inspectors + Area Managers of inspection department (collection of information)
- Internal operational experience feedback coordinator (analysis of domestic OE)
- External operational experience feedback coordinator (analysis of OE based a.o. on IRS reports)
- Safety Analysts (support assessment of selected events)

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

Discussions with licensees about events are documented in inspection reports. Selected events are also documented by the inspectors in an incident file (template with selection criteria provided). This first hand information and any subsequent useful information provided in the licensee event reports is introduced in an event data base.

Information about a selection of international event reports is collected and discussed in a separate database.

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

- Inspection reports circulate within the organisation (so that any staff member has the opportunity to learn about recent events).
- 2 weekly coordination meetings are organised within the inspection department, where recent events are discussed among inspectors.
- Domestic OE coordination meetings take place on periodic basis (discussion of follow up to be given to selected events).
- Domestic OE annual report.
- Quarterly international OE reports (discussion of selected international events supported by new data base records).

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

No particular tools are used.

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

Information about domestic and international events are stored in dedicated databases.

Recurring Event Reports are exported from the International Events database into the general Bel V Knowledge Library (document management system), which allows advanced searches by all staff members.

How does your RB measure if the methods are effective?

A few KPI exist to monitor the OEF process (for domestic OEF: number of IRS drafted; for external OEF: number of IRS reports and USNRC reports analysed) but we cannot say that this is sufficient to measure whether our OEF process is operating “effectively”.

Canada

Follow-up to the 6th Meeting of the CNRA Working Group on Operating Experience (WGOE)

Action 6-11 - Maintaining and Transferring Knowledge on Operating Experience

In preparation for the April 2010 WGOE meeting, Canadian Nuclear Safety Commission (CNSC) staff has reviewed past and current programs aimed at maintaining and transferring corporate knowledge.

The CNSC requires a large number of highly-trained and knowledgeable staff in order to fulfil its mission of ensuring that the use of nuclear energy in Canada does not pose undue risk to health, safety, security, and the environment. Since nuclear technology is constantly evolving, CNSC staff must maintain and continually improve their knowledge and skills through the available training and learning resources and programs provided.

Like many other agencies, the CNSC faces an oncoming wave of staff retirements. The skills and knowledge of this ageing workforce must be retained within the organisation and where possible transferred to the incoming workers who are replacing the retirees.

It is thus not only necessary to ensure new staff is trained to a level comparable to that of the soon-to-be-retired work force, but to transfer a part of the senior-staff knowledge to the new staff.

An important part of the knowledge to be maintained and conveyed to new workers is operating experience knowledge.

Although the CNSC does not have an approved overarching knowledge management strategy, the importance of maintaining adequate numbers of highly skilled knowledge workers has long been recognised and numerous knowledge management programs have been implemented. These programs currently include:

- Internal and external training programs organised and structured via a learning management system (LMS).
- A co-op program with the University of Ontario Institute of Technology.
- A new-grad recruitment program.
- An alumni program which can bring some workers back from retirement for short periods of time.
- Information technology for the capture, storage, maintenance, access, and use of documents received and produced.
- Documentation of the CNSC key processes under the framework of the CNSC management system.
- Maintenance of physical records.
- Maintenance of a technical library open to both staff and the public.
- Dissemination knowledge via the CNSC internal web site.
- Internship and mentorship programs were also attempted but later discontinued. A discussion of the CNSC experience with these former programs appears at the end of this document.
- Current CNSC Knowledge Management Programs.
- Training and the Learning Management System.

CNSC staff can enroll in CNSC and external courses using the CNSC Learning Management System (LMS) software. Staff members and their first line managers also develop individualized learning plans which are documented and maintained within the LMS. By accessing LMS, CNSC staff and management can see what training individual workers require to fulfill the needs of the position they hold.

Upon approval of the line manager, CNSC staff may also enroll in courses relevant to the CNSC mandate but which are not in their immediate individualized learning plan. Such courses include those at Universities, Colleges, and other educational institutions. The employee pays the enrollment fee but is fully reimbursed by the CNSC upon successful completion of the course.

Co-Op Program with the University of Ontario Institute of Technology:

In May of 2006, the CNSC accepted an invitation from the University of Ontario Institute of Technology (UOIT) to pilot a 15-month co-op program for third-year students in nuclear engineering, health physics, and radiation science. The UOIT co-op program helps students obtain valuable work experience relevant to their fields of study. The co-op pilot was so successful that the CNSC is continuing the program.

While at the CNSC, the co-op students participate in a variety of important work-related projects in different areas of nuclear regulation. The students are evaluated after every work assignment and are provided with an overall evaluation at the end of the program. Thus a variety of CNSC Divisions have an opportunity to assess these students as potential future hires.

Twelve students have participated in the program to date and it is anticipated that five more students will be accepted in 2010.

New Graduate Recruitment Program:

The CNSC New Graduate recruitment program began in May 2009. Four nuclear engineers from UOIT are currently on a 16 month term. They are on a four month rotation between the following 4 CNSC Divisions:

- Compliance Monitoring.
- Bruce Regulatory Program.
- Darlington Regulatory Program.
- Non-Proliferation and Export Controls.

The New Graduates are assessed at the end of each work assignment (rotation) and they are also asked to evaluate the CNSC Division where they were assigned. In addition to the work rotations, the New Graduates also attend training courses and workshops when possible.

Alumni Program:

The CNSC has many skilled employees; however the workforce turnover rate remains steady at about 10%, and cumulative projected retirements are expected to reach close to 25% in the next five years. These factors make succession planning and knowledge transfer essential for ensuring that CNSC managers continue to have access to a workforce which possesses the required specialized technical skills and knowledge. The Alumni Program provides managers with a valuable means of accessing a ready source of tested skill and talent.

All retiring and currently retired CNSC staff is offered the opportunity to participate in this program. The objective of the Alumni Program is to allow managers to retain the services of retirees who may possess certain specialized skills, technical knowledge, or important corporate memory which needs to be transferred to younger employees through training, mentoring, or coaching. These individuals may also be engaged to address periods of high workload, unexpected absences, or to undertake short-term projects. The Alumni Program was initiated on 29 April 2009.

Documentation of CNSC Key Processes:

In November 2005, the CNSC initiated an Integrated Regulatory Review Service (IRRS) peer review of its regulatory regime and processes by an international team of experts selected by the International Atomic Energy Agency (IAEA). Many initiatives were begun to prepare for this review; one of these initiatives, begun earlier in 2005 before the IRRS project, was the implementation of a management system modeled on the requirements of International Atomic Energy Agency (IAEA) standard GS-R-1 and associated safety guides.

An Integrated Improvement Initiatives Project (I3P) was begun to coordinate the wide-ranging initiatives. As part of a licensing and compliance project, process maps for all of the key CNSC licensing and compliance activities were created. Work is now ongoing to develop written procedures documenting how these key licensing and compliance activities are to be carried out. Documentation of the CNSC's work processes preserves the CNSC's internal operating experience of how best to carry out its mission.

In 2009 the CNSC introduced corporate processes for developing new regulatory documents, guides, processes, and procedures. A suite of documents was produced to guide employees on how to develop, implement, maintain, and modify documents.

Templates were developed so that documents would have the same "look and feel" when regulatory information was made available to stakeholders, including licensees, applicants, special interest groups, and the public at large. Thus, the templates should promote consistent interpretation and implementation of regulatory requirements, an important part of maintaining regulatory operating experience.

Central Event Reporting and Tracking System (CERTS) and System of Performance Indices (SPIES):

All Nuclear Power Plant licensees are required to report event information and Regulatory Performance Indicator information in accordance with the CNSC Regulatory Standard S-99 – Reporting Requirements for Operating Nuclear Power Plants.

Event information provided by the licensees is input in a CNSC database called CERTS, coded, and then made accessible to all CNSC staff members who can perform OPEX searches or trends as required for the conduct of regulatory work. Approximately 400 event reports are input into the CERTS database every year making it a very important source of Canadian NPP OPEX knowledge.

The Regulatory Performance Indicator data provided by the licensees on a quarterly basis is input into a CNSC database called SPIES which is also made accessible to all CNSC staff members who can perform trends as required for the conduct of regulatory work. There are currently 15 Regulatory Performance Indicators with more under development.

Records Systems:

E-Access is the CNSC document management system begun in 2009 to replace the former recording system known as BITS. E-Access is now the CNSC corporate repository for documents and records and is thus vital for retaining corporate knowledge

E-Access is integrated with CNSC Microsoft Office suite (Outlook, Word, Excel, and PowerPoint) and provides a single, secure location to manage authoritative electronic versions of official records.

CNSC Technical and Proprietary Library:

The CNSC Technical Library maintains collections of documents from such nuclear organisations as the International Atomic Energy Agency and the Nuclear Energy Agency. In addition, library staff regularly review current nuclear industry relevant publications and obtain copies for CNSC staff as appropriate. CNSC staff may also request that nuclear industry relevant books be purchased and kept in the CNSC Technical Library. The library also maintains a sizable collection of computer-based research tools such as reference books, regulatory documents, journals, and data bases.

The CNSC Proprietary Library maintains a complete set of the original NPP Design Manuals, Commissioning Reports, Safety Reports, Operating Manuals, Training Manuals, and Flow Diagrams for every Canadian NPP. This Proprietary Documentation is available to CNSC staff only and is also a very important source of Canadian NPP design knowledge for new CNSC hires.

CNSC Internal Web Site (BORIS):

Information maintained and easily accessible on the CNSC internal web site (BORIS) includes:

- Current operating status of all the Canadian power reactors.
- Computer-based training on the Canadian nuclear laws and regulations.
- Currently approved process maps and internal procedures.
- The computer-based research tools maintained by the library.
- Methods for obtaining CNSC publications.
- Electronic bulletin boards through which staff can exchange views and provide up-to-date information.

Previous CNSC Knowledge-Management Initiatives which were discontinued:

- *Internship Program:*

  In 2000, due to an ageing workforce at the CNSC and within the nuclear industry in general, the CNSC realized it needed to change its hiring practices. In Canada at that time, there was also the lack of university programs in nuclear engineering and science. To help rejuvenate its workforce, the CNSC initiated an Internship Program – an entry level program into the CNSC for University Graduates.

  The original pilot program held in 2001 saw eight interns progress through a 24-month program; six more interns joined in 2003 and again in 2004. The 2003 and 2004 programs were shortened to 18 months. Over the 18 month program, the interns experienced an environment where knowledge-sharing and teamwork was encouraged. The interns had the opportunity to work and learn from specialists from many disciplines and CNSC Divisions.

  The program was comprised of a combination of practical work assignments, comprehensive classroom instruction, and on-site training in nuclear and non-technical areas.

  This program was new and had to be designed from the ground up. As with any new program, the implementation was the most challenging part.

  Number of interns:
  2001/2002 = 8
  2003/2004 = 6
  2004/2005 = 6

Costs of the Program:
Excluding salaries, each of the three intern intakes cost approximately $100 000 Cdn.

Divisional Impact:
All the interns were placed in divisions within the CNSC Operations Branch (i.e. Licensing & Compliance).

Number of people who participated in the program: 20

Assessment Reports Produced:
During the program, every intern was evaluated at the end of each work term. They in turn evaluated the Division they had been in. They were given a written evaluation at the halfway mark and at the end of the program.

Successes: 20 interns were recruited.

One positive spin-off was the development of the CNSC Learning Management System which is an integrated planning tool for individual training needs for all staff.

Reasons for termination:
The CNSC had difficulty in retaining interns once they completed the Internship Program. More than half of the Interns left the CNSC to work for the licensees or in other industries which offered better terms and conditions of employment. A decision was made to terminate the program.

- *Mentorship Program:*

  The CNSC Mentorship Program began in 2001 for eight new graduates who participated in the Internship Program. Successful mentor candidates received training in being a mentor and then were assigned to one of the interns.

  Mentors were assigned only after the interns and mentors were interviewed to ensure mutual compatibility. This helped to promote the transfer of specialist knowledge from our Subject Matter Experts (SMEs) to the interns.

  Costs of the Program: External Contract: CAN$ 7 490.

  Divisional Impact: No impact on the divisions.

  Number of people who participated in the program: 8 interns and 8 mentors.

  Assessment Reports Produced: None.

  Successes:
  The mentor program was considered a success. However, it was discontinued after the first year. The interns were asked if it should continue and they said no. They said that once they became comfortable in the CNSC there was no need to have an individual mentor assigned to them. They felt very comfortable asking others for help when they needed it.

  Failures/Lessons learned:
  Although the mentoring program was discontinued, one of the lessons learned was to assign experienced staff to assist the interns during their work assignments.

  Conclusion:
  Although the CNSC has previously attempted to create a formal knowledge management policy, it has not succeeded. Nevertheless, the CNSC is acutely aware of the need for knowledge management as evinced in its many initiatives aimed at recruiting and adequately training new workers, in providing computer and other material support for maintaining knowledge, and in retaining for as long as possible the senior staff for the purpose of transferring experiential knowledge to the CNSC younger staff.

Czech Republic

What is your regulatory body's (RB's) process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

There are two activities related to the management of information on national OEF at SUJB:

- Periodic regulatory inspections focused on licensee's OEF process efficiency.
- Safety performance indicators.

Information and data necessary for inspections and safety performance indicators are provided by the licensee. Information obtained during these activities is stored in an SUJB internal databases and/or spreadsheets. An annual report on safety performance indicators is issued. SUJB inspectors are involved in both above mentioned activities and thus no specific arrangements for data transfer/sharing within SUJB are necessary.

There is no implemented systematic activity focused on international OEF at SUJB at present. The most safety relevant IRS reports are discussed with the licensee and necessary actions at domestic NPPs are agreed and/or required by SUJB if necessary.

What organisation or people in your RB are involved in the process of knowledge management for operating experience?

There is a specific Feedback Branch in the SUJB organisational structure responsible for coordination of inspections and activities related to the safety performance indicators.

Resident inspectors are responsible for safety performance indicators data collection; they are also heads of the above mentioned periodic inspections. Inspections focused on OEF are team inspections, relevant SUJB specialists are team members.

Events at domestic NPPS are reviewed also by independent reviewers contracted by SUJB. Results of their review are used as inputs for SUJB inspections.

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

MS Access databases are used.

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

MS Access databases are used.

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

There is a generic training process for newcomers implemented in SUJB. As a part of this process, new employees are familiarized with relevant legal requirements related to the OEF and with the SUJB activities in this area. Above mentioned databases and reports on safety performance indicators are available at SUJB intranet.

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

MS Access databases accessible in SUJB intranet are used.

How does your RB measure if the methods are effective?

There are no formal indicators developed that could be useful for measurement of SUJB effectiveness in this area. However, safety performance indicators, trends and results of regulatory inspections give good signals of licensee OEF system efficiency. These trends are also understood as indirect indicators of SUJB

activities efficiency. If negative trends are evident, actions focused on improvements are initiated at SUJB.

Prepared by Zdeněk Tipek
Head of SUJB Local Inspectorate at Temelín NPP
OECD/NEA/WGOE member, SUJB CR

Inputs from SUJB Feedback Branch and results of SUJB Nuclear Safety Section discussion were used for preparation of responses.

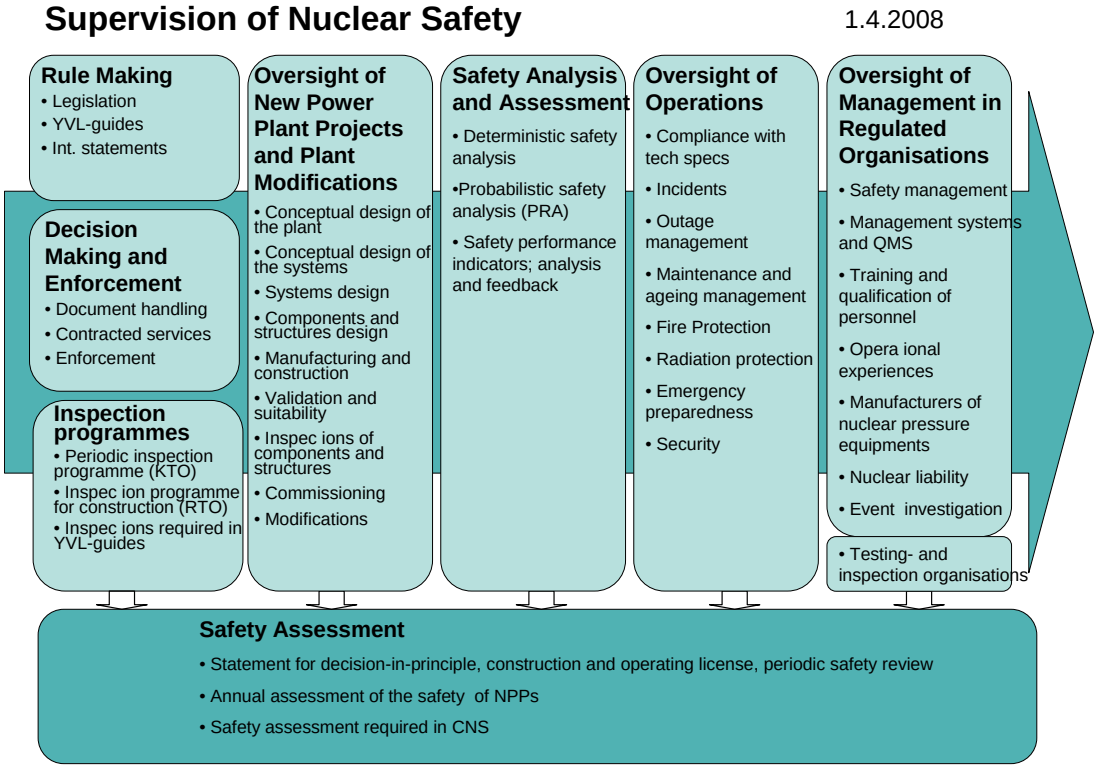
Finland

Maintaining and Transferring Knowledge on Operating Experience:

What is your RB's process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

STUK does not have a consistent, written process for managing knowledge of operating experience: the KM process of OE is composed of several processes and tasks of oversight activities of the Nuclear Reactor Regulation (NRR) department (Figure 1).

Figure 1. **Processes and tasks of Nuclear Reactor Regulation (NRR) department of STUK**



OEF process (review and assessment of operating events) which is defined as one sub-process of the main process. "Oversight of Management in Regulated Organisations" is the most essential in capturing and collecting OE and in managing OEF. In addition, review and assessment of domestic operating events and utilising OE are also part of other tasks and sub-processes of the NRR department.

STUK has a separate process. Lessons from our own and relevant international OE are used for safety enhancements at plants, in licensees' procedures and in regulation. STUK's procedures for review and assessment of domestic and international operational events are presented in the Quality Manual of the NRR department.

In the Finnish legislation are the general requirements for utilisation of OE and for safety enhancement.

The Government Decree on the Nuclear Power Plant Safety (issued 1991, revised 2008) says that the licensee shall gather operating experience from nuclear power plants and results of safety research and these both shall be systematically assessed for further safety enhancement. Operating events both at the Finnish plants and abroad which have, or may have, specific safety-significance shall be analysed to resolve root causes and to determine appropriate corrective actions which shall be implemented for the removal of root cause to prevent occurrence or recurrence of an event and for the continuous improvement of safety. The same principles were added in 2008 in Nuclear Energy Act (issued 1987) on Leading Principles for Nuclear Safety. The requirements pertain to the licensees as well as the regulator itself.

A fundamental principle within the nuclear industry is that the licensees have the prime responsibility for safety. Likewise, the collection of information on OE is the responsibility of the licensee and they must have established processes to systematically follow and analyse OE of their own and from foreign NPPs. The regulatory challenge is to assure that OEF is used effectively to promote safety. Regulatory bodies must have parallel process to review the results, and to ensure proper function of licensees OEF processes, and to ensure that the relevant events have been brought to the attention of operators.

Detailed requirements for licensees' OEF arrangements are given in STUK's regulatory guides. Guide YVL 1.11, "Nuclear power plant operational experience feedback" sets forth the criteria and requirements for NPP operational experience feedback process and for implementing improvements at their plants.

It requires that a licensee examines all operational events which have safety significance, using a sophisticated root cause analysis method. Requirements for reporting events and for contents of the plant operational event reports are presented in the Guide YVL 1.5, "Reporting nuclear power plant operation to the Radiation and Nuclear Safety Authority". Amongst the other, this guide establishes the reporting and notification processes to be followed by the utilities for events that have to be reported at a regular time intervals and events for which a prompt reporting is needed.

The separate guides addressing OEF arrangements and reporting on NPP events are going to be integrated as one STUK-YVL Guide in accordance of on-going renewal project of STUK's regulatory guidance which should be completed by the end of 2011.

Event reports are prepared by licensees on events and issues which need to be reported in detail after the event has occurred and certain criteria have been met. These event reports can be divided into three categories: operational event reports, disturbance reports, and special report. A special report will be submitted to STUK for approval within one month of an incident. Special reports must include the following detailed data as applicable: event description, safety assessment, causes of the incident and measures to avoid recurrence.

The objective of STUK's OEF process is to improve the safety and reliability of the plants as well as regulation and STUK's own activities. Systematic collection, documentation, analyses, and sharing of NPPs' operating experience are essential prerequisites for the achievement of these goals. Operating experience feedback procedures shall contain also adoption of good practices.

The aim of STUK's OEF process is:

- to ascertain that licensees have adequate procedures and arrangements for investigating operational events and utilising operating experience of their own and abroad.
- to assess if an event challenges any assumptions made in connection of NPPs' safety reviews (analyses and other clarifications).
- to assess if any modifications to the structure, procedures or organisation of the plant are needed based on the causes of an event.
- to find out whether STUK's activities or deficiencies in STUK's activities have contributed to the initiation of occurred events, and to use that information for improving STUK's procedures, maintaining and developing regulation and guides for event investigation and operating experience feedback.
- to inform the public on events nationally and abroad.

Capture/collect and transfer of OE:

It is a licensees responsibility to notify and report on operational events at their plants but in addition STUK performs continuous oversight at plant sites and informs its staff at headquarters.

STUK has two resident inspectors at Loviisa nuclear power plant and four site inspectors at Olkiluoto - two of them dedicated on OL3 construction and another two on operating plants. The site inspectors' role in ascertaining a steady flow of information is of great importance to STUK's oversight practices. The resident inspectors inform management and personnel of NRR about operational disturbances as well as about safety significant events or incidents immediately by phone call (during office hours) and/or by e-mail.

STUK encourages all its inspectors making inspections on-site to pay attention to unusual phenomena and to openly report all safety significant observations, including errors made in their own work. STUK also stresses the importance of recording the essential case specific data about operational events and the conditions during their occurrence (YVL 1.11).

Incidents and failures in equipment and systems not having nuclear safety importance, minor deficiencies in periodic tests, and near misses as well as other low level events are normally reported in weekly reports by resident inspectors and discussed in departmental meetings on operation (OPERA) held every other week at NRR. Specific events that may require regulatory actions are discussed in the meeting of NRR management (directors and office heads) held every other week. The meeting may decide if deeper inspections or any other actions are required before or after the routine reporting of the utilities.

Preliminary investigation of operational events might be performed right after incidents in order to inform the NRR department, management, and public if necessary. Selected events are reviewed and discussed on-site with the licensee once a month. Reactive inspections are made in the case of an important event or inadequate performance of the licensee.

STUK performs reviews of operational event reports/events basically at three different levels: A general review is performed for events, which licensee's event reports are submitted to STUK for information. Such events are; transients, reactor scrams and other events. Assessment and analyses of event reports of the events which meet the set criteria for the licensee to submit a special report to STUK for approval may include clarifications at the plant site. Contributing or latent human and organisational factors are determined by special techniques performed by behavioural specialists of NRR.

Safety significance of operational events is determined by deterministic safety analysis. Risk significance of events is determined using probabilistic safety assessment (PSA) techniques. INES classification made by the licensee is assessed and confirmed. STUK assigns its own investigation team for events deemed to have special importance, especially when the licensee's organisation has not operated as planned.

Number of event reports in different categories: special reports, disturbance reports, and incident reports are followed by STUK's safety performance indicator system for NPPs. STUK divides the direct causes of events roughly into technical failures and erroneous operational and maintenance actions (non-technical, human errors) which are also followed as indicators as well as the risk significance of events.

All IRS reports received through IAEA/NEA webbased international reporting system (WBIRS) are immediately reviewed and their relevance assessed if there are concerns or lessons to be discussed or investigated at Finnish plants. Process chart for "Use of IRS reports at STUK" is as attachment 1. STUK also reviews the utilisation of international OE by operators.

Organising/storing/sharing of OE:

STUK has following repositories for OE: Nuclear Safety Archive (YTD), where all the documents submitted by licensees as well as related STUK's decisions and memorandums are registered and stored. YTD is part of STUK's Document Management System (DOHA), which is a common repository for all documents, memos, assessments and inspection reports of STUK.

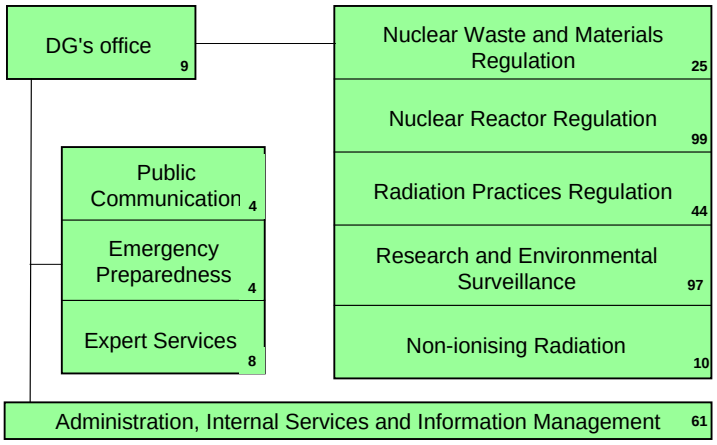
Event reports are stored into STUK's intranet on the page of oversight of NPPs. Event information is taken on a standard form containing the following fields: name of event (describing name), plant unit(s) in question, time and date of event, event report type/event number in Nuclear Safety Archive (YTD), INES-classification, short description of event, causes of even (human/technical failure, faulty performance), preventive and corrective actions at the plant and at the licensee (description, time schedules), safety significance of the event, and text published in STUK's Quarterly Report on the Use of Nuclear Energy in Finland. Word-search is possible at a time on several reports, but the system does not enable any trending because coding of events and their root causes or any contributing factors is not performed when putting events in the storage.

IRS-reports received from the IAEA are also stored into STUK's Document Management System (DOHA) in a separate folder with related presentations given for example in NC or WGOE meetings and other related documents e.g. reports, memos etc. STUK has its own access-based IRS database, where every IRS report is recorded with a short event description (in Finnish), the categorisation, justification for STUK's position and summary of actions needed or already performed at Finnish NPPs (in Finnish and in English) for each report categorized to class 1 or higher. The list of IRS reports is in intranet. STUK's response on lessons presented in IRS-reports can also be found in intranet (actions in Finland or good practice in Finland in a case an issue had been addressed earlier with proper actions).

Selected operational events are reported in Annual and Quarterly Reports on *The Use of Nuclear Energy in Finland*. These reports act as good collective memory on the events, and licensees' and STUK's actions.

Decision on reporting events at the Finnish NPP's to WBIRS is made in the department meeting of NRR management. Events to be reported to the IRS are selected according to the general principles and main reporting categories applying IAEA/NEA Incident Reporting System (IRS) Reporting guidelines, and also a general principle that experience when led to corrective measures in Finland is shared with others. Process chart for "IRS report preparation at STUK" is shown in Figure 2.

Figure 2. **Departments of STUK**



What organisation or people in your RB are involved in the process of OE KM?

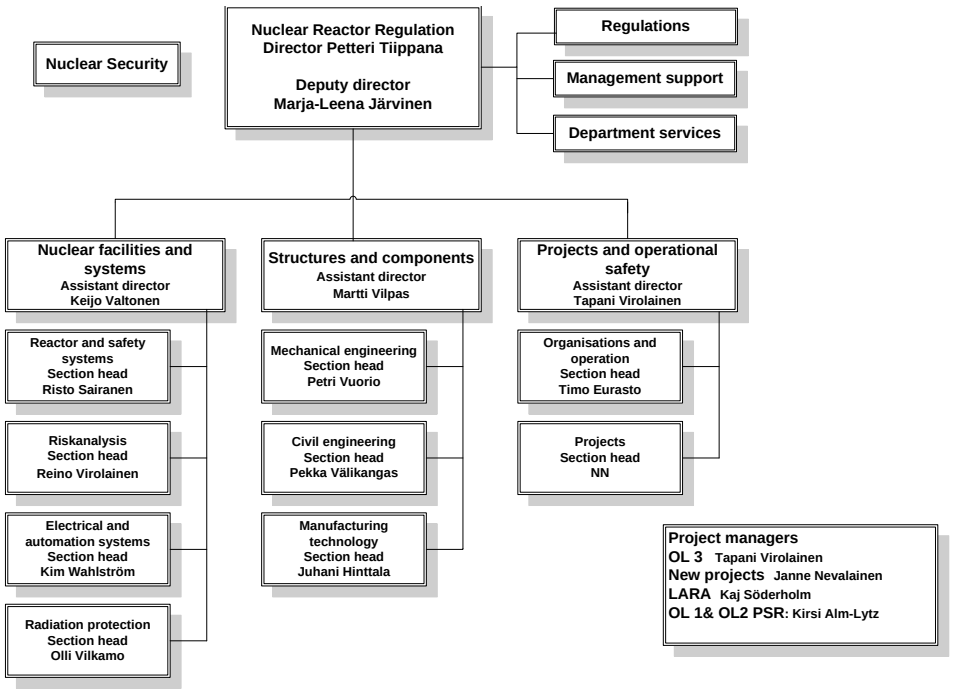
STUK's regulatory activities are organised around four major departments: Nuclear Reactor Regulation, Nuclear Waste and Materials Regulation, Radiation Practices Regulation, and Research and Environmental Surveillance (Figure 2). The Nuclear Reactor Regulation (NRR) Department is responsible for monitoring the safety of Finnish nuclear power plant operations.

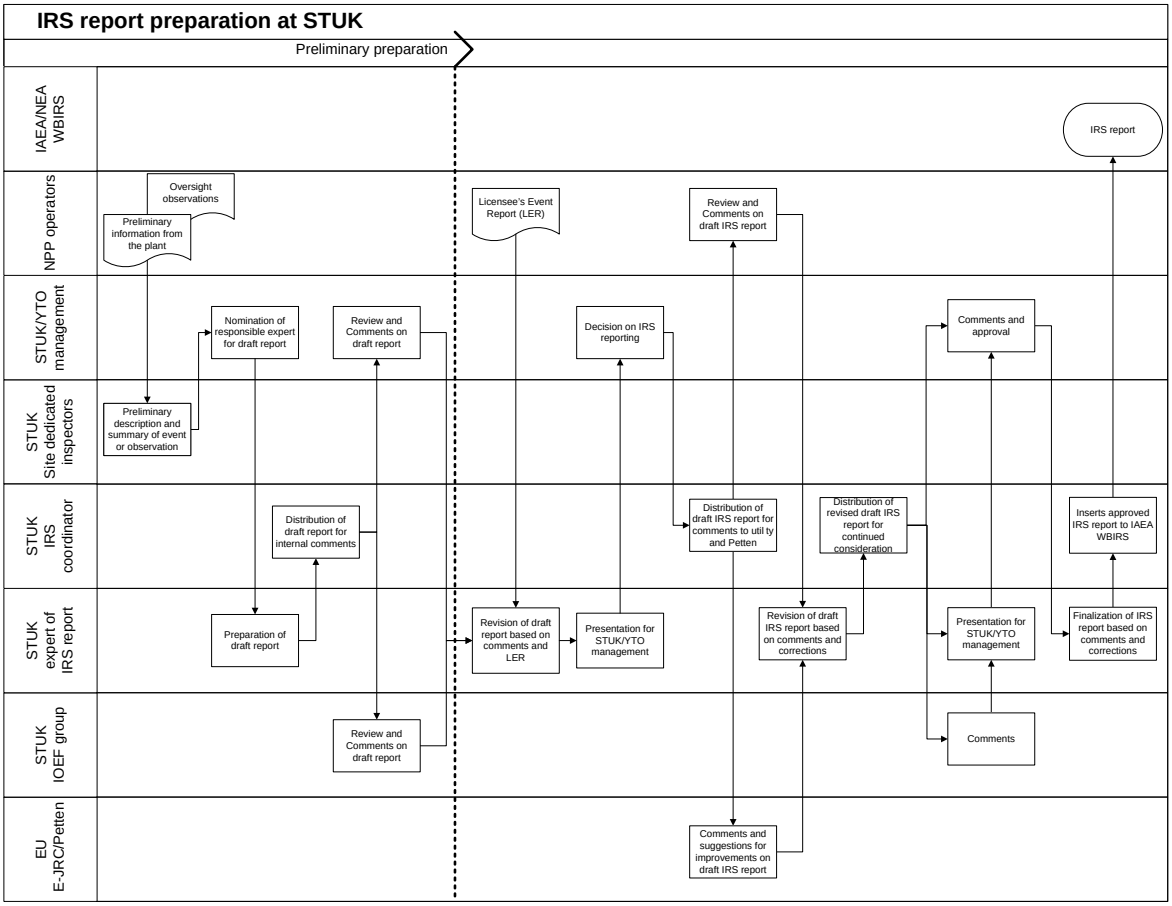
The Nuclear Reactor Regulation department consists of three groups (Nuclear Facilities and Systems; Structures and Components, Projects and Operational Safety).

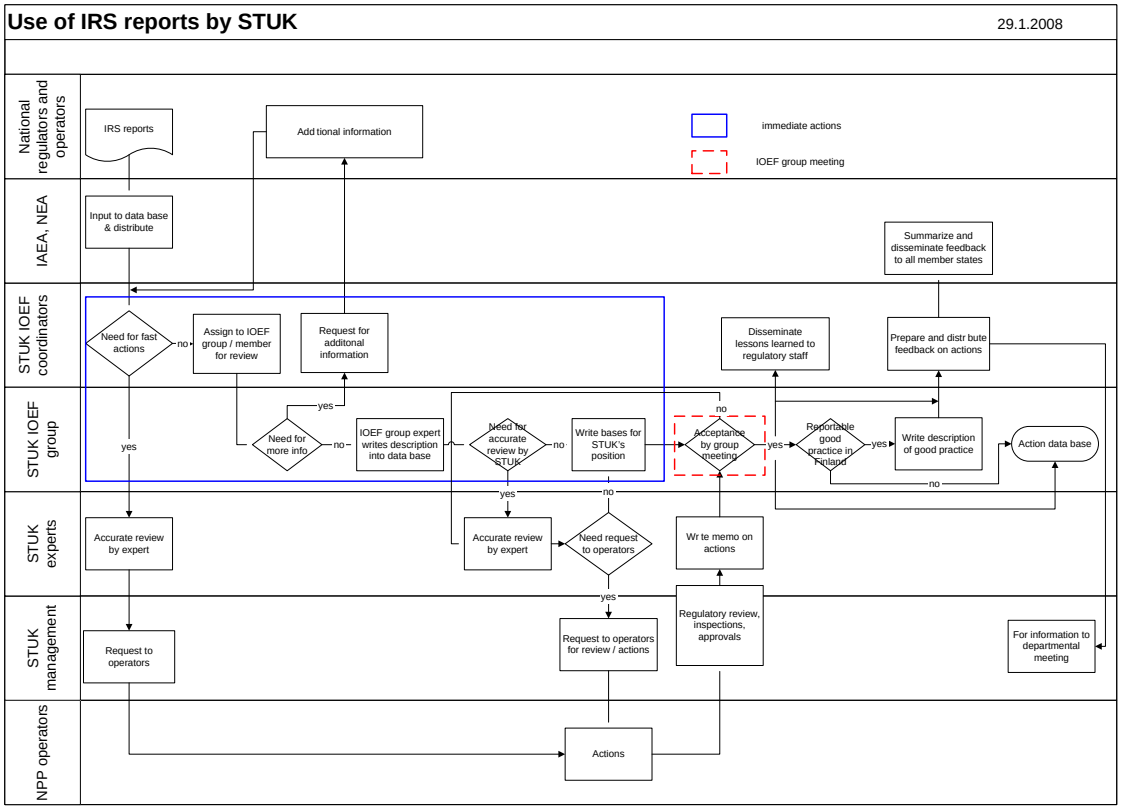
In these groups there are altogether nine sections of special expertise areas: Reactor and safety systems,

Radiation protection, Risk assessment, Electrical and automation systems, Mechanical engineering, Civil engineering, Manufacturing technology, Organisations and operation, and Projects (Figure 3). The section of "Organisation and operation" has a primary responsibility for managing OE within the NRR department, but all other sections of the department participate in the review and assessment and reporting within their specific know-how and expertise.

Figure 3. **Organisation of the Nuclear Reactor Regulation Department**




IRS report preparation at STUK
Preliminary preparation
IAEA/NEA WBIRS
NPP operators
STUK/YTO management
STUK Site dedicated inspectors
STUK IRS coordinator
STUK expert of IRS report
STUK IOEF group
EU E-JRC/Petten
IRS report
Oversight observations
Preliminary information from the plant
Licensee's Event Report (LER)
Review and Comments on draft IRS report
Nomination of responsible expert for draft report
Review and Comments on draft report
Decision on IRS reporting
Comments and approval
Preliminary description and summary of event or observation
Distribution of draft report for internal comments
Distribution of draft IRS report for comments to util ty and Petten
Distribution of revised draft IRS report for continued consideration
Inserts approved IRS report to IAEA WBIRS
Preparation of draft report
Revision of draft report based on comments and LER
Presentation for STUK/YTO management
Revision of draft IRS report based on comments and corrections
Presentation for STUK/YTO management
Finalization of IRS report based on comments and corrections
Review and Comments on draft report
Comments
Comments and suggestions for improvements on draft IRS report


Use of IRS reports by STUK
29.1.2008
National regulators and operators
IAEA, NEA
STUK IOEF coordinators
STUK IOEF group
STUK experts
STUK management
NPP operators
IRS reports
Add tional information
immediate actions
IOEF group meeting
Input to data base & distribute
Summarize and disseminate feedback to all member states
Need for fast actions
no
Assign to IOEF group / member for review
Request for additonal information
Disseminate lessons learned to regulatory staff
Prepare and distr bute feedback on actions
yes
Need for more info
no
IOEF group expert writes description into data base
Need for accurate review by STUK
no
Write bases for STUK's position
Acceptance by group meeting
yes
Reportable good practice in Finland
yes
Write description of good practice
Action data base
no
yes
no
Accurate review by expert
Accurate review by expert
Need request to operators
Wr te memo on actions
yes
Request to operators
Request to operators for review / actions
Regulatory review, inspections, approvals
For information to departmental meeting
Actions

The Organisations and Operation section (OKA) has the responsibility for the day-to-day oversight of plant operations and screening and assessment of operational events as well as the coordination of analyses of significant events. In principle, all regular reports as well as operational events, disturbance and reactor scram reports are submitted to STUK for information whereas special reports need STUK's approval. Assessments are performed on a case by case basis by the expert sections depending on the expertise needed.

Resident inspectors of OKA follow-up operation and events on-site and inform the office staff at headquarters through daily reports. OKA performs a preliminary investigation of operational events right after the incidents and for safety significant events immediately informs the management of the department as well as the other expert sections of the department essential in declaring the event. Having received information on an unusual event OKA will first assess, together with the experts of other sections and management of the Nuclear Reactor Regulation Department, whether there is a need for an immediate intervention and/or other swift measures by STUK. The main purpose of the initial assessment of the event it to figure out its immediate safety implications, and to evaluate its impact on the possibilities to continue operation or to start-up the plant again. As part of the initial assessment process STUK may carry out inspections on site, too.

OKA brings the events requiring actions or other significant events to the notice of the departmental meeting on operation (OPERA), which is participated in by the management of NRR (director, goup heads), unit heads, and several inspectors being specialists in different technical areas as well in SM, QA, HOF, OEF, etc. Other units of the NRR department have to inform OKA on all significant events which they have got out into their notice.

Risk significance of events is determined using probabilistic safety assessment (PSA) techniques by the inspectors of Risk analysis section. Risk follow-up of operational events is made also by this section and they are responsible on risk based indicators connected to events. Risk significance of events is used as support when assessing the INES classification made by the licensee. Review of the licensee's classification is coordinated by the national INES coordinator nominated from the OKA. Inspectors of section 'Reactor and safety systems' participate in confirming INES classification as well as inspectors of the specific technical area whose competence is needed.

The process to review, assess, and use of IRS reports is managed by an experienced expert working full time on IOEF. Most of the work is conducted by a group of ten experts representing different technical disciplines. Other experts of the department contribute to the work of in-depth assessment and regulatory measures to address similar concerns in Finland as needed. The IRS group of the department also oversees the utilisation of international OE by licensees by an inspection focused on that area.

A national IRS coordinator coordinates preparation of IRS reports on events at Finnish nuclear power plants. The appointed STUK expert drafts an IRS report based on information from a fact finding mission that STUK conducts immediately after any event with potential safety significance, and on the Licensee's event report.

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

Lessons learnt from domestic and international events are captured and collected by the experts in connection of review and assessment of events, event reports and licensees' corrective action plans.

STUK's decisions on the propriety and acceptability of licensees' plans are shared to all expert sections and stored in STUK's Document Management System (DOHA) in addition with justification memos.

Identified corrective actions based on events at Finnish nuclear power plants and their planned implementation with time schedules are stored into STUK's intranet on the page of oversight of NPPs on a standard form with a short description of an event.

STUK's response on lessons presented in IAEA/NEA IRS reports can also be found on the intranet (actions in Finland or good practice in Finland in a case issue had been addressed earlier with proper actions). Summaries of actions needed or already performed at Finnish NPPs (in Finnish and in English)

are also available in STUK's own access based database for IRS reports. Regarding events which STUK has raised the concern to the licensees are managed at the department according the same decision process as the events at own plants.

STUK follows licensees' OEF arrangements and implementation of preventive and corrective actions in its inspections of periodic inspection programme (PIP) for operating NPPs: In the process oriented inspection "Operating activities" conducted every three years, licensees' OEF process for a plants own events are reviewed. The inspection "International Operating Experience Feedback" conducted once a year focuses on licensees process for review and use of OEF from other plants. Arrangements are verified with concrete examples chosen in meetings of STUK's IRS group. Implementation of corrective actions are followed in an inspection "Safety assessment and enhancement" conducted every second year.

Efficiency and effectiveness of the OEF processes are reviewed in an inspection "Safety management" conducted every second year. Implementation of preventive and corrective actions are followed and reviewed also in several other inspections of STUK's periodic inspection programme.

According to the reporting requirements licensees are obliged to submit reports on the utilisation of internal and international operational experience to STUK for information once per year. Reports contain a description of operational experience feedback activities and a list of events which corrective measures and progress are followed by the utilities. The goal is to assess implementation and also adequacy of corrective measures to avoid recurrence of such events. Reports are inspected by STUK to assure that operational experience feedback activities are carried out as described in YVL guides and quality assurance manuals.

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

Repositories of OE (see answer to question 6.) are tools to transfer OE and lessons learnt to current and future staff. Repositories are used also as a reference in clarification of new events: looking for similar events and assessing recurrence.

Sharing of STUK's decisions on the licensees' event reports and corrective action plans to all expert sections promotes awareness of events and licensees' actions. Intranet is also nowadays an easy way to share information on events at Finnish nuclear power plants and at other plants as well.

Knowledge on OE and lessons learnt from domestic and international events are transferred primarily in connection of review and assessment of events and licensees' event reports. Participation in STUK's event investigation teams is also an efficient way getting familiar with OEF arrangements at plants and at STUK as well as with the results of previous inspections, recommendations given to investigated organisations and their plans for preventive and corrective actions.

A Knowledge Management project has been started at the department of NRR. The purpose of STUK's KM project is the transfer of tacit knowledge and learning from experience. Goals of the project are: develop knowledge management and tools to ensure learning from experience; ensure transfer of tacit knowledge of experienced inspectors before their retiring; strengthen documentation, storage and utilisation of operating experience and lessons learnt; collect experiences and tacit knowledge on decision making in some difficult cases related to operational events or to degraded performance of the plant (components, equipment, systems) or organisation; harmonise decision making methods and practices at the department (decision making was more decentralize in connection of the latest reorganisation at the department); training on the cases and results to ensure that tacit knowledge is transferred to newcomers and persons moving to new tasks. KM project is in the pilot phase but when finished it will offer an excellent tool for the management of knowledge on OE.

General information on training and training planning:

A systematic approach to training is introduced in STUK. Training Policy is defined in an internal guideline on training administration. The training system is covered in guides of the STUK Quality Assurance System. In the Quality Manual of Nuclear Reactor Regulation (NRR) department of STUK are

two guides on staff training - “Training of Personnel” at Guide YTV 8.2, “Introductory and Basic Training Programme for a New Employee” Guide YTV 8.3, and on general level in “Principles of Personnel Administration” STUK 5.1 and other relevant documents.

Regularly performed systematic competence inventory is used for planning staff knowledge and skills development (of current staff and recruitments). To be able to recruit competent staff (and to keep the already existing) a fair and competitive compensation policy is needed.

A competence inventory was first time carried out at STUK in 2002 and has since that been seen as a useful input for yearly training plans. The aim was to get a common view on competencies and competence levels in STUK. Competence charts were made at all departments and in every working unit separately. The necessary competence were defined in a program containing basic skills (common working life skills, STUK-special competences), professional skills (department / unit specific) and managerial skills.

Each unit defined target levels of their own and then analysed the current situation. Standard scale for assessment (identify, use, apply, develop, expert) was applied. A gap analysis between real and optimum situations was performed and critical areas were recognised. Training programmes were produced for ‘critical’ competence areas. Competence analyses have been repeated three times at STUK and department level - in 2002, 2005 and 2008.

At the individual level – competencies and needs for training and other development is one topic in the annual discussion between supervisors and subordinates. On the unit level - the office head is responsible to arrange training and other development opportunities. On the departmental level – the training programme will focus on identified common gaps. Results will be taken into account regularly in new recruitments.

Operational experience is defined as a core competence only for the section of ‘Operation and Organisations’ and for the former event investigation manager, nowadays principal advisor. International operating experience is identified as a core competency only for a principal advisor.

The most commonly identified competencies for expert sections needed are: Operation and Maintenance.

For each new inspector a personal development plan is made including several types of training: self-education, mentoring, participation on Knowledge Management project, on-the-job-training (senior-junior couples), internal class-room training, simulator training, participation in the training courses organised by a utility for its own staff, participation in external training courses and conferences etc.

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

Repositories of OE (see answer to question 6.) are tools to transfer lessons learnt to future staff.

Transfer of tacit knowledge and lessons learnt from experiences will in the future be performed through the process and system developed in STUK’s KM project (see answer to question 4). STUK’s long-term recourse plan takes into account future tasks and retirements and KM plan is updated yearly. Replacement recruitments are typically performed 1-2 years in advance enabling on-the-job-training and senior-junior couples.

In the training programme, there are common parts for all new comers, but the basic principle is that introduction training programme is tailored individually for every new inspector taking into account the area where he/she will be acting. OEF activities and arrangements of STUK and licensees are introduced and detailed to the new inspectors of OKA and to those who will be appointed as resident inspectors.

MSc or diploma thesis is one possibility to be recruited; this contributes to developing and maintaining nuclear competence in Finland. Annually STUK has a few students who are at the end of their studies performing their thesis. STUK also maintains and supports specific nuclear competencies at research institutes, which are STUK’s TSOs and whose experts are potential staff for STUK. A basic professional six week’s training course on nuclear safety gives a wide view on the area and has been arranged annually since 2003 with the ministry, VTT, technical universities and power companies; the 7th course is ongoing.

General information on training and training planning (see answer to question 4.).

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

STUK has following repositories for OE: Nuclear Safety Archive (YTD), where all the documents submitted by licensees as well as related STUK's decisions and responses are registered and stored. YTD is part of STUK's Document Management System (DOHA), which is a common repository for all documents, memos, assessments and reports of STUK.

IRS-reports received from IAEA are also stored into STUK's Document Management System (DOHA) in a separate folder with related presentations given in NC or WGOE meetings and other related documents e.g. reports, memos etc. STUK has also its own Access-based IRS database, where every IRS report received through the IAEA WBIRS is recorded with a short event description (in Finnish), the categorisation, justification for STUK's position and summary of actions needed or already performed at Finnish NPPs (in Finnish and in English) for each report categorized to class 1 or higher.

Information on the events at Finnish plants with links to licensees' event reports and the text written in STUK's Quarterly Reports on the Use of Nuclear Energy in Finland are available on STUK's intranet. Also the list of IRS-reports is in the intranet. STUK's responses on lessons presented in IRS-reports can also be found in the intranet (actions in Finland or good practice in Finland in a case issue had been addressed earlier with proper actions).

In addition to the events being reported in the Annual and Quarterly Reports on the Use of Nuclear Energy in Finland, these reports act as a good collective memory on the events, licensees' and STUK's actions.

How does your RB measure if the methods are effective? (Kuinka viranomainen mittaa näiden menettelyjen tehokkuutta ja vaikuttavuutta?)

STUK monitors the efficiency of its administrative processes, e.g. handling times for event reports received from nuclear power plants.

In connection of a safety significant event requiring a special report the licensee and STUK review recurrence of an event. STUK follows the number of licensees' event reports in different categories: special reports, disturbance reports, and incident reports by its plant performance indicator system. STUK divides the direct causes of events roughly into technical failures and erroneous operational and maintenance actions (non-technical, human errors) which are also followed as indicators. Risk significance of operational events is followed by PSA based indicators as well.

As the indicator, the annual probability of an accident leading to severe damage to nuclear fuel (core damage frequency) is also followed. The accident risk is presented per nuclear power plant unit. The data is obtained as the result of probabilistic risk analyses (PRA /PSA) of the nuclear power plants. The indicator is used to follow the development of the nuclear power plant's accident risk. The objective is to operate and maintain the nuclear power plant so that the accident risk decreases or remains stable. Risk analyses can help detect a need to make modifications to the plant or change operating methods. Decrease of accident risk achieved by safety enhancements which were implemented on the bases of OE from own or foreign plant can be assorted but is not reported separately.

STUK follows the number of IRS report received annually through IAEA WBIRS as well as the number of reports assessed by STUK's IOEF group. Also the numbers of reports falling into different categories in STUK assessment are followed.

STUK does not have any explicit indicators for assessing the adequacy (efficiency) of licensees' or its own event investigation activities.

France

What is your reagultory body's (RB's) process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

ASN and IRSN processes include both capture/collecting, transfer/sharing, and organising/storing.

ASN has quality assurance processes that define the management of operating experience.

What organisation or people in your RB are involved in the process of knowledge management for operating experience?

In ASN, both people from directorates and regional units are involved in Op. E. management process. The ASN directorate for NPP includes an Op. E. Unit (7 members but who are not dedicated to Op. E. and are in charge of other missions). In every regional unit, one person is part time in charge of Op. E.

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

ASN fills its own database to which all ASN inspectors have access. ASN and IRSN have also access to the EDF national events database called "SAPHIR". IRSN operates the relevant international systems IRS, IRSRR and FINAS. At quarterly meetings between EDF, ASN and IRSN, additional information are also reported on a selection of events made by the TSO, the RB and the licensee.

Every year, a report concerning Op. E. is made by ASN inspectors for each NPP. Then all reports are analysed and summed up by people from the ASN directorate.

Besides, ASN and IRSN also exploit other international feedback sources (IRS reports, Information Notices and Regulatory Guides produced by the NRC, events declared in the IAEA NEWS database, information exchanged in the context of international co-operation).

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

At ASN, inspector's training includes 2 days specifically dedicated to Op. E.. ASN generalists also derive benefit from the technical experts from IRSN staff, who have long-term experience on specific subjects.

In order to inform people in regional units, the Op. E. Unit select the events most interesting for inspectors based on a 2-weeks review, and suggest subjects to be checked by inspectors. One objective of the Op. E. Unit is also to give advice to inspectors (reporting criteria, INES level, actions for inspectors…).

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

ASN:

- ASN database of events and their analysis.
- Op. E. Unit: e-mail box.
- ASN Guidelines: written by Op. E. Unit and introduced during training of inspectors (reporting criteria, INES level, …).

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

The ASN national database offers a free access for every ASN inspector to events and ASN guidelines.

Every 3 years a meeting of the Advisory Committee for Reactor Safety (GPR) experts is organised in order to examine the significant incidents of past 3-year period. The objectives of this meeting are to put forward modifications of equipment or mode of operation, on the base of an in-depth analysis of incidents made by IRSN and EDF.

For these periodical meetings, IRSN presents in a report a general review of safety and radiological protection based on Op. E., as well as in depth analysis of several specific topics related to events in the period. The IRSN reports are available in ASN internal documentation.

How does your RB measure if the methods are effective?

ASN:

- ASN audit periodically organised
- ASN directorate/regional units meetings: every 3 months, while directorate present their actions, regional units express their feedback

Hungary

What is your regulatory body's (RB's) process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

A new knowledge management system is under development. OEF will be a central part of the new system. The data of internal and international experience will be placed here. The data upload and the construction of the user interface are on the way.

On the basis of different levels of access, it is available for the authority, the licensees and the TSOs to up/download information to/from the database.

Now, the collection and storage of the internal and external experiences is done in different databases. The internal (Hungarian) database contains the data of all the reportable events and the low significance events discovered by the authority. We follow up the mitigating actions worked out throughout the event assessments and the status and deadline of these actions too.

The main source of international experience is the IRS database. The interesting events are translated and stored on a drive of the network. Since the web IRS works, the IRS reports are not forwarded.

What organisation or people in your RB are involved in the process of knowledge management for operating experience?

To develop the database, we use outside resources too. At the HAEA, three persons of a department deal with the process.

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

The screening of the experiences is performed according to the internal procedure and all the inspectors within the organisation may initiate the use of an experience.

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

Now, we share/spread the experiences in email notifications, discussions, monthly meetings and the assessments of the licensee's event reports.

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

In the frame of its standard newcomer training program the authority makes the new inspectors acquatinted with the essential features of databases used for obtaining and storing these lessons learnt. These educations are held by professional, daily users of these tools.

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

Now the internal network and a Lotus database based on the internal experiences are available. The new system will provide help to share the experiences in a user friendly way.

How does your RB measure if the methods are effective?

Our internal indicators refer to the use of Hungarian experiences.

Japan

Since the initial operation of the Japan commercial Nuclear Power Plant in 1966, studying Operating Experience (OE) has been an important subject for plant operators and the regulatory body to mature knowledge regarding safety assessment, feedback to technical standards; criteria; policies, etc. The Nuclear and Industrial Safety Agency (NISA) of the Ministry of Economy, Trade and Industry (METI) is a regulatory agency. The Japan Nuclear Energy Safety organisation (JNES) is a technical support organisation to the NISA. The NISA and the JNES are cooperating on nuclear power plant OE review for ensure regulatory enforcement.

The JNES is a knowledge-centric organisation that relies on its staff supports to make regulatory decisions needed through accomplishing the NISA nuclear regulatory process. This document describes the answer of the NEA WGOE questionnaires about "The International Special Topic Extended Meeting on Maintaining and Transferring Knowledge from Operating Experience" by JNES as representative of Japan.

What is your RB's process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

The NISA evaluates plant operator's event reports about cause investigation; policy planning; validity assessment; sharing to the other plant operators as lessons learnt etc, through regulatory inspection.

The JNES maintains operator's event information in a database that includes minor incidents. Also, the JNES maintains overseas information on this subject.

The NISA and the JNES hold Safety Information Review Meetings (SIRM) periodically to evaluate overseas operating experience. The JNES reports screening output and the NISA feeds it back to the regulatory enforcement. Also, the NISA notice overseas event information to the plant operator for their reference, even if these events have no need for feedback to the regulatory guide.

What organisation or people in your RB are involved in the process of operating experience knowledge management?

Organisations are involved in the process of operating experience knowledge management at the NISA and the JNES. The JNES advises the NISA about technical issues through whole activities as follows:

- Correspond on domestic events:
- Operating experience database shares evaluated operating experience data to the JNES staff.

The RB of Japan has established the web based information sharing system in which site-inspectors can share the incident reports at each reactor sites. Knowledge sharing tools would be elaborated in corporation with TIP service ability.

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

The JNES is preparing preliminary project planning work about improvement of knowledge management; advancing tools utilisation; transfer or share the lessons learnt, etc. The NISA is in the picture of the user of the next step JNES information systems.

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

The JNES has been maintaining Technical Information Data Base (TIDB) for use as technical support work to the NISA activities. TIDB consists of multiple database systems which contain individual technological area of information. There are some knowledge related data stored, such as screening report of the important event process, such tools will be shared with the NISA in the future.

How does your RB measure if the methods are effective?

To evaluate a method's effectiveness is one of the approaches of RB measurement, which is one of the future knowledge and information management subjects.

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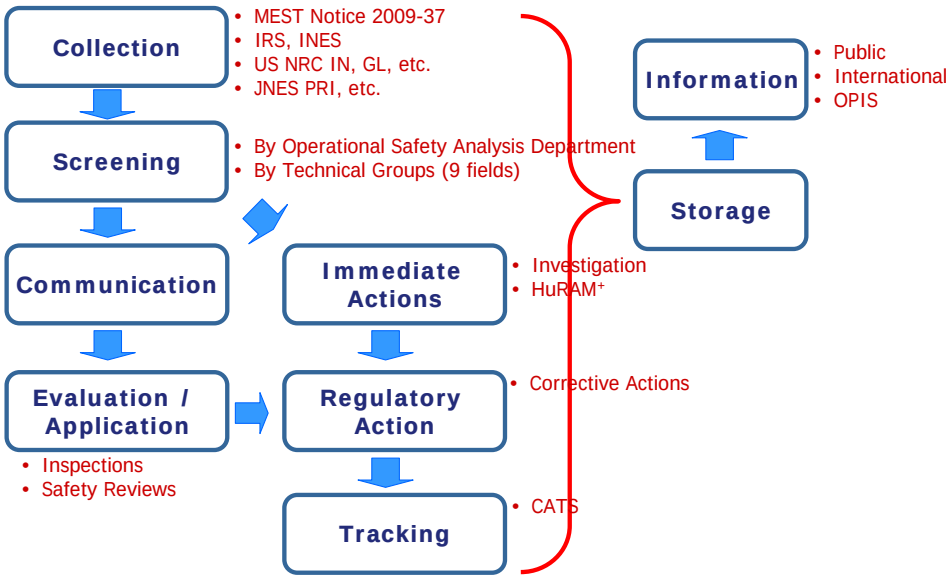
Republic of Korea

What is your reagultory body's (RB's) process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?



What organisation or people in your RB are involved in the process of knowledge management for operating experience?

Department of Operational Safety Analysis, Nuclear Regulation Division, Korea Institute of Nuclear Safety

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

Corrective Action Tracking System (CATS) for tracking of regulatory corrective actions to prevent recurring for domestic events and, Dissemination of Incidents and OE System (DIOS) for collect/ classification/ dissemination of OE.

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

- MiDAS for management of regulatory inspection and safety review.
- Operational Performance Information System (OPIS) for incidents of NPPs.
- Dissemination of Incidents and OE System for OE information.
- Safety Issue Management System (under development).
- National Operational Experience Feedback Workshop (once a year).

- Education and Training Program.

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

Same with the response of No. 4

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

Using the Systems and Workshop shown as Response of No. 4

How does your RB measure if the methods are effective?

Satisfaction Investigation (or Enquete) of Users or Participants for Systems or Workshop, respectively.

The Netherlands

Questions:

- *What is your RB's process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?*
- *What organisation or people in your RB are involved in the process of OE KM?*
- *What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?*
- *What are the tools utilised by your RB to transfer or share the knowledge to the current staff?*
- *What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?*
- *What are the processes or tools by which your RB organises or stores the knowledge (e.g.,database, Communities of Practice websites)?*
- *How does your RB measure if the methods are effective?*

Answers:

The process for managing knowledge of operating experience in the Netherlands is a two-tier approach consisting of a permanent training programme and the active exchange of operating experience by internal and semi-internal seminars on different aspects of the operation of nuclear installations. Transfer of knowledge from the older to the younger generation is actively encouraged.

VROM/VI, the mother organisation of the KFD has an institutionalized training centre. KFD uses coaches and mentors.

The tools used are hand-outs, internal and external seminars and courses, several databases, personal and personnel coaching and the KFD standing task force on operational experience which meets at least 6 times a year. Information is collected from all available sources.

New staff embark on a two year training programme that is focussed on the expertise to be developed by the new employee.

This training programme is custom made for every new employee.

Storage of the operating experience and the training programmes is digital.

Practice websites may be used. Examinations take place. There is a formal radiation protection minimum requirement and a nuclear safety minimum requirement. Exams have to be passed.

The measurement of the effectiveness of the training is demonstrated by carrying out new tasks independently with good result.

Slovenia

Maintaining and Transferring Knowledge on Operating Experience

What is your RB's process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

At the regulatory body, Slovenian Nuclear Safety Administration (SNSA), the process for managing knowledge of operating experience (OE) is defined in internal operational procedure (no. OP 2.1.2). The purpose of the process is to learn about foreign' experiences to prevent similar events in Slovenia and to build on good foreign practices. The processing of operating experiences (OE) comprises five main tasks: tracking, screening and evaluating operating experiences, preparing and executing action plan, and archiving. Timely and competent evaluation of OE enables SNSA to be anticipative and proactive.

With the development of the electronic data storing system the SNSA puts a lot of effort to make all OE data inputs easily accessible and user friendly. The domestic operating experience is not organised as such, due to the fact that there is only one NPP in Slovenia. Knowledge about its operating experiences are managed through archiving of inspection findings, organising and storing data on events, work orders, performance indicators, some safety relevant SSCs etc. on our intranet.

What organisation or people in your RB are involved in the process of OE KM?

The SNSA employs only 41 specialists in 4 divisions therefore almost every employee is somehow involved in the process of OE and OE KM. Nevertheless most of the process is limited to the activities of the nuclear safety division (ca 12 employees).

In the process of using a particular foreign OE are, according to OP, involved the following people: OE administrator, a chosen analyst and nuclear safety section head, and if needed also director of the SNSA, director of inspection, radiological and nuclear safety inspector and other SNSA employees. The OE administrator is tasked with management of the OE process including documentation and archiving. Director of the SNSA checks the OE process every three months when the administrator presents status of the OEs being analysed and those OEs which are about to be treated. Based on the analysis, the analyst proposes an action plan and follows it through to its conclusion. All SNSA employees have access through special software application to the OE database where operating experiences and all the steps for every considered OE are documented.

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

Our only NPP's periodic reporting (daily, monthly, quarterly), event reporting and modification notifications or requests are primary input for the SNSA about OE of our only NPP. Foreign operating experiences that are screened by the SNSA staff according to relevant OP are obtained through NRC website, IAEA IRS, other IAEA documents, documents of foreign regulatory bodies, EC Clearinghouse and other relevant documents. Also all SNSA employees are expected to report any information that could be used in OEF system. Relevant intranet databases are used to collect actions taken and lessons learnt from operating experiences.

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

The SNSA Info System enables easy and transparent intranet access for all staff to the relevant data collections of NPP performances: shutdowns (from 1981 onwards), event reports and analysis (from 1993 onwards), modifications (from 1995 onwards) and corrective work orders (from 2005 onwards). Intranet enables also access to database on foreign operating experiences (from 2004 onwards). The knowledge is also shared to the staff through meetings that are organised within individual division, between particular divisions or for all SNSA staff. Meetings on current issues are performed as a rule once per month.

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

The SNSA does not have a special OE KM strategy regarding future/new staff. The newcomers gain the necessary insight in operating experiences through their work, on the job training and participation in international training courses.

The IRRS mission (25.9-4.10.2011) which has a section of sharing of operating experience and regulatory experience. Some informations about the IRRS mission: At the request of the Government of the Republic of Slovenia, an international team of ten senior safety experts met representatives of the Slovenian Nuclear Safety Administration (SNSA), from 25 September to 04 October 2011, in order to conduct an Integrated Regulatory Review Service (IRRS) Mission. The mission took place at the headquarters of SNSA in Ljubljana. The purpose of this IRRS mission was to review the effectiveness of the Slovenian framework for safety as implemented by SNSA. This IRRS mission was the second to be conducted after the occurrence of the TEPCO-Fukushima Dai-ichi accident. Accordingly, special attention was given to the regulatory implications of the TEPCO-Fukushima Dai-ichi accident in the Slovenian framework for safety, as part of a newly developed core IRRS module.

The review compared Slovenian regulatory framework for safety against IAEA safety standards as the international benchmark for safety. The mission was also used to exchange information and experience between the IRRS Review team members and the Slovenian counterparts in the areas covered by the IRRS.

The IRRS Review team consisted of 10 senior regulatory experts from 9 IAEA Member States, 4 staff members from the IAEA and an IAEA administrative assistant. The IRRS Review team carried out the review in the following areas: responsibilities and functions of the government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body including the authorization, review and assessment, inspection and enforcement processes; regulations and guides; emergency preparedness and response; waste management; decommissioning; public and environmental exposure control; and transport.

The IRRS mission also included the following Regulatory Policy Issues for discussion: response to the TEPCO-Fukushima Dai-ichi accident; long term operation of nuclear power plant and waste management. The IRRS review addressed all facilities and activities regulated by SNSA: one nuclear power plant, one research reactor, one radioactive waste storage facility, the former uranium mine and all use of radiation sources outside the health and veterinary sectors. Radiation sources in the health and veterinary sector (not regulated by SNSA) were not included in the scope.

The mission included observations of regulatory activities and a series of interviews and discussions with SNSA staff and other organizations to help assess the effectiveness of the regulatory system. These activities included visits to: the Krško nuclear power plant, Off-Site emergency Facility (NEK EOF) Emergency Center, the Brinje TRIGA Mark II research reactor and the industrial radiography facility at the Institut zametalne konstrukcije. Throughout the review of the various areas and policy issues, special consideration was given to the implications of the TEPCO-Fukushima Dai-ichi accident for the Slovenian Regulatory System. The IRRS team members observed the working practices during inspections carried out by SNSA, including discussions with the licensee personnel and management. SNSA provided the IRRS Review team with advanced reference material and documentation including the results of the self-assessment in all areas within the scope of the mission. Throughout the mission, the IRRS Review team was extended full cooperation in regulatory, technical, and policy issues by all parties; in particular the staff of SNSA provided the fullest practicable assistance.

The IRRS Review team identified a number of good practices, made recommendations and suggestions that indicate where improvements are necessary or desirable to continue enhancing the effectiveness of regulatory functions in line with the IAEA Safety Standards.

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

Intranet based databases and relevant internal procedures (OPs).

How does your RB measure if the methods are effective?

There is no special process at SNSA for this in place. Effectiveness of the OE methods is in a way reviewed yearly within the scope of the yearly quality assurance review of SNSA work. Once per year QA evaluators perform evaluation of work done by each division and SNSA as a whole. Statistical analysis of RB's work in the OE field is also routinely performed (number of analysed OEs, number of finished and open actions...). Regarding the OE KM in 2009 the introduction of meetings between Nuclear Safety Division and Inspection Division discussing open OEs has been marked as a good practice.

Spain

CSN (Spanish Regulatory Body) doesn't have a formal program for Knowledge Management. There are some specific practices as for example, whenever a CSN Technical Instruction is issued, the person responsible gives a talk to the CSN staff.

What is your regulatory body's (RB's) process for Knowledge management of operating experience? (record/collecting, Knowledge transfer and organisation of information)

The knowledge of incidents that occurred in NPP is obtained through: daily communication with Resident Inspection, Event Reports informed by the NPP, also through the Inspection process and the evaluation of the CSN (The Spanish Nuclear Safety Council)

Daily Communication

First thing in the morning, the Coordinator for Resident Inspection, located at the CSN headquarters has several conversations with the Resident Inspection, situated on each site, in which they inform him about the incidents and operational aspects that are most relevant to the plant.

After this phone conversation with the Coordinator for Resident Inspection, he informs the daily meeting of information about the plant to the Project Manager and to the different Specialist Areas in the CSN, where depending on the type of incident, they can decide if: they make a phone call to the plant to obtain more information, they request that the plant sends further information, or they request the emission of an ER (Event Report)

At the end of the week, every Friday, each Resident Inspector sends to the CSN Headquarters, a summary of incidents which have occurred in the plant, which are put at the disposition of the rest of the CSN staff on the Internal website.

Event Reports notified by the NPP:

Apart from the procedure previously described for minor incidents, the plants have to send notification – after one hour or within 24 hours – of the incidents that fulfill certain notification criteria – according to the IS 10 Technical Instruction of the CSN. The incidents are sent by the plant in a Event Report (ER) to the Emergency room of the CSN; after this a more detailed report is sent on, 30 days later. The ERs are evaluated initially by staff in Operational Experience and Training and then incorporated into the database of Event Reports, which holds logs of over 1800 entries and may be checked by all CSN staff.

Additionally these reports are distributed within the Spanish Nuclear Plants, and some of them which fulfil certain criteria are communicated by the CSN to the public by press releases or via their website.

Inspection Process & CSN Evaluation:

As well as the ER (Event Report) that the plant must send in 1 hour or within 24 hour periods, on site

the Resident Inspection of the CSN carry out a revision of the problem, in the specific area, checking that the information that the ER contains is exact and clearly understood, using the information given by the responsible person as well as adding their own independent observations.

In order to do this, after receiving the incident notification, the inspectors compile details relative to the situation of the plant and to the behaviour of equipment, components and of the staff whom have taken part in the incident.

The knowledge of other incidents in the plant also may be found during the periodic inspections – as much in the basic inspections as well as supplementary or incident investigation inspections – or even during the evaluation processes carried out by the CSN. As well as the ER database, there is another type of database with generic issues, so called due to the fact that it may affect various Spanish plants, and that contains entries of ER that apply to more than one plant, IRS reports, Generic Letter, IE Bulletin, or new requirements published by the NPP project origin country.

Which organisation or people in your RB are involved in the process of knowledge management for operating experience?

In the CSN the people in the Operating Experience and Training Area, depend on the Nuclear Installations Department, are involved in the process of knowledge management for operating experience.

What are the tools used by your RB to record or collect lessons learnt from operating experience?

The Incident revision panel, made up of representatives of the several specialist areas of the CSN (Nuclear Systems, Mechanic Engineering, Electrical Systems and Instrumentation Control, Auxiliary Systems & Maintenance, etc) meet monthly, to analyze the ER in more depth, propose a series of additional actions and classify them according to their significance of risk.

After each meeting of the Incident revision panel, the minutes of the meeting are written up. Then they are distributed to the members of the Incident revision panel and approved them during the follow up meeting. Afterwards they are put onto the ISN database.

The Incident revision panel revises the ER with the following point of view: quality of report content, suitability of the corrective actions which were proposed by the Licensee to avoid the repetition of the incident and possible application to other Spanish plants. The Incident revision panel may propose the following actions, if the actions proposed by the plant are considered insufficient:

- Request for additional information.
- Request to carry out Root cause analysis to find the cause of the incident.
- Carry out a monographic inspection at the site.
- Preparation of an in depth evaluation with details of the incident by specialist in that particular area.

Additionally, if the incident is considered to be generic, as it could affect other Spanish plants, the Incident revision panel may propose as an additional measure, a letter to be sent out to the plants that are potentially affected so that they may analyse the application of this incident and propose preventative actions to avoid it occurring. When the analysis has been completed, the Incident revision panel agrees on the classification of the incident, according to its importance with regard to safety: significant event, event of interest or generic event.

What are the tools used by your RB to transfer or share the knowledge to the current staff?

- Event Report Database.
- Generic Issues Database.
- Weekly report of minor incidents sent by the Resident Inspectors.
- Minutes from the Incident revision panel meetings.
- All of these tools are accessible to all CSN Staff through the internal website.

What are the processes or tools used to capture and transfer or share the lessons learnt to future staff?

The CSN has the following processes and tools to record and share the knowledge acquired for the future generations at the CSN:

- IRRS Mission (28 Jan – 8 Feb 2008) which has a section on best practices.
- Procedures.
- Document management System. Containing all the internal reports carried out by the CSN, as well as the documentation received and sent to other plants.
- Competence Management System.

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

Basically through databases with generic issues and Event Reporting, the latter include the following:

- Basic information on the incident (Plant, Date, Title, Mode, Power, etc.).
- Specific Information (Cause, Applicable notification criteria, etc).
- Level of Classification of importance of the incident given by the Incident revision panel.
- Findings or associated errors.
- Additional documents (LER Resident Inspection notes).

Follow up with summarized information from the reports received and additional information which is linked to the incident.

How does your RB measure if the methods are effective?

Through the performance indicators:

Classical performance Indicators (previous to the Reactor Oversight Process of NRC - ROP)

Performance Indicators based on ROP

United States

What is your regulatory body's (RB's) process for managing knowledge of operating experience (capture/collecting, transfer/sharing, and organising/storing)?

The NRC uses several complementary processes to successfully manage the transfer of knowledge:

Knowledge Sharing – Knowledge sharing involves the capture of informal discussions and experiences, in this case, Operating Experience (OpE), as it becomes available, through the collection and screening and evaluation processes. This activity includes data capture of OpE reported by licensees, or that identified and passed on by NRC Resident Inspector and Regional inspection staff. This type of knowledge sharing may occur during routine OpE screening meetings or special workgroup exchanges to resolve issue(s).

Information capture may be in the form of meeting minutes, questions & answers, etc. The NRC also uses forms of "storytelling" or other informal information exchanges, for example, lunch & learn sessions to remind or inform staff of historic events. Additionally, informal mentoring is routinely supported and encouraged within the various organisations to help ensure transfer of important learning and experience from more experienced staff to new or less experienced staff.

Communities of Practice (CoP) forums are hosted on agency internal websites, allowing staff to share information regarding particular experiences, events, or practices. Many of these articles are in the form of blogs which help to encourage a sense of interactivity or exchange of thoughts/ideas. NRC uses processes involving the linking of many independent databases or electronic repositories to WebPages & portals.

The NRC has also captured interviews with staff regarding response to particular events or occurrences

that may be determined to have historical value. Such information may be documented in podcasts, awareness seminars, video training libraries, etc.

Personnel Development – The NRC encourages every staff member to develop an Independent Development Plan (IDP) to set strategic long & short terms goals to meet the agency mission. This is accomplished by identification of appropriate training for individual staff.

The NRC requires all newly reporting staff members to complete a qualification process which includes satisfactory completion of agency, branch, on-the-job-training (OJT), and oral qualification board examinations. Through the use of checkouts, OJT and individual study, the qualification process establishes a formalized mechanism to systematically transfer knowledge from more experienced staff members to those newly arriving at the agency.

Via the use of Training Centers located near NRC Headquarters in Bethesda, Maryland, and in Chattanooga, Tennessee (which includes classroom and simulator training facilities), the NRC has focused resources on appropriate formal classroom training for all staff, based on their needs. Training includes many engineering/technical courses (including PRA and software analysis codes), administrative & management classes, computer based training, etc. These classes are instructed by individual staff members and contractors with advanced training credentials and/or nuclear industry/military experience.

The NRC supports and encourages staff to become involved in either coaching or rotation opportunities in other parts of the agency. This interaction provides staff with exposure outside of their immediate position or daily discipline; enabling them to have a better overall understanding & comprehension of other aspects of agency operations.

Succession Planning – The NRC strives to place the right person in the right job in order to meet agency objectives. This is accomplished by adhering to a Strategic Workforce Planning process. The NRC uses targeted recruitment processes to fill and maintain specific skills gaps. NRC has deployed a process to recapture retirees (annuitants) for the specific transference of knowledge to incumbent staff. The NRC uses incentives for personnel recruitment, retention, and relocation.

What organisation or people in your RB are involved in the process of knowledge management for operating experience?

- Office Champions (Executive members of Management)
- Branch SharePoint (Subsite) Administrators
- Operating Experience Branch staff (through their interactions with OpE processes and databases, and issuance of Operating Experience communications)
- Office Web Services Team
- Community of Practice (CoP) Administrators (Counterparts)
- The various Office Program Management, Policy Development and Analysis (PMDA) Staffs provide KM support
- Subject Matter Experts (SME)

What are the tools utilised by your RB to capture or collect lessons learnt from operating experience?

- Community of Practice WebPages & blogs (Tomoye ECCO)
- NRC@Work web pages - hosted from Windows IIS platform
- Reactor Operating Experience Information Gateway (internal webpage)
- Branch/Divisional SharePoint sites (portals) – hosted from Microsoft Office SharePoint Server (MOSS 2007) platforms
- NUREGS; Brochures
- Agency Official Records (AOR) – entered into the Agency-wide Document Management System (ADAMS)

- Agency Historian Publications
- Agency Technical Library
- Information Exchange with other Agencies/Organisations – (i.e., DOE, NASA, Industry, etc.)

What are the tools utilised by your RB to transfer or share the knowledge to the current staff?

- Inspector Newsletters
- Reactor Operating Experience Information Gateway (internal webpage)
- Internal Operating Experience communications (OpE COMMs)
- OpE work processes involving evaluation of Issues for Resolution (OpE that is screened in for further evaluation due to safety significance and generic applicability)
- Generic Communications on OpE topics
- Lunch/Learn Seminars
- Knowledge Management Fairs
- Regulatory Information Conferences (RIC)
- Techical Conferences
- Value Added Summaries (Region Resident Inspector Offices)
- Agency Historian Publications
- Mentoring – Information exchange between senior to junior staff
- Divisional (Qtr)/Branch(Week) staff meetings
- Anniversary Events – (i.e., TMI, Brown Ferry, etc)
- Staff Training seminars – (i.e., EPRI, INPO, etc.)
- Tutorials (Automated or personalized hands-on coaching/training)

What are the processes or tools utilised to capture and transfer or share the lessons learnt to future staff?

- New Employee Orientation – (i.e., What It Is What It Does sessions)
- Qualification Process – ADM 503/504
- Reactor Awareness Seminars
- Training at Professional Development Center (PDC) – (Bethesda)
- Training at Technical Training Center (TTC) – (Chattanooga, TN)
- Coaching/Mentoring

What are the processes or tools by which your RB organises or stores the knowledge (e.g., database, Communities of Practice websites)?

Please see the answer to question 3. In addition, note that the office of Nuclear Reactor Regulation (NRR) within NRC has issued an office instruction, ADM 506 -- Knowledge Management Process. The purpose of this Office Instruction (OI) is to provide guidelines to ensure that the Office of Nuclear Reactor Regulation (the Office) effectively uses knowledge management to fulfill the Office's mission consistent with the U.S. Nuclear Regulatory Commission's Strategic Plan.

Additionally, this OI describes how the Office will identify, capture, transfer, and retain critical knowledge that promotes continuous learning and transfer between subject matter experts and staff members. This Office Instruction (OI) is intended to guide routine knowledge capture within a critical program and/or skill area. It describes the expectations for capturing information, knowledge, and review guidance. It also identifies specific roles and responsibilities for managers, supervisors, and staff members. Finally, it is a useful resource to help plan and implement knowledge transfer (KT) strategies throughout the Office. Among the requirements and tasks within this instruction are the following steps, which have a checklist of questions to help supervisors assess the need for KT in their areas of responsibility:

- Assess the Need for Succession Planning for Critical Workforce Skills.

- Identifying Additional Knowledge Possessed by Subject Matter Experts.
- Determining the Intended Recipient for KT.
- Capturing knowledge from the Subject Matter Expert.
- Common Practices Used to Transfer Knowledge.

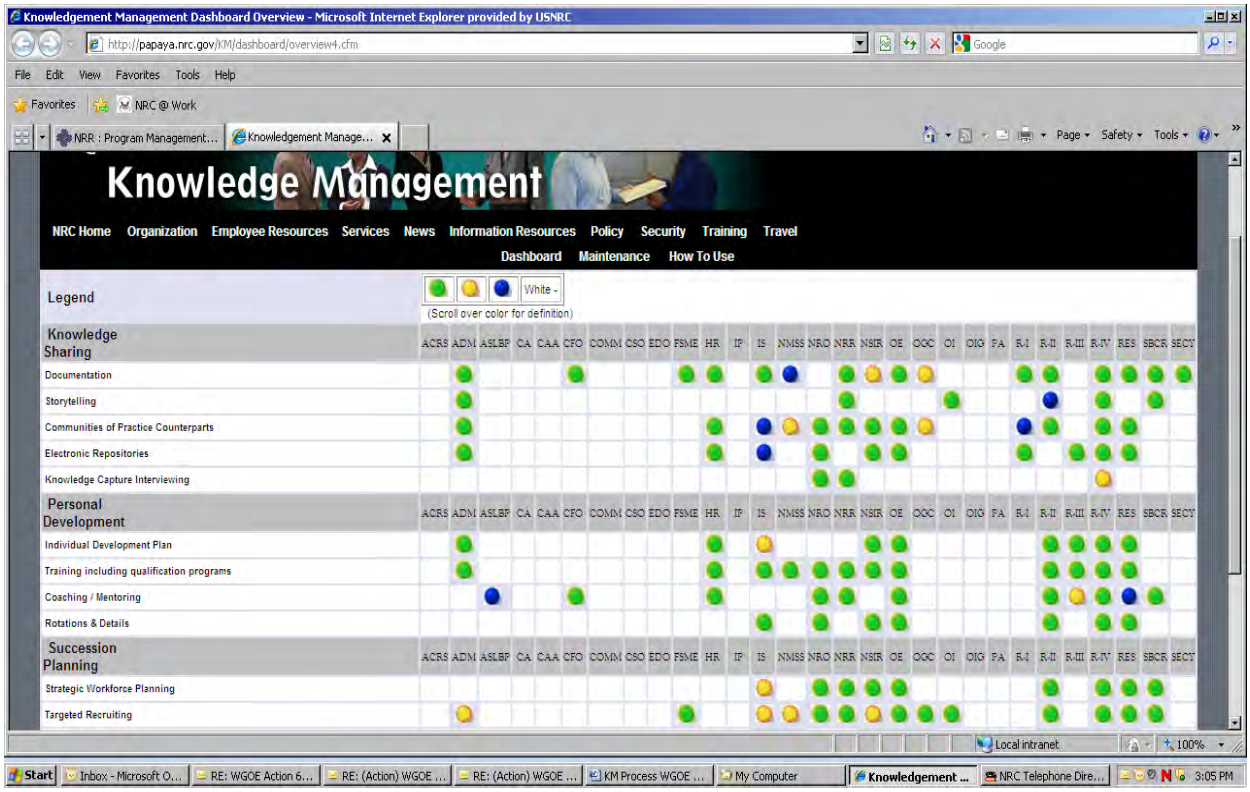
At a minimum, any knowledge captured to support KT should first be assessed and evaluated for integration into an existing regulatory process.

Once the knowledge has been captured into an existing regulatory process, priority should be given to integrate captured knowledge into NRR's New Hire Orientation Program, Qualification Plans, and Branch-Specific Training Plans. Given sufficient time and resources, the subject matter expert's knowledge can also be captured into less formal practices where appropriate. The implementation of these practices is typically driven by the unique needs of the staff within the unit. They will vary from unit to unit.

How does your RB measure if the methods are effective?

- Dashboards (i.e., KM dashboard* evaluates level of NRC office participation in various KM activities)
- Training attendance metrics
- Training & qualification review boards assessment of candidate knowledge
- Performance measurement/appraisal of operating experience staff
- Region Staff and Resident Inspector Feedback on value of information and tools provided.

*See below for an example (print screen) graphic of dashboard status indicator

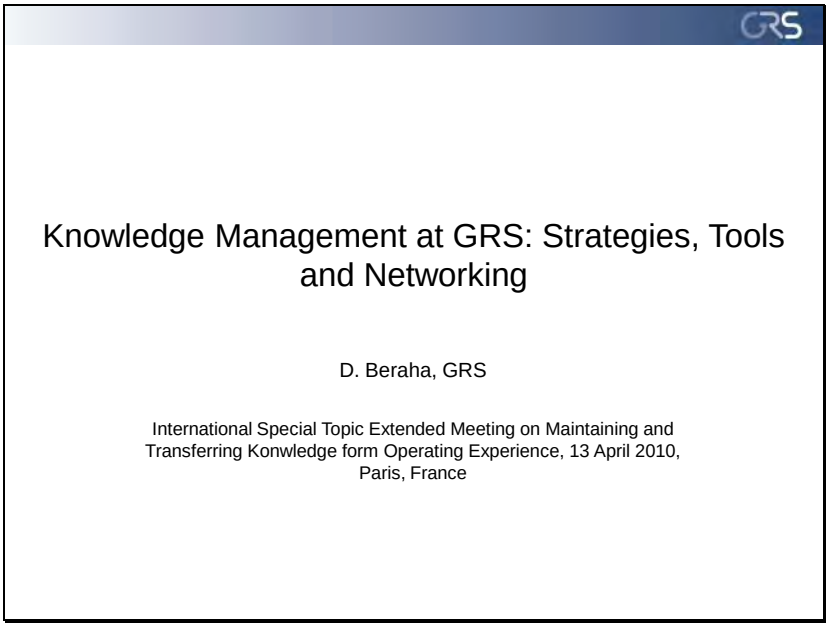


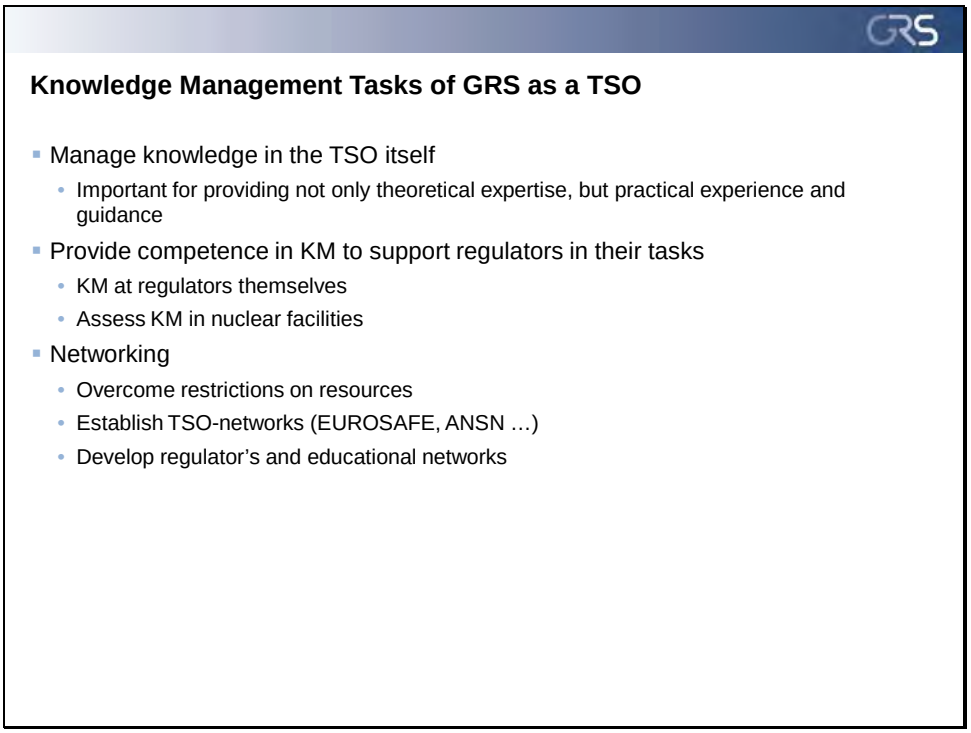
Green = Current
Yellow = Pending
Blue = Completed
White = No activity - Strategy not attempted or not needed.

Appendix C

Presentation Materials

David Beraha, GRS
Knowledge Management at GRS: Strategies, Tools and Networking





KM at GRS

- Driving force: Retirement of a generation of experts, shortfall of junior experts, lack of education and training opportunities
- Range of KM activities
  - Hiring junior staff
  - Improved education and training
    - New and extended education modules for newcomers
  - Developing a KM Infrastructure:
    - GRS-Intranet Portal
    - Teamsites and portals for cooperation between other organizations

→The generation change is in full swing – envisaged to be almost accomplished by 2013

Early attempts at retaining expert‘s knowledge

- Experimental Workshop on Knowledge Retention in the knowledge domain of „Containment“ early on (2001)
  - Domain choosen because of retirement of a leading expert
  - Group of 4 subject experts, supported by 3 KM people
  - Aim: build an knowledge base by use of an ontology (topic taxonomy + links between topics)
- Conclusions
  - Achievements
    - Construction of a „controlled vocabulary“ and an ontology for the containment
    - Intensive exchange between the subject experts leading to knowledge transfer
  - Drawbacks
    - Knowledge elicitation time-consuming and costly
    - Concentration on a single expert may not be the best path, since knowledge is spread among many experts, vast literature, many outside sources (people, literature, internet …)
  - Decision for further work
    - Provide Corporate Memory, particularly the Project Center
    - Concentrate on „knowledge pages“
    - Provide collaboration sites and portals for national/international teams

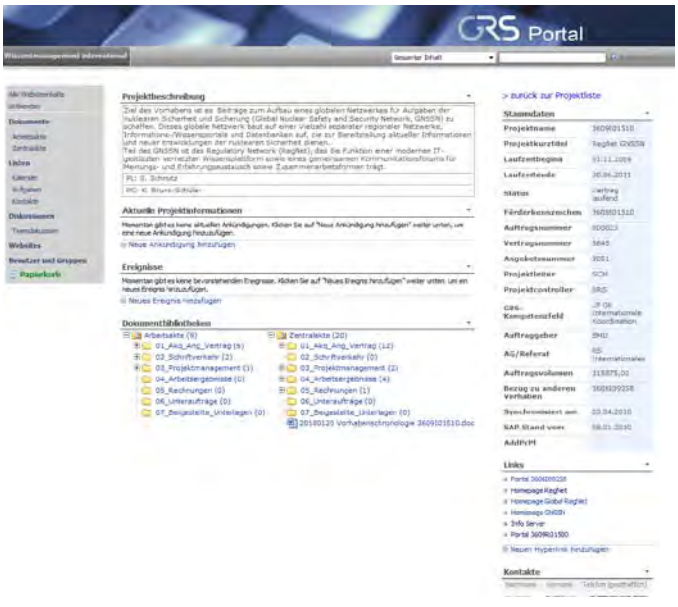
GRS Intranet Portal

- Central access point to all documents and information
  - Realized with MS Sharepoint Portal
    - Document Management
    - Collaboration
- Document Management System (DMS)
  - Build a “Corporate Memory”
  - DMS features include checkIn/checkOut, versioning, metadata (document profile data) ...
- Extensive search facility
  - All portal content
  - Crawling and indexing of external sources, mostly
    - File Shares (CD’s, …)
    - Notes Databases
- Very good integration with MS Office 2007

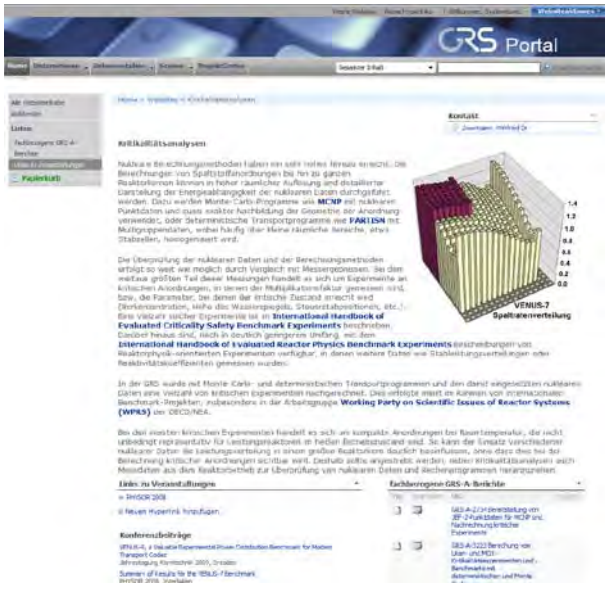
- “Vertical” structure
  - Management site with main business indicators, Divisions sites, Department sites (all sites may have subsite hierarchies)
- “Horizontal” structure (cross cutting themes)
  - News
  - Yellow Pages
  - Project Center
  - Knowledge Pages
  - Quality Management
  - Education and Training
  - Organisation Handbook
  - Information Systems – Links to databases inside/outside the portal
  - GRS-Reports
  - Photo- and Overhead Archive
  - Support and Help (portal and non-portal content)
  - Ideas forum (improvements, innovations)
  - ...

- Project Portal
  - Projects are the **central business processes** at GRS
  - Each project has an own site (subportal)
  - All project relevant information and documents should be included
  - Clear guidelines for setting up and utilizing project portals
    - For every new project, a project site must be set up by the project controller (templates available in German and English)
    - Project controller and project leader has administration rights, all team members may contribute
- Knowledge Pages
  - Usually, several projects contribute to a broader view of the topic
  - Competencies of GRS refer to 3 main business areas
    - Reactor Safety
    - Waste Disposal
    - International and Cross-Cut ing Topics
  - Each area is subdivided in competence fields
  - For each competence field, an own portal site („Knowledge Page“) is developed
  - For each knowledge page, the same template is used on the first level

Example of a Project Site



Example of a knowledge page (criticality analyses)



- Collaboration
  - Open Team Sites for
    - Departments
    - Projects
    - Particular Areas
      - Emergency Response Team
      - Strategical Programme Groups
      - …
  - Closed Team Sites
    - Often short-term collaboration on restricted fields
  - Tools available on team sites
    - Announcements
    - Event calendar
    - Wikis
    - Blogs
    - Discussion forum
    - ...

Tools in use

- Features of the Sharepoint Portal Server
  - Sharepoint lists very flexible (sorting, grouping etc.), may replace databases
- Mind Maps
- CMapTools (concept mapping)
- Semi-automatic document classification (ontology based)
- Knowledge representation (KR)
  - Semantic Miner (semantic search)
  - K-Infinity (tested, but too expensive)
  - Protégé (ontology development for containment knowledge base)
  - Ontopia (topic maps)

  → KR tools mostly in test phase

Example of Sharepoint list as a database

- Data residing on an external file server (large binaries)
- Related documents stored in Sharepoint libraries

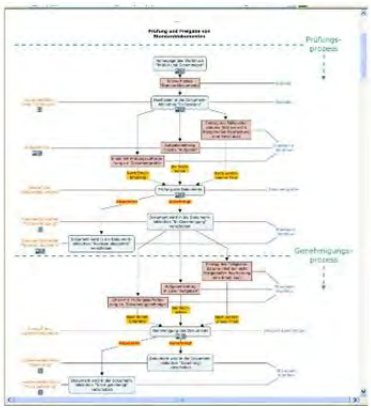
CORA-Experimente

Title	Date of Test	Reactortype	# of rods	Absorber	Burnup	Data	Report	Support
Cora2	06.08.1987	Fuel rods and grids only	25	-	Depleted Uranium	Cora02	Hardcopy only	
Cora3	03.12.1987	Fuel rods and grids only	25	-	Depleted Uranium	Cora03	Hardcopy only	
Cora5	26.02.1988	PWR	24	1(AIC)	Depleted Uranium	Cora05	Hardcopy only	
Cora7	22.02.1990	PWR	52	5(AIC)	Depleted Uranium	Cora07	Hardcopy only	
Cora9	09.11.1989	PWR	23	2(AIC)	Depleted Uranium	Cora09	Hardcopy only	
Cora10	16.07.1992	PWR	23	2(AIC)	Depleted Uranium	Cora10	Hardcopy only	
Cora12	09.06.1988	PWR	23	2(AIC)	Depleted Uranium	Cora12	Hardcopy only	
Cora13	15.11.1990	PWR	23	2(AIC)	Depleted Uranium	Cora13		KFK5287
Cora15	02.03.1989	PWR	23	2(AIC)	Depleted Uranium	Cora15	Hardcopy only	
Cora16	24.11.1988	BWR	18	blade (B4C)	Depleted Uranium	Cora16	Hardcopy only	
Cora17	29.06.1989	BWR	18	blade (B4C)	Depleted Uranium	Cora17	Hardcopy only	
Cora18	21.06.1990	BWR	48	blade (B4C)	Depleted Uranium	Cora18	Hardcopy only	
Cora28	25.02.1992	BWR	18	blade (B4C)	Depleted Uranium	Cora28	Hardcopy only	
Cora29	11.04.1991	PWR	23	2(AIC)	Depleted Uranium	Cora29	Hardcopy only	
Cora30	30.10.1991	PWR	23	2(AIC)	Depleted Uranium	Cora30	Hardcopy only	

Support of KM – activities at the BMU

- A knowledge management infrastructure centering on a Reactor Safety Portal has been designed and developed by GRS for the RS department at the BMU
  - Purpose of the RS-Portal
    - Work bench for the RS staff
    - Unique access point to information and collaboration resources,
    - Providing a Document Management System
    - Providing the means for workflow processes
  - Main topical sites
    - Homepage (entry point)
    - Rules and regulations
    - National ins itutions
    - Interna ional institutions
    - In house planning
    - Projects documentation
    - Department file system
    - Knowledge management
    - Quality management
    - …

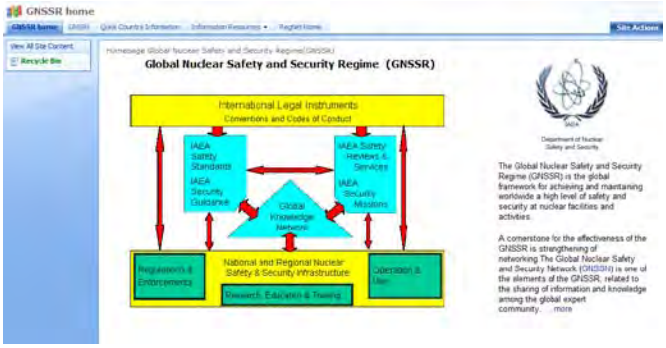
- Replication of project documentation (BMU sponsored projects) from the GRS Project Center to the RS-Portal (daily)
- Ongoing support for KM national and international activities within two BMU-funded projects
- Development of Workflows for main regulatory processes (ongoing)



Networking

- About 12 Portals for national and international collaboration
- Portals access from the outside controlled by UserID and password, secure links (https)
- Several ouside servers containing portals for
  - G8-NSSG
  - GRS Emergency Center
  - RAMG - Regulatory Assistance Management Group
  - Belene
  - EUROSAFE
  - ETSON
  - IRRS mission
  - …
- Portals for EU-projects
  - SARNET (Phase 1 and 2)
  - COVERS (ended)

- GNSN (Global Regnet)
  - A prototype developed by GRS in cooperation with BMU is being ported to the IAEA site
  - IAEA provides infrastructure
  - Site should be ready by Q3 2010



What's next?

- As the generation gap closes, knowledge transfer will loose importance
- Dominant KM issues will concern
  - Integration of KM in everyday work
  - Ease of documentation of KM activities
  - Sustained „Corporate Memory"
  - Improved internal/external collaboration in networks (e.g. Web 2.0, video conferencing)
  - Utilization of Knowledge Representation methods for modeling knowledge domains
    - Semantic Networks (Web 3 0)
    - Building domain taxonomies and ontologies (e.g. IAEA's knowledge base on Fast Reactors)
  - Guidelines for KM in nuclear organizations (IAEA)

→ In conclusion, many complementary efforts will have to contribute in maintaining and transferring knowledge from operating experience

Marc Noel, European Union Clearinghouse on OEF for NPPs
A knowledge development tool in OE

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WGOE - Maintaining and Transferring knowledge from OE 1

The EU Clearinghouse on OEF for NPPs: a Knowledge development tool in OE

Vision by the Central Office

Marc Noël
EC - Joint Research Center
Marc.NOEL@ec.europa.eu

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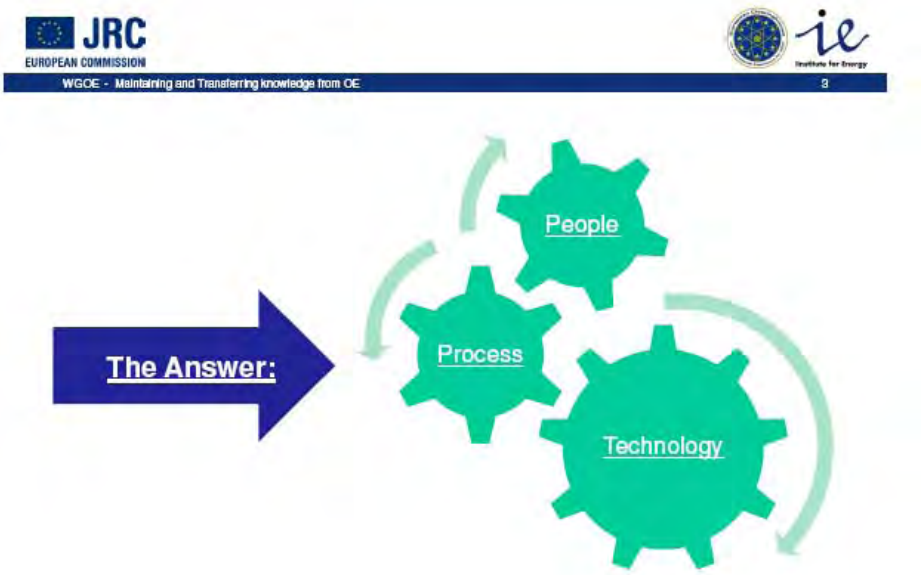
WGOE - Maintaining and Transferring knowledge from OE 2

Objectives of the EU Clearinghouse:

- To develop OE sharing and cooperation on OE in the EU region.
  → Optimal diffusion of knowledge, excellence (best practices) and lessons learnt from OE
- To strengthen existing resources on OE

Complexity of the initial situation:

- More than 10 different national languages among the users
- Community of users disseminated in 9 different countries
- Subsidiarity principle: only complementary action to existing KM at level of EU MS Safety Authorities, when a community approach can be more effective.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WGOE - Maintaining and Transferring knowledge from OE
3
The Answer:
People
Process
Technology


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1. People
WGOE - Maintaining and Transferring knowledge from OE
4
Detached National Experts & Visiting Scientists
Centralized Office
Permanent Core group dedicated to OE
Other JRC experts
EU TSOs

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1. People

ie Institute for Energy

WGOE - Maintaining and Transferring knowledge from OE 5

- Creation of a Centralized Office with a core group dedicated to OE.
  - Complemented by list of experts on specific topics on ad-hoc basis
  - Complemented by temporary Detached National Experts and Visiting Scientists (OE experts) on a rotational basis
  - Complemented by support of EU TSOs on specific technical topics.
- Advantage of this organisation = supports the development of networking and experience of OE experts in the EU (to strengthen existing resources)
- Training: yearly workshop on OE jointly organized by JRC and IAEA in Petten.

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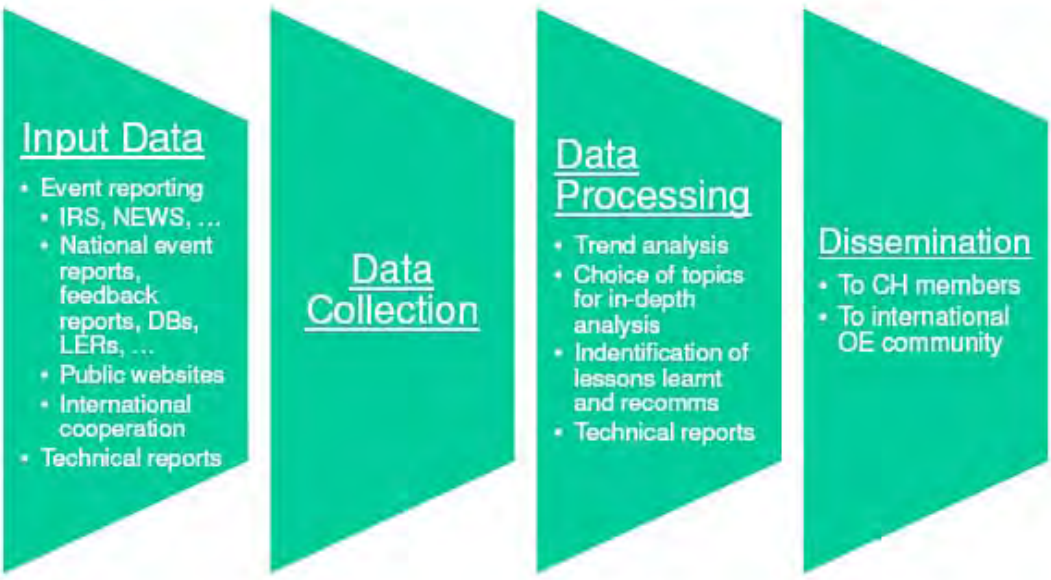
2. Process (1/4)

ie Institute for Energy

WGOE - Maintaining and Transferring knowledge from OE 6



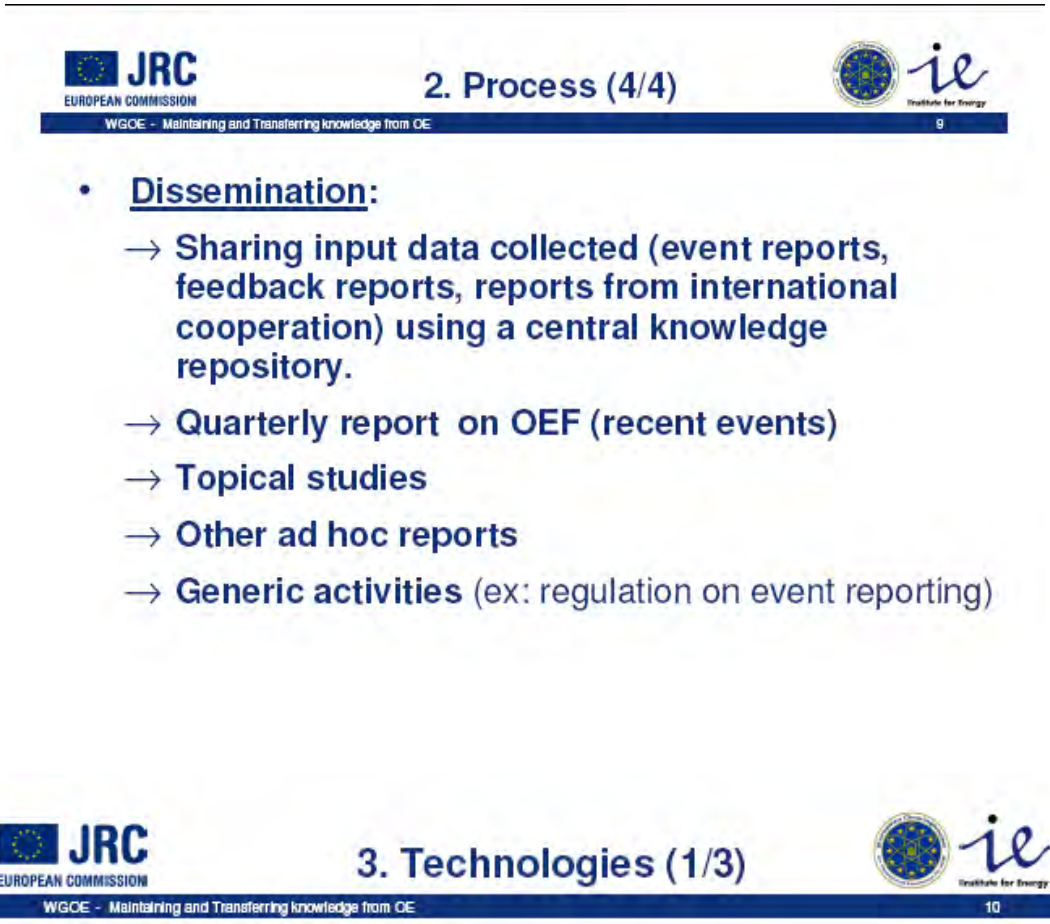
- **Input Data:**
  - → Review of draft IRS report
- **Data Collection:**
  - → **Knowledge merging:** increasing the number of data sources accessible by EU Safety Authorities by facilitating partial access to OE data of the other network members (sometimes in national language)/ to sources external to the network.
  - → Collection of recent event reports on public web sites

- **Data Processing:**

Data / information < Knowledge

  - → Trend analysis of DBs
  - → Identification of event families needing further in-depth analysis
  - → Topical studies
  - → Identification of generic concrete lessons learnt and recommendations
  - → Translation when necessary
  - → Identification & selection of safety significant events among recent events publicly reported

Quantity of information is often too high to find easily relevant and useful data (sometimes over-information of not structured data).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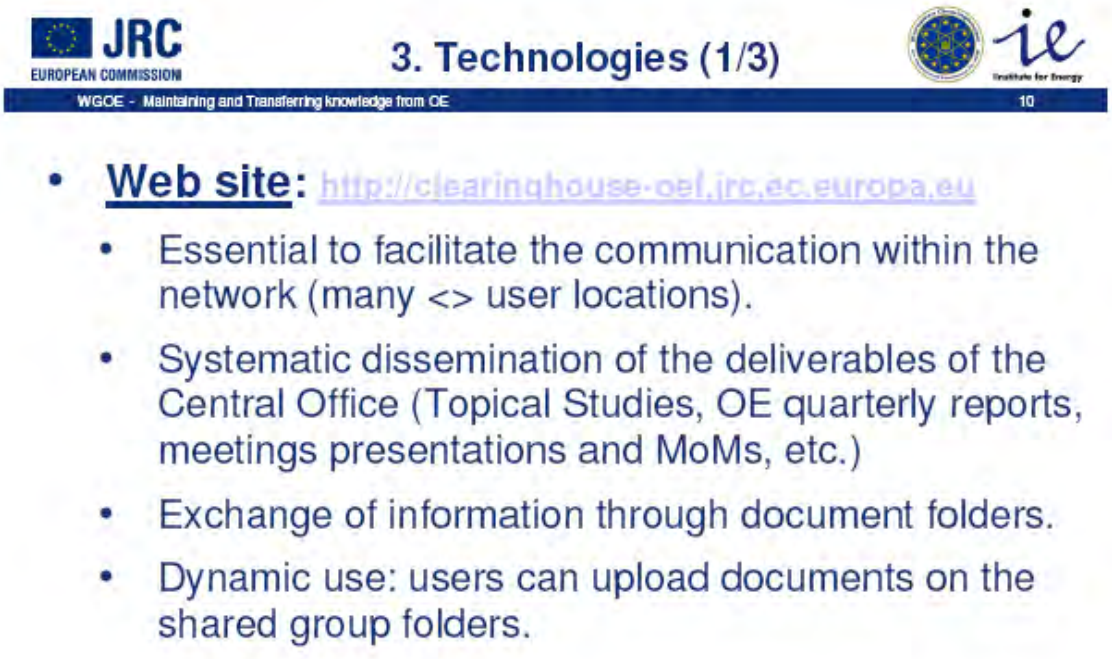
2. Process (4/4)
WGOE - Maintaining and Transferring knowledge from OE
9
• Dissemination:
→ Sharing input data collected (event reports, feedback reports, reports from international cooperation) using a central knowledge repository.
→ Quarterly report on OEF (recent events)
→ Topical studies
→ Other ad hoc reports
→ Generic activities (ex: regulation on event reporting)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3. Technologies (1/3)
WGOE - Maintaining and Transferring knowledge from OE
10
• Web site: http://clearinghouse-oef.jrc.ec.europa.eu
• Essential to facilitate the communication within the network (many <> user locations).
• Systematic dissemination of the deliverables of the Central Office (Topical Studies, OE quarterly reports, meetings presentations and MoMs, etc.)
• Exchange of information through document folders.
• Dynamic use: users can upload documents on the shared group folders.


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3. Technologies (2/3)
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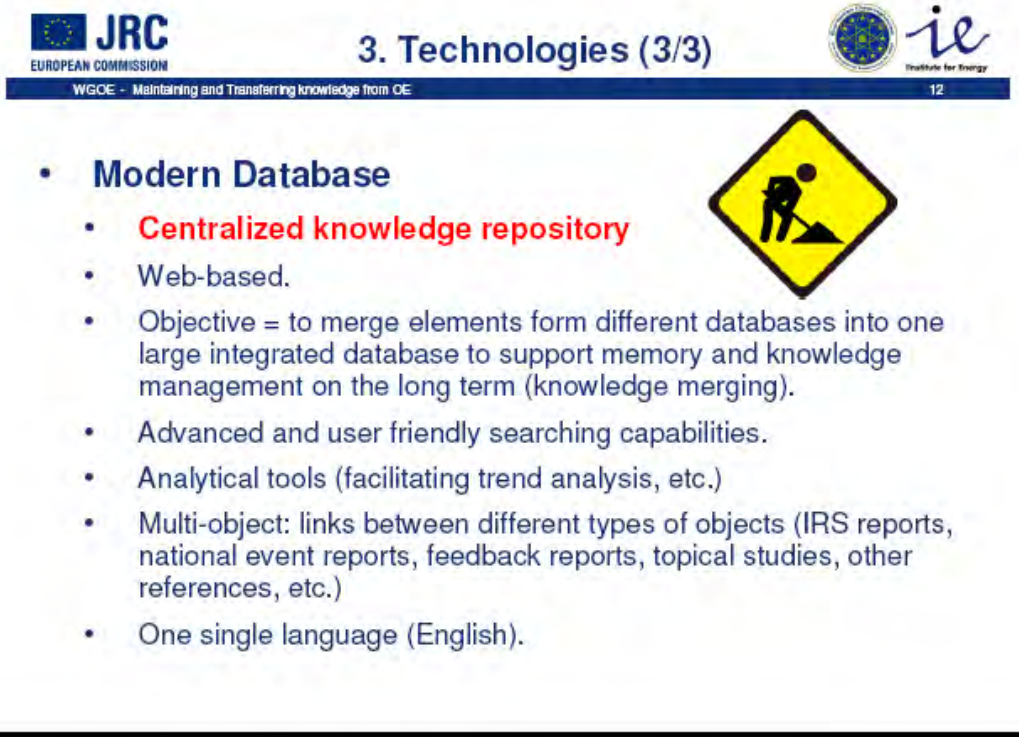
EU Clearinghouse on DEF for NPPs
Safety of Present Nuclear Reactors Unit (SPNR)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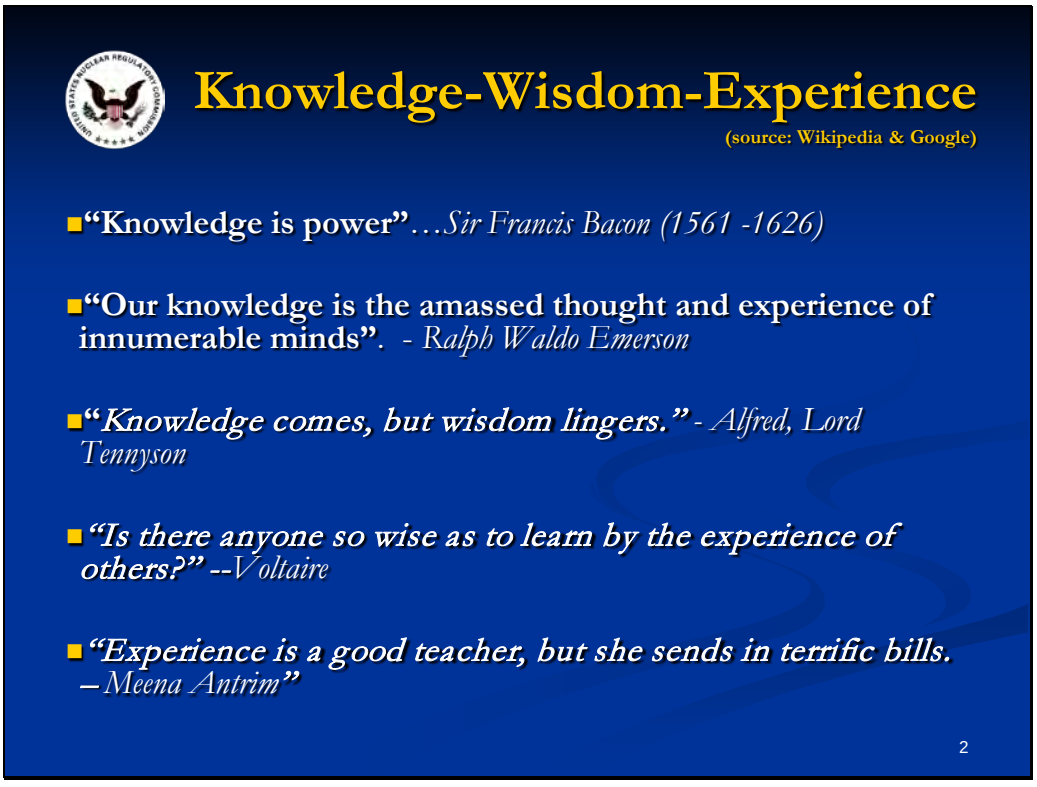
3. Technologies (3/3)
WGOE - Maintaining and Transferring knowledge from OE
12
Modern Database
Centralized knowledge repository
Web-based.
Objective = to merge elements form different databases into one large integrated database to support memory and knowledge management on the long term (knowledge merging).
Advanced and user friendly searching capabilities.
Analytical tools (facilitating trend analysis, etc.)
Multi-object: links between different types of objects (IRS reports, national event reports, feedback reports, topical studies, other references, etc.)
One single language (English).

John Thorp, NRC
Transfer Mechanisms for Knowledge Management of Operating Experience



How Does the NRC Define Knowledge Management?

- Knowledge management is capturing critical information and making the right information available to the right people at the right time. Knowledge Management includes, but is not limited to, databases, electronic reading rooms, formal and informal training, interviews, mentorship, procedures, desk references, communities of practice, websites and portals.
- Knowledge management is a part of the strategic management of human capital, along with strategic workforce planning, recruitment, and training and development. HR is coordinating the NRC's efforts to implement knowledge management strategies.

3

Knowledge Management at NRC

- Agency Knowledge Management (KM) Focus
- Office Instruction/Guidance on KM
- NRC KM Resources/Events/Initiatives
- Training & Qualification Programs
- The role of NRC's Operating Experience Branch and its focus on evaluating OpE and communicating that to the staff for KM Transfer
- Operating Experience Branch Products for KM
- Summary

4

Knowledge Management Focus

- Agency KM Resources - Agency has established numerous KM initiatives/web-sites
- Every Office at NRC has a KM Champion – a high level senior executive who actively promotes maintenance and transfer of Knowledge from more experienced staff to junior staff
- KM events including: TMI 30th Anniv and NRC 35th Anniv Seminars, KM Fair, Reg. Info Conference
- NRC Historian – Samuel Walker author of definitive books on the history of NRC and major events
- Mentorship – Routine use of informal mentorship helps transfer knowledge between senior and junior/new staff, through discussion, OJT, and focused training, rotational & other assignments.

5

KM Focus at USNRC (cont'd)

- Knowledge Management Web Page
- NRC Technical Library – Contains wealth of information & tools, periodic workshops to help staff understand the tools
- Dedicated KM Staff expertise in each office -- Each Office has one or more staff focused on KM & transfer of knowledge
- Rx Regulatory Awareness Seminar Series (targeted new employees) was filmed, so new employees can review the seminars as part of their training
- Position Specific and general agency/office qualification process includes reading and discussion topics to ensure knowledge of significant issues and events is passed on.
- KM of Operating Experience is part of many training classes for technical staff, site access training classes, PRA classes, etc.

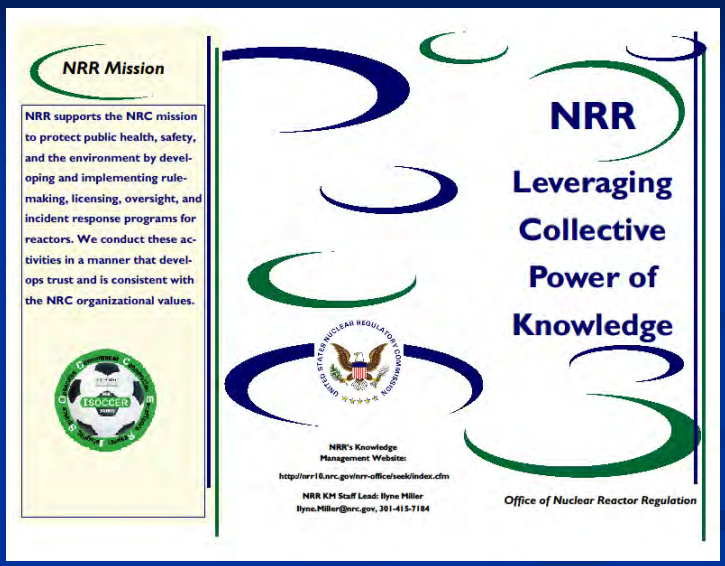
6

KM Resources

NRR Office Instruction – ADM-506 Knowledge Management Process

- **Purpose:** The purpose of this Office Instruction (OI) is to provide guidelines to ensure that the Office of Nuclear Reactor Regulation (the Office) effectively uses knowledge management to fulfill the Office's mission consistent with the U.S. Nuclear Regulatory Commission's Strategic Plan. Additionally, this OI describes how the Office will identify, capture, transfer, and retain critical knowledge that promotes continuous learning and transfer between subject matter experts and staff members.
- **Knowledge Transfer (KT) Common Practices provided in a helpful Table**
- **Expectations, Roles, Responsibilities:** This Office Instruction (OI) is intended to guide routine knowledge capture within a critical program and/or skill area. It describes the expectations for capturing information, knowledge, and review guidance. It also identifies specific roles and responsibilities for managers, supervisors, and staff members. Finally, it is a useful resource to help plan and implement knowledge transfer (KT) strategies throughout the Office.

7



8

NRC KM Resources: Webpage

Knowledge Management Events

- TMI 30th Anniversary Day of Learning
- NRC 35th Anniversary Seminars
  - Talk by NRC Historian Sam Walker
  - Nearly every session was video-taped for use by new staff.
- Annual Knowledge Fair—OpE Branch was a key participant
- Regulatory Information Conference
  - International OpE Panel Session
- Published History of the NRC includes major events that shaped the industry

11

Recent NRC KM Fair Topics/Initiatives

- NRC In-House Meeting Facilitator and Advisor Program
- High Temperature Gas-Cooled Reactor KM
- Research SharePoint Sites
- Research Seminars and Workshops
- Fire Research Branch NUREGS
- Research Databank
- Region III Podcasts
- e-Rulemaking
- Enterprise Content Management (ECM) Program
- The Wayback Machine, 35 Years of Managing Information at the NRC
- IDEAS, A Web-Based Technical Reviewer Job Aid
- EARRTH
- New Reactor Construction Experience Database
- iLearn (Training classes include OpE)
- Spent Fuel Storage and Transport CoPs
- High Level Waste KM Activities
- Fuel Cycle KM Activities
- FSME Electronic Library and Environmental Review Database
- Nuclear Materials Safety Reference Book
- Business Process Improvement Using Lean Six Sigma
- ACRS Knowledge Management Activities
- Sharing Your Story - The NR&C
- B.5.b Inspections CoP
- Headquarters Operations Center
- Combined Regional KM Activities
- Reactor Operating Experience Gateway
- OCFO Management and Knowledge Transfer Tool

Training & Qualification Process for New Employees includes OpE

- Formal Training & Qualification Manual for all of the various Staff positions in NRC/NRR
- Position Specific Qualification Requirements for OpE Engineers and other technical staff include:
  - Required Readings in OpE Lessons Learned
  - Review/Completion of Reactor Regulatory Awareness Seminars
  - Job specific knowledge interviews ("Check-outs")
  - Completion of On-the Job and Self Study items, documented on a formal Signature "Qual" Card
- Preliminary and Final Evaluation Board
  - Board Chaired by Senior Executive Service Mgr & Branch Chiefs
- Certification of Qualifications (Signed documentation of readings, OJT, and Checkouts)

13

Reactor Regulatory Awareness (Seminar #4)

- **Division of Inspection and Regional Support (DIRS)**
  - Reactor Oversight Process (ROP) (including how OpE is taken into account during the ROP process, especially in the "Cross-Cutting" areas of human performance, problem identification and resolution, and safety conscious work environment)
  - Operating Experience Program (We describe our processes)
  - Significance Determination Process (How events and inspection findings are examined for risk-informed safety significance)
  - Event Lessons Learned (The major events in history of nuclear power were presented to all new employees, TMI, Browns Ferry Fire, Davis Besse RV Head, Vogtle Loss of Off-Site Power)

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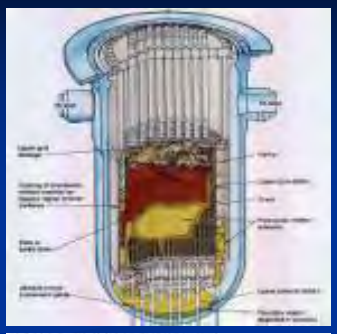
Major Defining Industry Events

- Browns Ferry (Fire) (1975)
- Three Mile Island (Core Melt) (1979) →
- Vogtle (Loss of Offsite Power) (1990)
- Davis Besse (Head Corrosion) (2002) →



15

Operating Experience Branch Role & KM Tools

- ROLE: Collect, Screen, Evaluate, Communicate OpE, both inside and outside the agency. Interact with Technical Branches, Regions & INPO to apply Operating Experience
- FOCUS/METHODS:
  - Operating Experience Clearinghouse & Analysis Teams
  - Training & Qualification Program
  - Review of Domestic & International OpE
  - Participation in WGOE, IAEA activities & KM events
  - Grow awareness of NRR Reactor OpE Information Gateway
    - Reactor OpE Forum & OpE COMMs
    - Initiative to build OpE Subscriber Base has raised readership 20%
  - Continually grow awareness of OpE & significant events through multiple tools and paths

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OpE Products

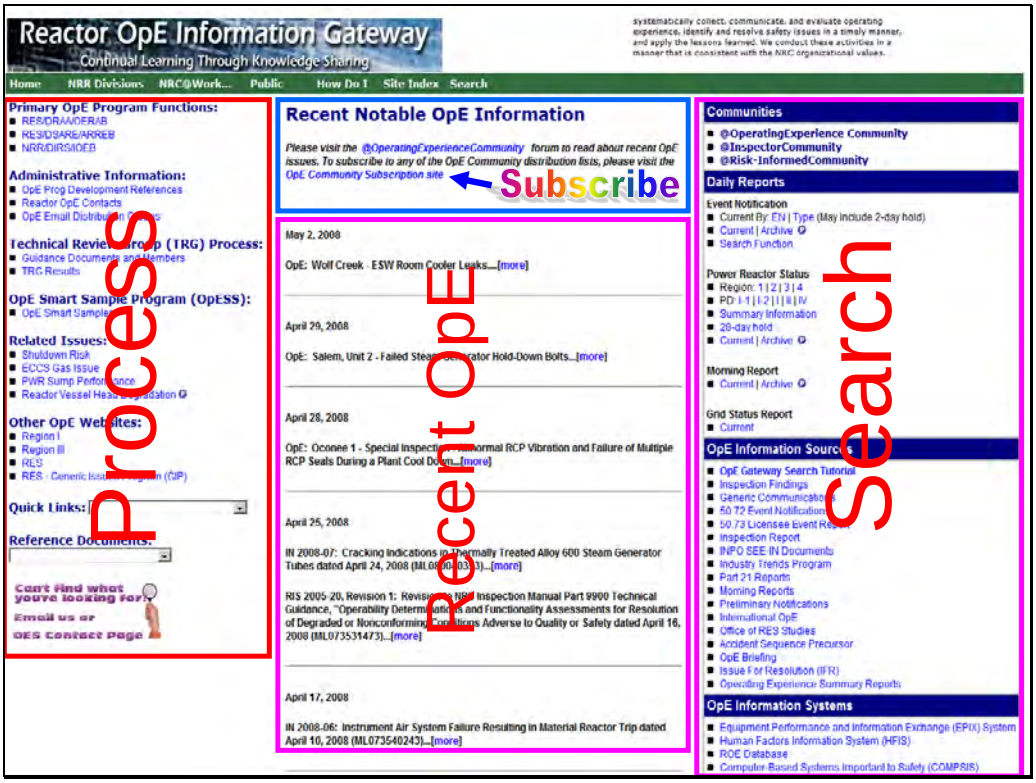
- OpE Products are also communicated to NRC Staff and are another means to transfer knowledge and Operating Experience:
  - Executive Team Morning Briefings
  - OpE Screening Summary (Daily summary of Operating Experience sent to over 500 staff subscribers)
  - OpE COMMunications (Single Web page condensed summaries of OpE Issues and Events in more than 24 different technical areas that are routinely shared with over 500 internal subscribers
  - Issue for Resolution Evaluation Reports
  - OpE Smart Samples (Focused inspection guidance shared with all Resident Inspectors as a tool for their use.)
  - Current OpE Focus/Significant Topics (Top Ten List) (Shared with Regions for use in Mid-Cycle and End-of-Cycle Reviews
  - Technical Review Group Process
  - OpE Overview & Analysis Report (OAR) and other Management Briefings

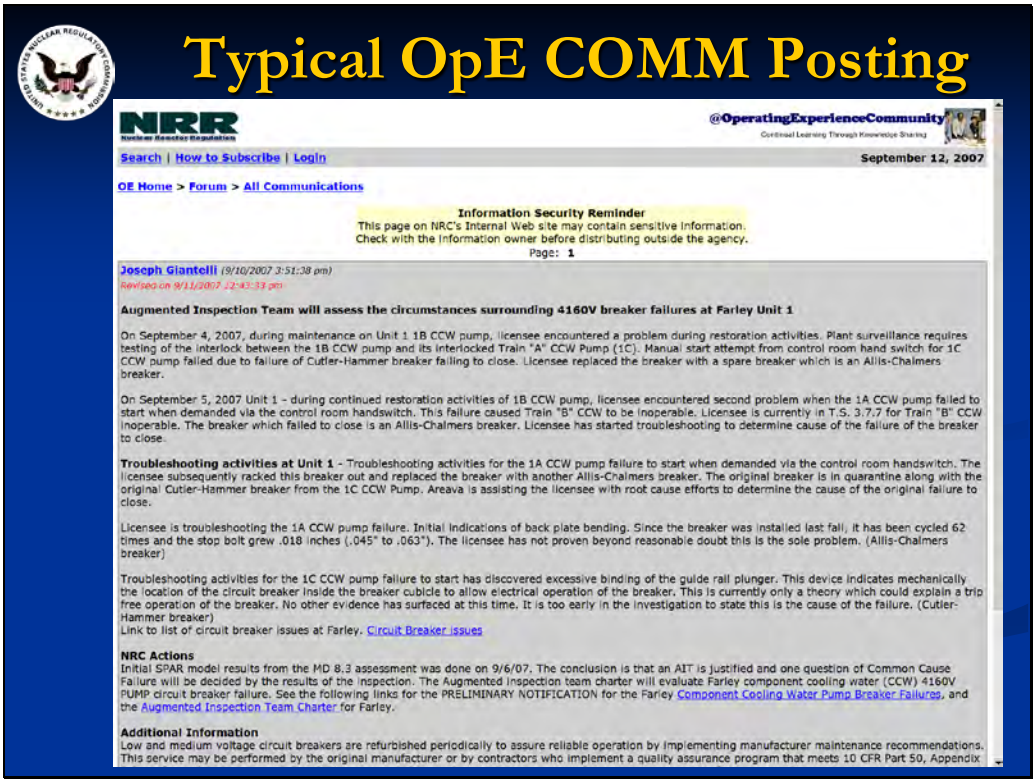
17

Information Technology OpE KM Tools

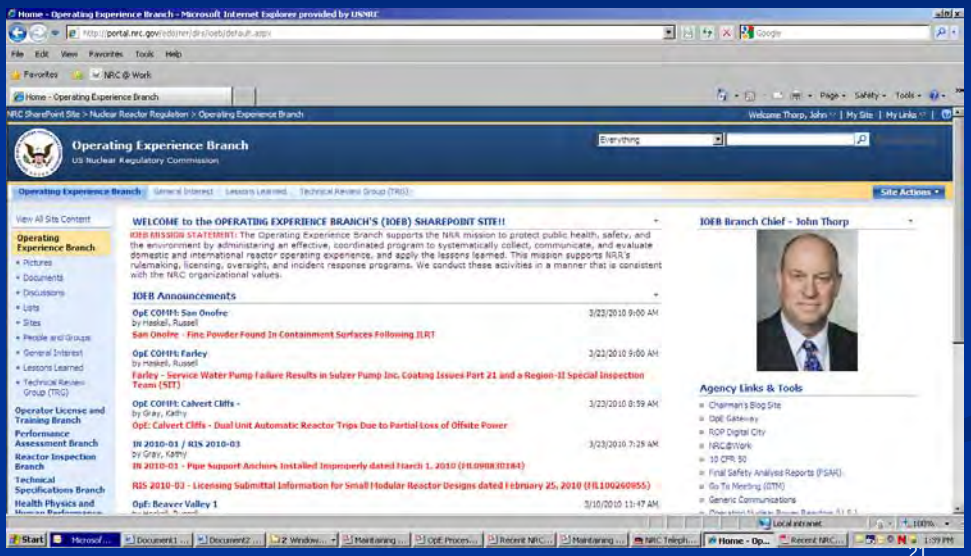
- OpE Information Gateway
  - Single web access point to multiple databases
  - Dataset assumptions and limitations explained
  - Improved OpE search capabilities
- @Operating Experience Community
  - Web-based NRC internal communication forum
  - Subscription notification to over 30 topical groups
  - Provides links to related documents
  - Searchable records
- OpE Sharepoint Site (New)
- **New Initiative:** Low Level OpE Database (Under Construction) For Search/Query of Data for Trends/Analysis

18


Reactor OpE Information Gateway
Continual Learning Through Knowledge Sharing
Home
NRR Divisions
NRC@Work...
Public
How Do I
Site Index
Search
Primary OpE Program Functions:
Administrative Information:
Technical Review Group (TRG) Process:
OpE Smart Sample Program (OpESS):
Related Issues:
Other OpE Websites:
Quick Links:
Reference Documents:
Can't find what you're looking for?
Email us or
OES Contact Page
Recent Notable OpE Information
Please visit the @OperatingExperienceCommunity forum to read about recent OpE issues. To subscribe to any of the OpE Community distribution lists, please visit the OpE Community Subscription site
Subscribe
May 2, 2008
OpE: Wolf Creek - ESW Room Cooler Leaks...[more]
April 29, 2008
OpE: Salem, Unit 2 - Failed Steam Generator Hold-Down Bolts...[more]
April 28, 2008
OpE: Oconee 1 - Special Inspection - Abnormal RCP Vibration and Failure of Multiple RCP Seals During a Plant Cool Down...[more]
April 25, 2008
IN 2008-07: Cracking Indications in Thermally Treated Alloy 600 Steam Generator Tubes dated April 24, 2008 (ML080900033)...[more]
RIS 2005-20, Revision 1: Revision to NRC Inspection Manual Part 9900 Technical Guidance, "Operability Determinations and Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety dated April 16, 2008 (ML073531473)...[more]
April 17, 2008
IN 2008-06: Instrument Air System Failure Resulting in Material Reactor Trip dated April 10, 2008 (ML073540243)...[more]
Process
Recent OpE
Search
Communities
@OperatingExperience Community
@InspectorCommunity
@Risk-InformedCommunity
Daily Reports
Event Notification
Power Reactor Status
Morning Report
Grid Status Report
OpE Information Sources
OpE Gateway Search Tutorial
Inspection Findings
Generic Communications
Inspection Report
INPO SEE IN Documents
Industry Trends Program
Part 21 Reports
Morning Reports
Preliminary Notifications
International OpE
Office of RES Studies
Accident Sequence Precursor
OpE Briefing
Issue For Resolution (IFR)
Operating Experience Summary Reports
OpE Information Systems
Equipment Performance and Information Exchange (EPIX) System
Human Factors Information System (HFIS)
ROE Database
Computer-Based Systems Important to Safety (COMPSIS)


Typical OpE COMM Posting
NRR
@OperatingExperienceCommunity
Search | How to Subscribe | Login
September 12, 2007
OE Home > Forum > All Communications
Information Security Reminder
This page on NRC's Internal Web site may contain sensitive information.
Check with the information owner before distributing outside the agency.
Page: 1
Joseph Giantelli (9/10/2007 3:51:38 pm)
Revised on 9/11/2007 12:43:33 pm
Augmented Inspection Team will assess the circumstances surrounding 4160V breaker failures at Farley Unit 1
On September 4, 2007, during maintenance on Unit 1 1B CCW pump, licensee encountered a problem during restoration activities. Plant surveillance requires testing of the interlock between the 1B CCW pump and its interlocked Train "A" CCW Pump (1C). Manual start attempt from control room hand switch for 1C CCW pump failed due to failure of Cutler-Hammer breaker failing to close. Licensee replaced the breaker with a spare breaker which is an Allis-Chalmers breaker.
On September 5, 2007 Unit 1 - during continued restoration activities of 1B CCW pump, licensee encountered second problem when the 1A CCW pump failed to start when demanded via the control room handswitch. This failure caused Train "B" CCW to be inoperable. Licensee is currently in T.S. 3.7.7 for Train "B" CCW inoperable. The breaker which failed to close is an Allis-Chalmers breaker. Licensee has started troubleshooting to determine cause of the failure of the breaker to close.
Troubleshooting activities at Unit 1 - Troubleshooting activities for the 1A CCW pump failure to start when demanded via the control room handswitch. The licensee subsequently racked this breaker out and replaced the breaker with another Allis-Chalmers breaker. The original breaker is in quarantine along with the original Cutler-Hammer breaker from the 1C CCW Pump. Areava is assisting the licensee with root cause efforts to determine the cause of the original failure to close.
Licensee is troubleshooting the 1A CCW pump failure. Initial indications of back plate bending. Since the breaker was installed last fall, it has been cycled 62 times and the stop bolt grew .018 inches (.045" to .063"). The licensee has not proven beyond reasonable doubt this is the sole problem. (Allis-Chalmers breaker)
Troubleshooting activities for the 1C CCW pump failure to start has discovered excessive binding of the guide rail plunger. This device indicates mechanically the location of the circuit breaker inside the breaker cubicle to allow electrical operation of the breaker. This is currently only a theory which could explain a trip free operation of the breaker. No other evidence has surfaced at this time. It is too early in the investigation to state this is the cause of the failure. (Cutler-Hammer breaker)
Link to list of circuit breaker issues at Farley. Circuit Breaker issues
NRC Actions
Initial SPAR model results from the MD 8.3 assessment was done on 9/6/07. The conclusion is that an AIT is justified and one question of Common Cause Failure will be decided by the results of the inspection. The Augmented Inspection team charter will evaluate Farley component cooling water (CCW) 4160V PUMP circuit breaker failure. See the following links for the PRELIMINARY NOTIFICATION for the Farley Component Cooling Water Pump Breaker Failures, and the Augmented Inspection Team Charter for Farley.
Additional Information
Low and medium voltage circuit breakers are refurbished periodically to assure reliable operation by implementing manufacturer maintenance recommendations. This service may be performed by the original manufacturer or by contractors who implement a quality assurance program that meets 10 CFR Part 50, Appendix

Operating Experience Branch SharePoint Site



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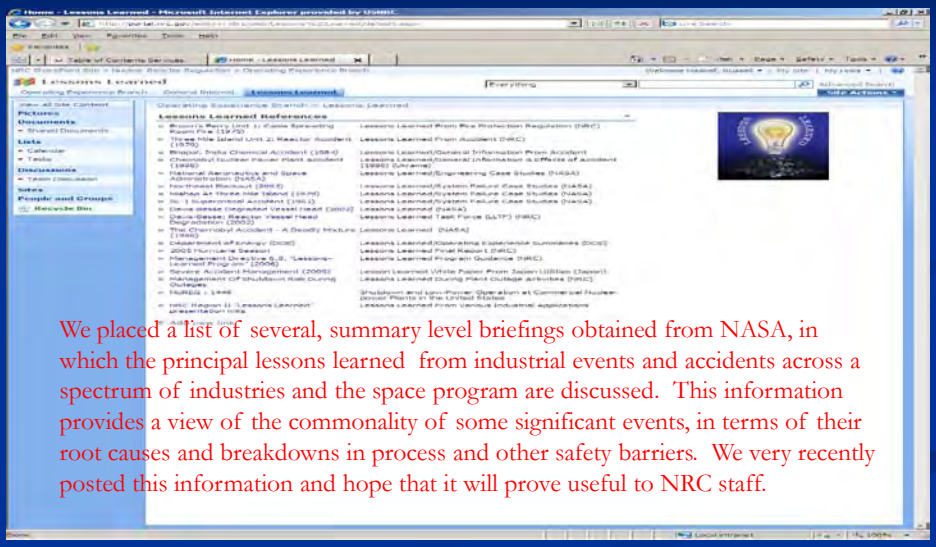
Industrial Accidents Lessons Learned (SharePoint Site example)



We placed a list of several, summary level briefings obtained from NASA, in which the principal lessons learned from industrial events and accidents across a spectrum of industries and the space program are discussed. This information provides a view of the commonality of some significant events, in terms of their root causes and breakdowns in process and other safety barriers. We very recently posted this information and hope that it will prove useful to NRC staff.

http://pbma.nasa.gov/index.php?fuseaction=pbma.archive

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More on OpE KM Transfer

- RES seminars on events such as TMI (3/25/2009), Browns Ferry fire (6/30/2008 and 3/26/2010)
- Davis Besse Lessons Learned & many others are posted on the OpE SharePoint Site
- Mentoring & frequent use of Three Month rotational assignments to Operating Experience Branch for On-the-Job learning and Knowledge Transfer
- Regional OpE Points of Contact, Region Web Pages, and OpE focus is also achieved via briefings and "Value Added Findings"
- Inspector Newsletter Articles – A quarterly Inspector Newsletter is published which routinely includes Operating Experience topics, helping the entire population of inspectors and other interested staff.

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Summary

- Position Qualification Program -- technical qualification cards provide for review and discussion of past OpE
- Rx OpE Information Gateway –OpE KM happens here
- Multiple Web Sites in NRC include KM & Link to the Gateway
  - OpE SharePoint Site Lessons Learned
- E-mail transmission of events & OpE reports to a large (& growing) subscriber base
- Lectures/Seminars/Conferences (RIC)
- Mentoring of junior personnel, including OJT and Rotational assignments is a key aspect

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Questions

Please visit us at www.nrc.gov

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BACK-UP/ ADDITIONAL SLIDES

Additional slides not planned for discussion due to time limitations, but which provide additional insights.

USNRC Regional Knowledge Management Activities/Examples

27

KM Activities
(Region I Video Training)

Objective: Address challenges in regional programs combined with staff turnover, the ***video training library*** provides an effective method to capture tactical knowledge, lessons learned, and corporate historical experiences. The video training library leverages various video formats (including DVD and Real Media) to enable the effective and efficient retrieval of information for future use particularly with new staff.

Action: Various technical divisions coordinate topics for the knowledge sharing training sessions. The main conference room is equipped with appropriate lighting and audio inputs for the high-end digital video camera to ensure the highest video and audio quality possible. IT support staff record these sessions, edit the video (including integrating PowerPoint presentation slides into the video), and convert the finished product into either Real Media format for streaming or DVD format for stand-alone viewing. Staff are able to view the training session and print the presentation slides as handouts if desired.

Results: Approximately twenty knowledge sharing training sessions have been captured and stored on the Region I streaming server.

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KM Activities

(Region II Web-based Qual Tracking)

Objective: Share knowledge through interactions and discussions of existing and developing programs. To improve programs and share innovative methods such as the inspector and emergency response qualification tracking tools that further the mission. To promote a culture of safety and sound environmental stewardship.

Action: Development of a web based application to track inspector qualifications. This tool was modified to accommodate the tracking of emergency response staff qualification requirements.

Results: Qualification tracking for inspectors and emergency response staff is being used to successfully document qualification progress towards completion for many regional staff.

29

KM Activities

(Region III Podcasts)

Objective: Utilize podcasts to preserve presentations on topics useful for new inspectors preparing for inspector certification. Topics are organized into a 20 week rolling presentation schedule, and added periodically. To provide a single repository for historic images collected by reactor and materials inspection staff. These images provide valuable training to newer inspection staff. Keywords and descriptions tagged to the images are meant to transfer the relevant details of why the image was captured.

Action: The IT staff created a client/database architecture and found a database solution allowing keyword and description field searching of the metadata, associated with several types of image files. A tool is used to "tag" images by placing image specific keywords and descriptions in the metadata of the image. Metadata elements of individual images are configured so future images can be migrated to other databases or applications to transfer knowledge with the image.

Results: Over 40 training sessions have been captured and placed on the Region KM website. A lesson learned was to incorporate a second audio channel into the recording to capture audience questions which allows the entire presentation to be captured for podcast viewer. The image database is operational and used daily by staff across the agency (1200 page views/day). The database hosts ~ 500 images.

30

KM Activities

(Region IV Capture of Natural Phenomena & Regulatory Response)

Objective: Capture and share knowledge gained and subsequent lessons learned from responding to various adverse natural phenomena (i.e.. hurricanes, tornadoes, earthquakes).

Action: A search was made for photos capturing event response to various natural disasters from hurricanes, tornados, floods, snow, ice storms and blizzards, earthquakes, tsunamis, volcanic eruptions, and fires. These types of naturally occurring destructive events have been experienced in the Region IV geographical area of responsibility.

Results: Region has been very successful in responding to the various events associated with natural disasters. Many lessons learned have been captured and preserved for future response activities. A collage and PowerPoint presentation has been prepared to demonstrate the adverse physical impacts of such events.

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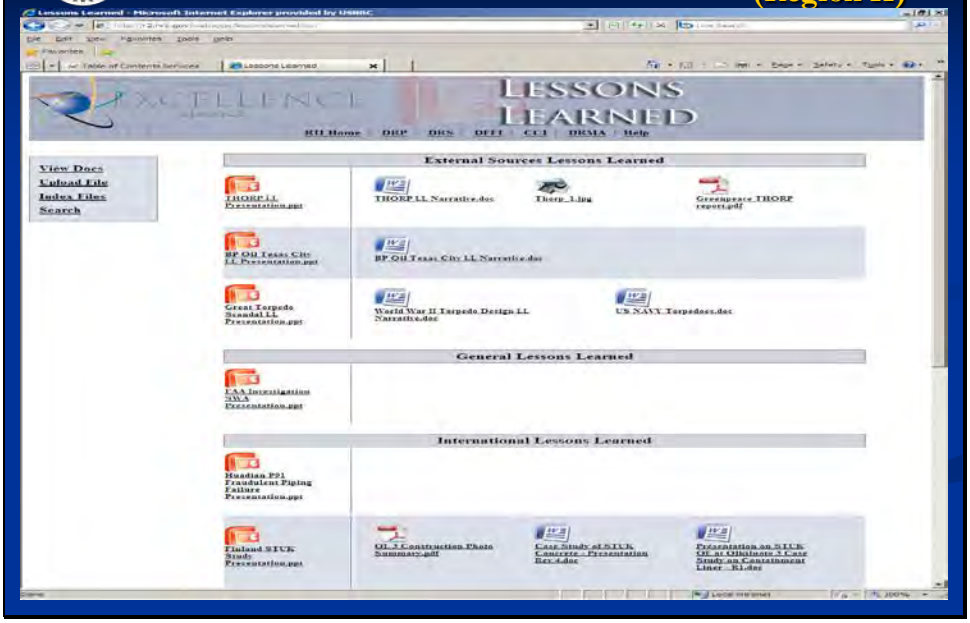
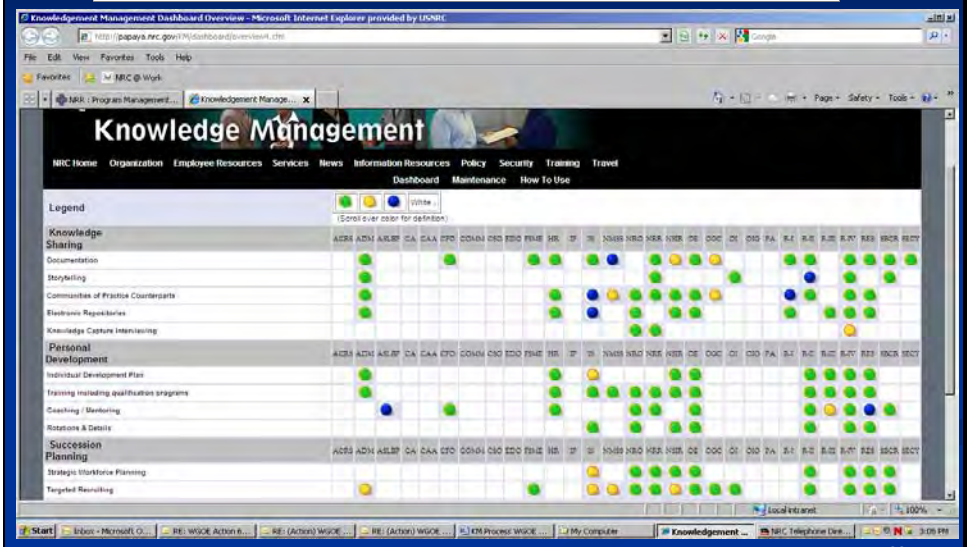
Lessons Learned Site

(Region II)



KM DASHBOARD AT USNRC

Legend | Green Current | Yellow Pending | Blue Completed | White No activity - Strategy not attempted or not needed.



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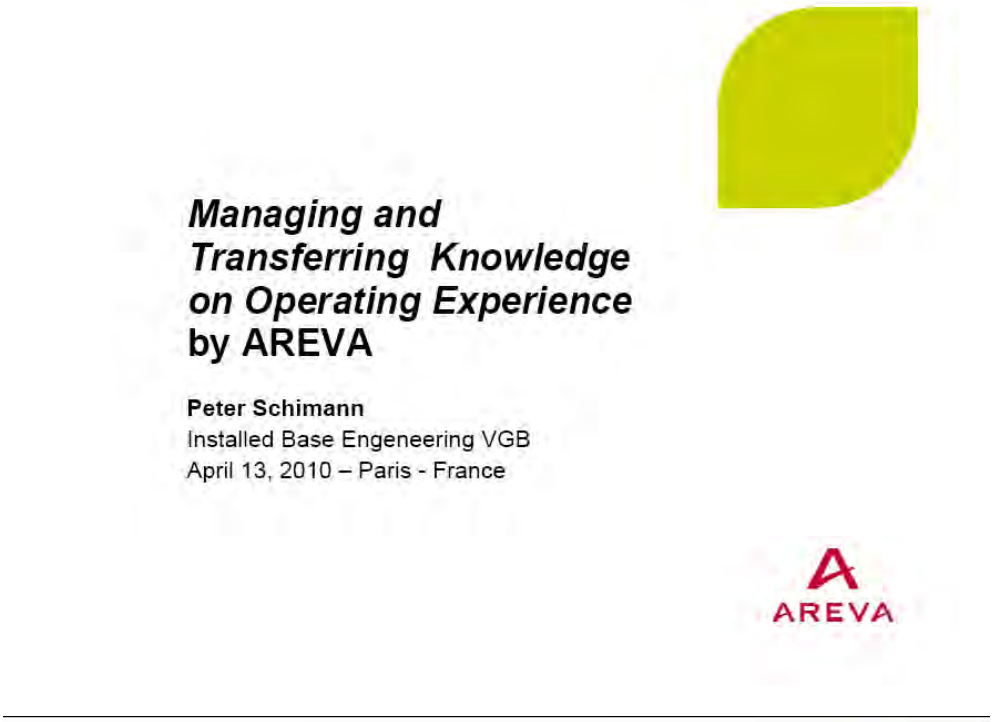
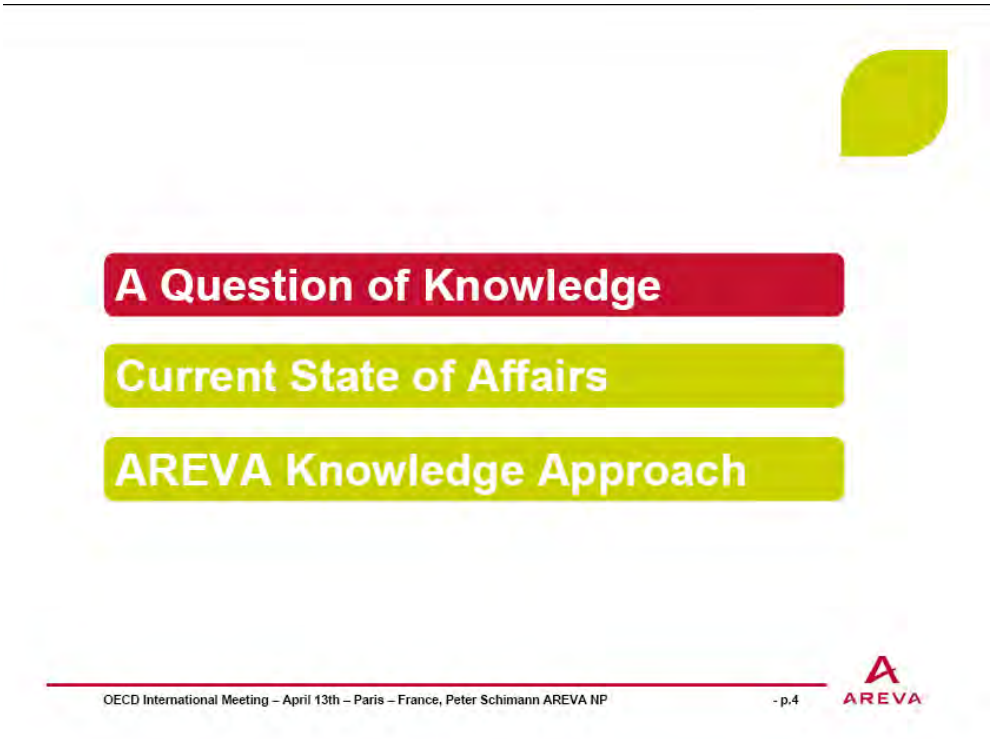
Other Region Websites include links to Reactor OpE for Knowledge Transfer:

Region III Reactor Inspector Web Site

- Provides links to:
  - Reactor OpE Gateway
  - Recent OpE COMMs
  - TRG Information
  - Other OpE Info
  - Keep informed and knowledgeable about OpE- and know where to find it so when you need it you can do your job better!

Peter Schimann, AREVA
Know How and Know Why





Quiz

- **Q:** A technical expert identifies a problem on an equipment, thus avoiding a possible accident. To do this, he uses a pair of gloves worth 5 euros to investigate and a pen worth 1 euro to write a note on this. What is the return on investment to the company?
- **A:** ?

"Knowledge is like underwear. You are only aware of it when it's lost"

AREVA

One Word

or

SHARING

« If knowledge is power, knowledge shared is power squared »

« Without knowledge sharing, there is no trust, no team spirit and no team success »

AREVA

A Question of Knowledge

Current State of Affairs

AREVA Knowledge Approach

Experience feedback in Germany

- The 1990 treaty demands AREVA NP to rate the following report types:
  - INPO-Reports (INPO-SER u. –SOER)
  - WANO-Reports
  - IAEA/OECD-IRS-Reports
  - GRS-WL-Reports
  - Reportable events of German NPPs
  - Selected plant modifications and own conclusions
- In May 2002 it was decided not to follow the INPO-Reports in favour of selected WANO-Reports.
- The 2006 Treaty stipulates that AREVA NP has to check international events of level 1 or higher within a couple of hours after publication by the IAEA concerning their assignability to German plants and to eventually do a quick evaluation.

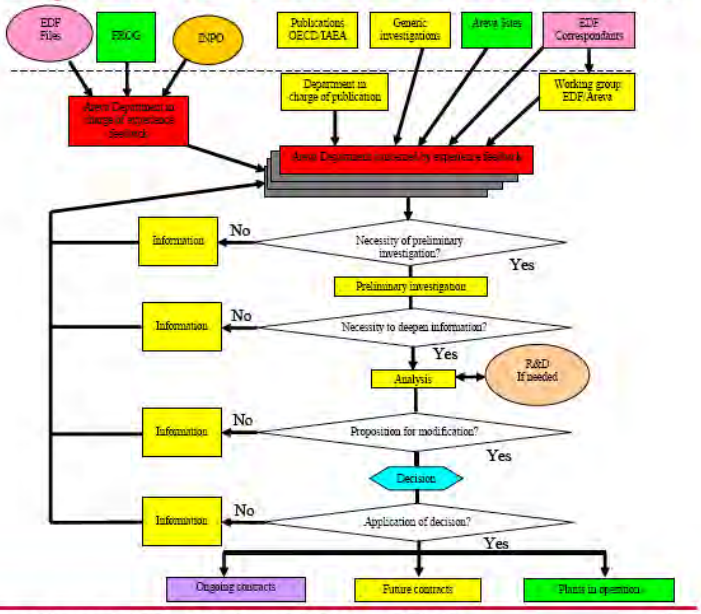
Scope of Experience Feedback in Germany

Currently AREVA NP Germany analyses their incoming national and international reports by their relevance for 24 (built by the former Siemens PG) European NPPs including Mülheim-Kärlich and since 2003 Angra 2. In detail it covers:

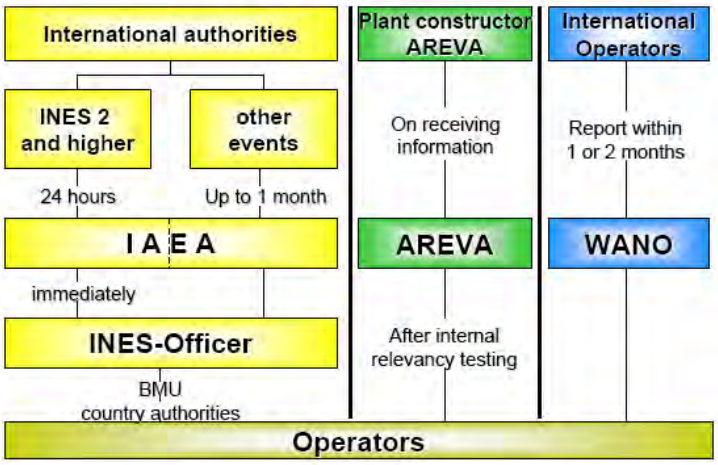
- 17 PWR-plants (13 in G, 3 in Europe, 1 in Brazil) and
- 7 SWR-plants (all of them in G)

Momentarily not included are all the newly-built plants respectively those already under construction!

Experience feedback in New Plants



Current processing of event-reports (international)



No horizontal exchange of information between authorities, operators and AREVA!!!

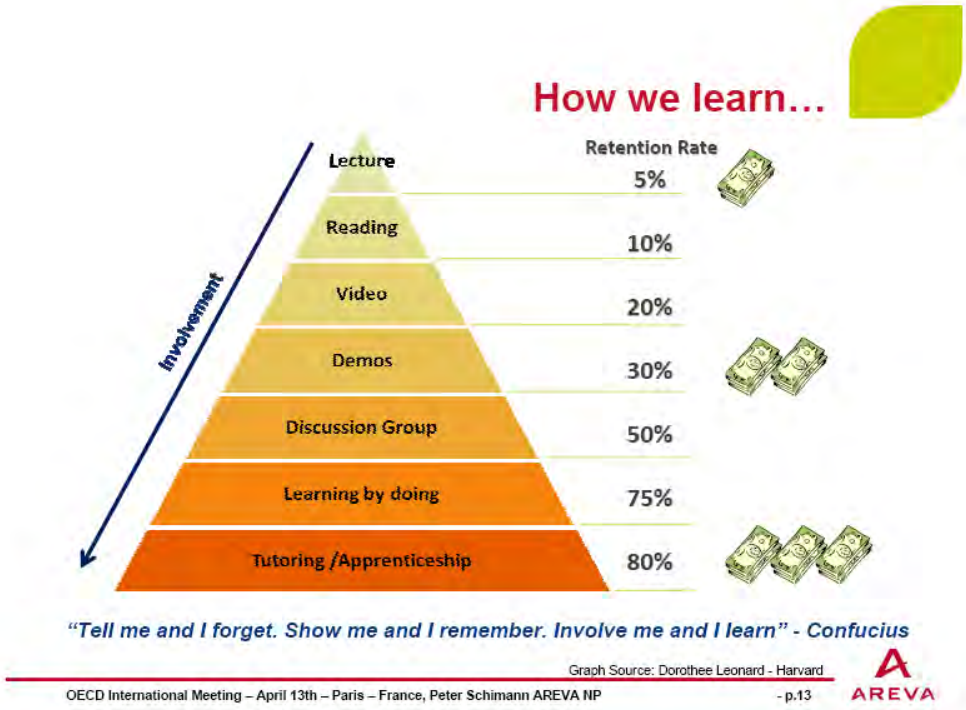
AREVA

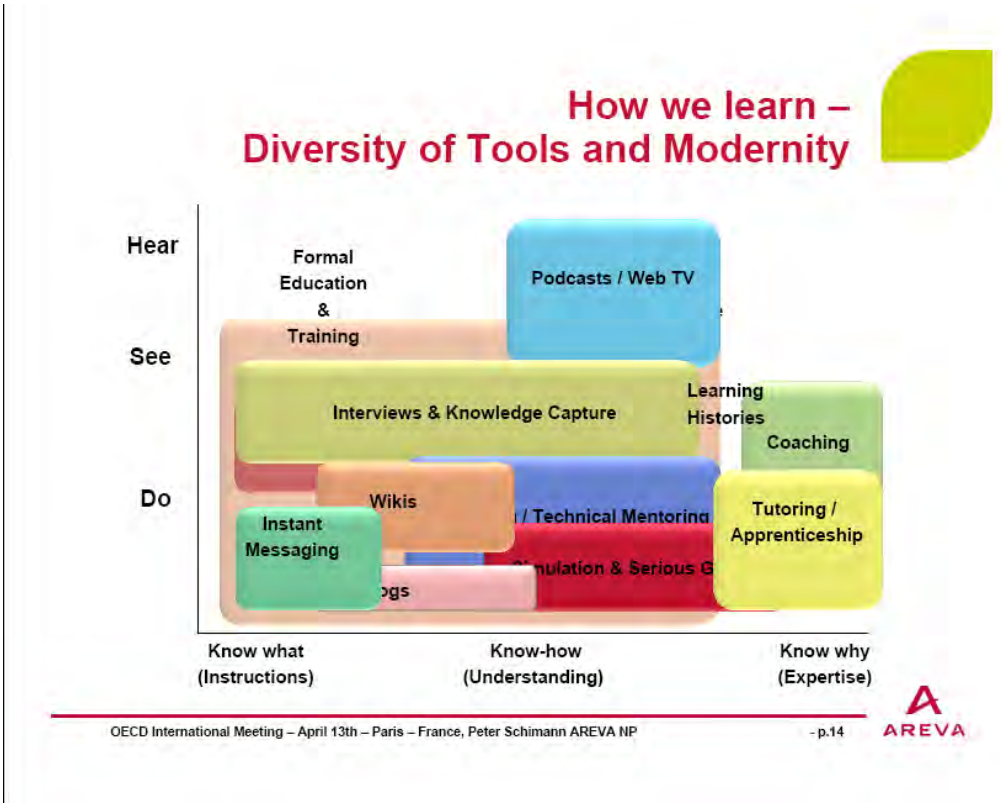
A Question of Knowledge

Current State of Affairs

AREVA Knowledge Approach

AREVA


How we learn…
Retention Rate
Lecture
5%
Reading
10%
Video
20%
Demos
30%
Discussion Group
50%
Learning by doing
75%
Tutoring /Apprenticeship
80%
Involvement
"Tell me and I forget. Show me and I remember. Involve me and I learn" - Confucius
Graph Source: Dorothee Leonard - Harvard
OECD International Meeting – April 13th – Paris – France, Peter Schimann AREVA NP
- p.13
AREVA


How we learn –
Diversity of Tools and Modernity
Hear
See
Do
Formal Education & Training
Podcasts / Web TV
Interviews & Knowledge Capture
Learning Histories
Coaching
Wikis
Instant Messaging
Tutoring / Apprenticeship
Know what (Instructions)
Know-how (Understanding)
Know why (Expertise)
OECD International Meeting – April 13th – Paris – France, Peter Schimann AREVA NP
- p.14
AREVA

Top Learning Priorities for AREVA

1.	Defining Priorities	▸ Networking, transfering knowledge of experts ▸ Lessons learned from projects, argumentation for recycling
2.	Training / Technical Training	▸ Induction programs ▸ Blending teaching and e-learning for effectiveness ▸ Involving experts for technical education
3.	People Networking	▸ Connecting people worldwide ▸ Making it easy to identify experts ▸ Including features and feedback to boost collaboration
4.	Communities / Technical Networks	▸ Building trust among practitioners ▸ Sharing critical knowledge in safe environments
5.	Documentation (« AREVApedia »)	▸ Organizing Shared Knowledge (content data bases) ▸ Between technical reports and powerpoints ▸ Shared glossary, thesauri, vocabulary ▸ « AREVA knowledge » vs. Personal knowledge

Start Small – Think Big

AREVA

Our learning mission as experts

« Nuclearize our Thinking » > Deeper knowledge of the nuclear field

« De-nuclearize our Minds » > More openness, more exchanges, more customer input

- **Culture « 1.0 »**
  - Which information shall we make accessible?

- **Culture « 2.0 »**
  - Which information has to be secured?

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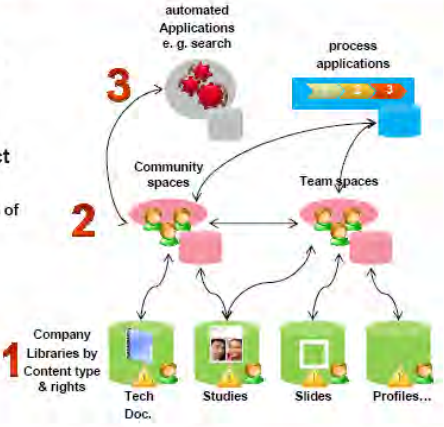
Learning Content / « AREVApedia »

- **Step one** - Documenting knowledge of retiring experts
  - Create dedicated repositories by content type under the responsibility of a "librarian"
- **Step two** - link with communities/ project teams
  - Only groups can maintain a common database of knowledge
- **Step three** – integrated architecture
  - Content integration (# application integration) through common categories, thesauri, glossaries and common search

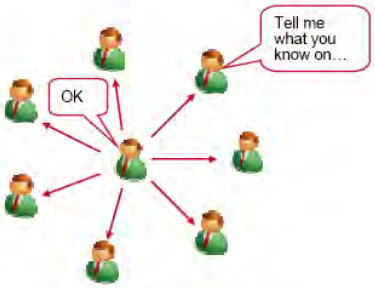


Guiding Principle: Decentralize Learning Activities – Centralize Documented Knowledge

AREVA

How transferring technical knowledge differs from transferring tasks

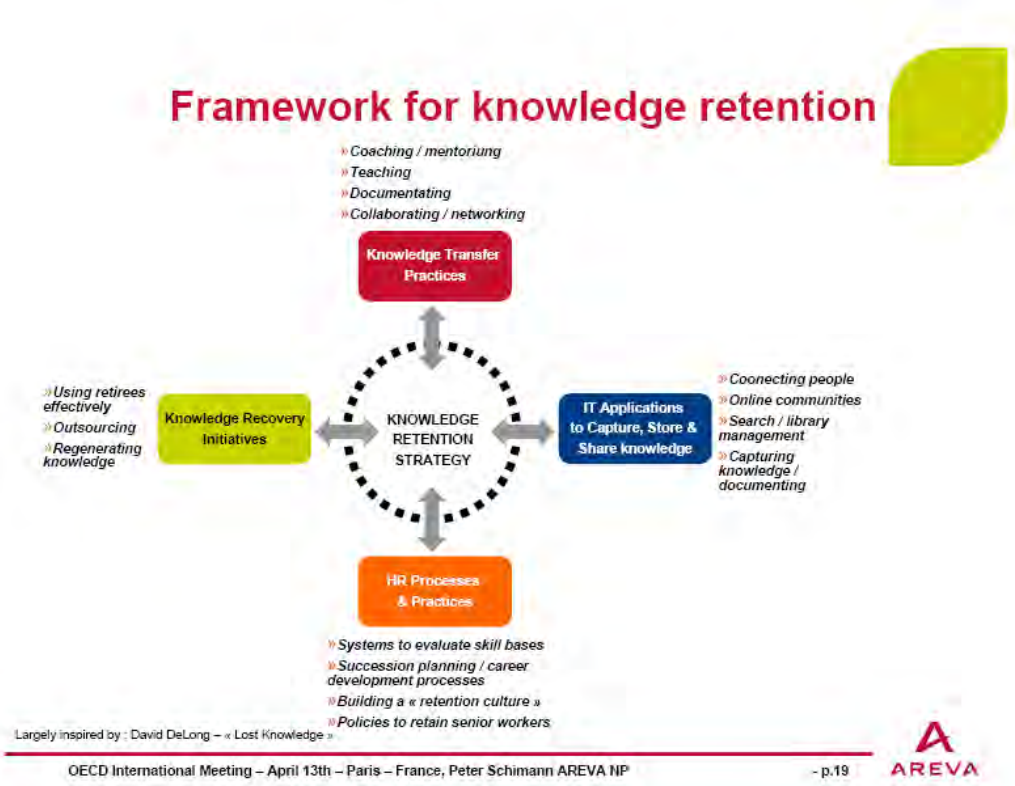
- **Transferring responsibilities and tasks**
- **Transferring technical expertise**

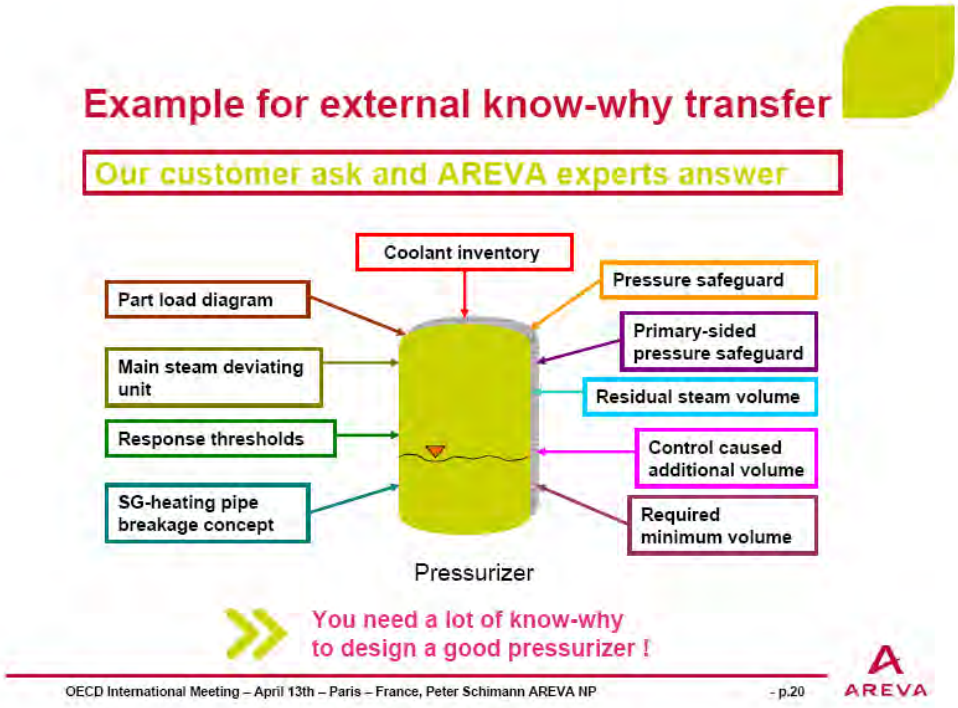


Position in Org-chart

Membership in Community

AREVA


Framework for knowledge retention
»Coaching / mentoriung
»Teaching
»Documentating
»Collaborating / networking
Knowledge Transfer Practices
»Using retirees effectively
»Outsourcing
»Regenerating knowledge
Knowledge Recovery Initiatives
KNOWLEDGE RETENTION STRATEGY
IT Applications to Capture, Store & Share knowledge
»Coonecting people
»Online communities
»Search / library management
»Capturing knowledge / documenting
HR Processes & Practices
»Systems to evaluate skill bases
»Succession planning / career development processes
»Building a « retention culture »
»Policies to retain senior workers
Largely inspired by : David DeLong – « Lost Knowledge »
OECD International Meeting – April 13th – Paris – France, Peter Schimann AREVA NP
- p.19
AREVA


Example for external know-why transfer
Our customer ask and AREVA experts answer
Coolant inventory
Part load diagram
Main steam deviating unit
Response thresholds
SG-heating pipe breakage concept
Pressure safeguard
Primary-sided pressure safeguard
Residual steam volume
Control caused additional volume
Required minimum volume
Pressurizer
You need a lot of know-why to design a good pressurizer !
OECD International Meeting – April 13th – Paris – France, Peter Schimann AREVA NP
- p.20
AREVA

Why no global objective?

Within 3 years,

10% of AREVA people are closely involved in Knowledge Management action

AREVA

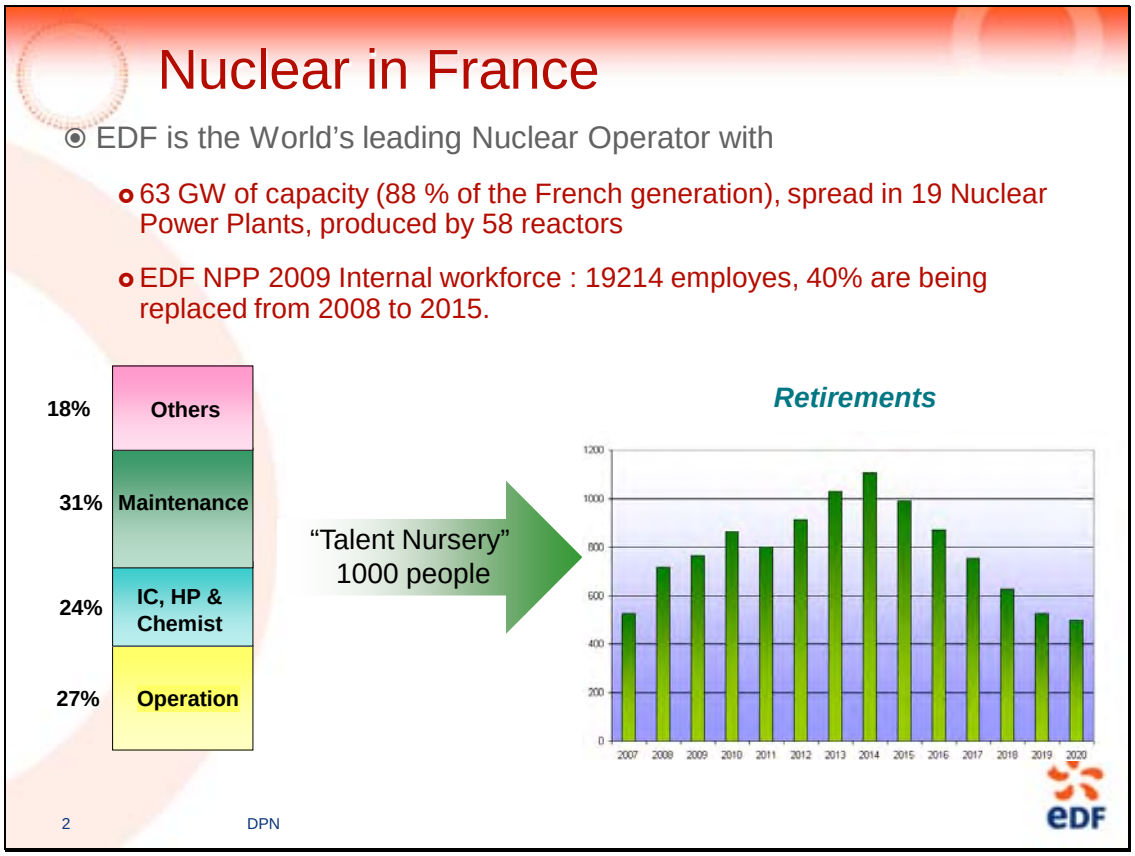
End of presentation

Managing and Transferring Knowledge on Operating Experience by AREVA

AREVA

Franck Dubois, EdF

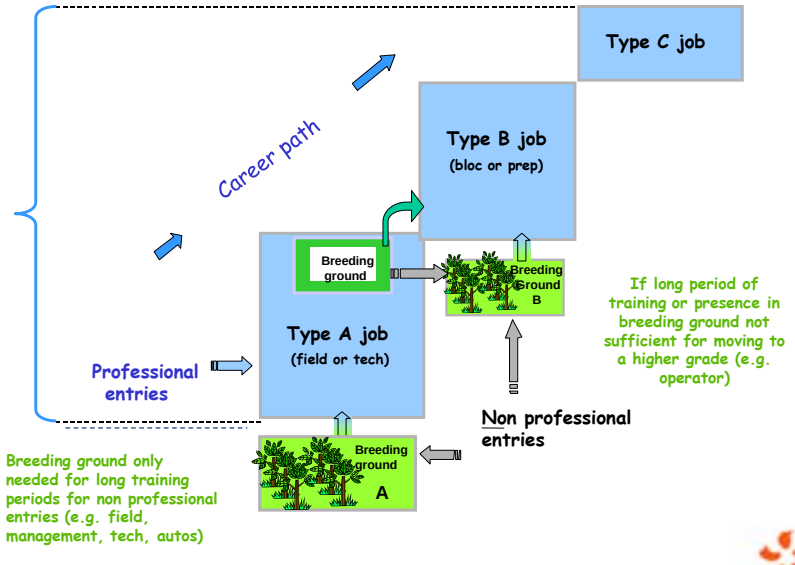
To Effectively Adapt and Renew Workforce Competences



THE BREEDING GROUND: A COMPLETELY SAFE GPEC TOOL

The number of people in the breeding-ground is added to the professional headcount.

The breeding ground would not be necessary if there weren't leavers to make up for.



3 DPN

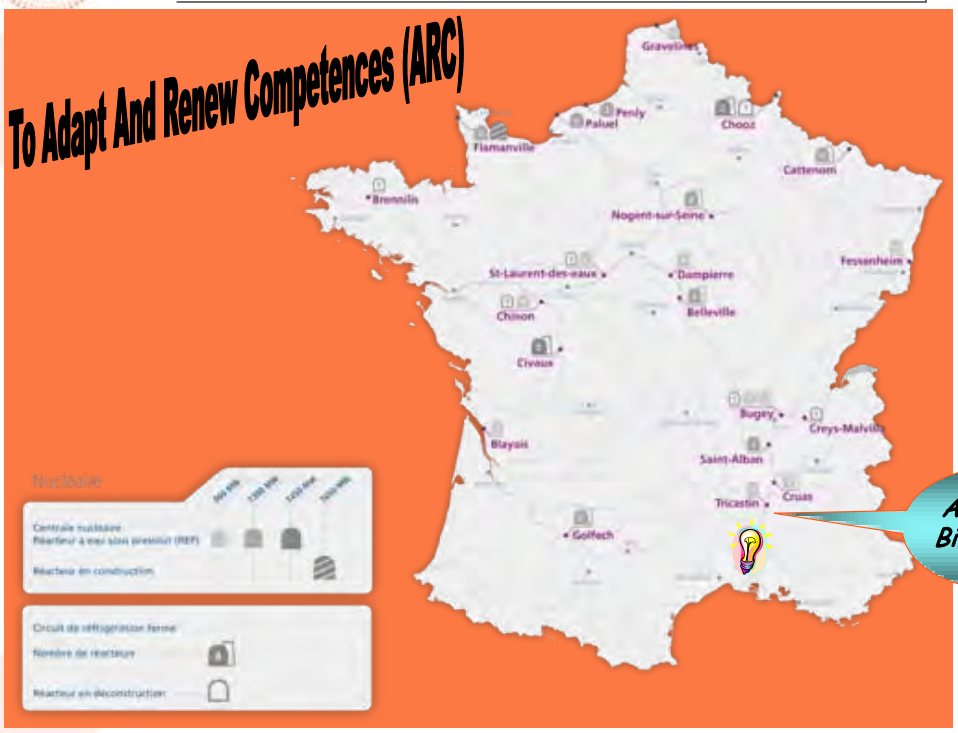
Issues

- Greying baby-boomers, or the « papy boom » effect
  - The NPP pioneers are leaving : How to conserve their knowledge and experience ?
  - ➔ **Keep up and reinforce our safety culture and our technical competences**
- Meeting the EDF Group's restructuring expectation
  - How to meet nuclear expectations as well ? Can an accoutant become a nuclear operator ?
  - How to reassure the managers ?
- Hiring young workers, increasing nuclear safety
  - How to attract the internet generation to the 70's technology ?
  - How to train and permit mistakes on an operating plant ?
  - How to create fundamental nuclear attitude in a safe and ordinary environment (without TMI, Tchernobyl etc…) ?
  - ➔ **Be attractive to tempt and catch best talents**

4 DPN

The Academy concept

To Adapt And Renew Competences (ARC)



A fleet management programme with 4 mains goals

- Management focused on employees skills and improvement of management skills
- Safe and successful workforce renewal, by hiring new EDF employees as well as recruiting EDF internal employees (from non nuclear areas). (see Annexe 1)
- Active initial training in the field for all the new comers, allowing them to perform their job earlier than before
- Competencies are developed with our contractors

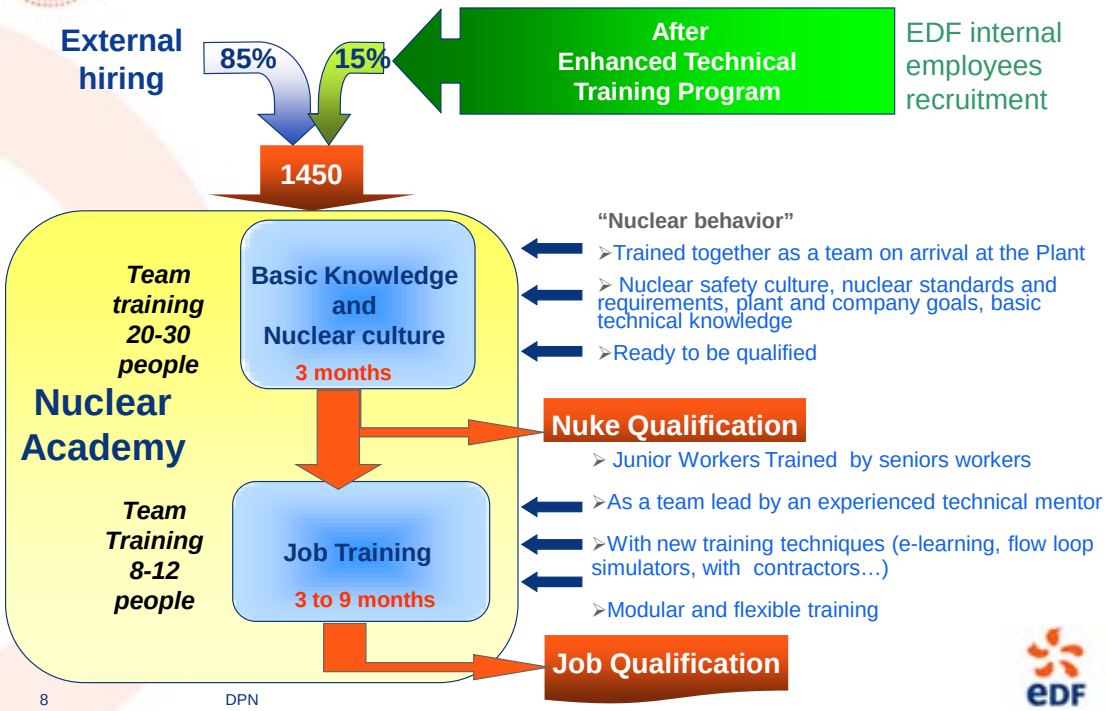
6 DPN

Implement a Nuclear Academy

- **Team building**
- **Classes/sessions** with trainees from all disciplines
- **Sharing experience and training with similar plants**
- **Lead by an experimented technical mentor**
- **Training by managers and seniors technical workers to transfer tacit and explicit knowledge**
- **Based on field training regarding behaviour and craft**
- a **Shared Knowledge** module followed by a **Specialised Knowledge** module according to occupation
- An **optimised duration**
- With the **contractors**

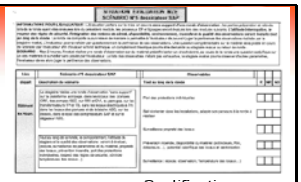
7 DPN

2009:Nuclear academy program in 19 NPPs



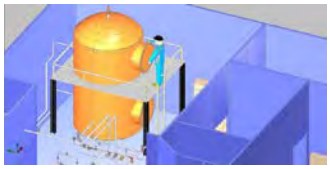
8 DPN

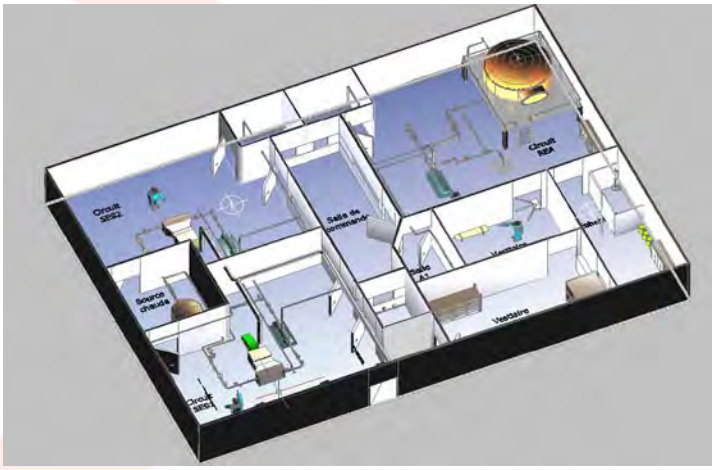
Basic Knowledge Academy



Flow loop maintenance simulator

- Nuclear Academy Program works out for each plant
- On line training and test for periodic training
- Flow loop maintenance simulator in each plant



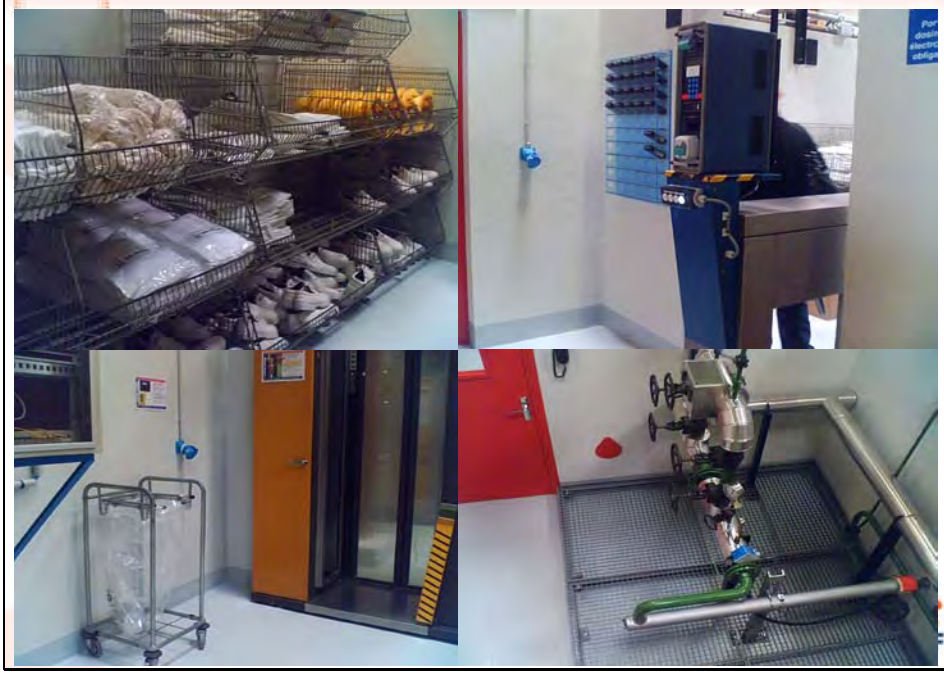


To gain or revisit:

- a prudent and questioning attitude,
- implementation of intervention reliability tools,
- safety/quality rules,
- security, radioprotection and fire protection rules,
- installation maintenance.

It is used:

- during the Academy,
- during retraining
- for training in constituted teams.



Training academy for first line managers

- **make them well aware of and confident in what it is expected of a manager in a nuclear power plant**
- **involving plant managers and their own manager**
- **preparation for new management responsibilities, how to make his or her staff improve, daily activities supervision, observation and presence in the field,**

4 training sessions (60 people) in 2009

10 sessions/year from 2010 (150 people/year) onwards

12 DPN

Training academy for contractors supervisors

Building with and for the contractors

training dedicated to their supervisors to :

- **make them have better competencies , knowledge and skills to supervise their teams in a nuclear power plant**
- **make them more confident to give their staff directives related to nuclear safety culture, nuclear standards and requirements**
- **let them know all the areas covered by the contracts**

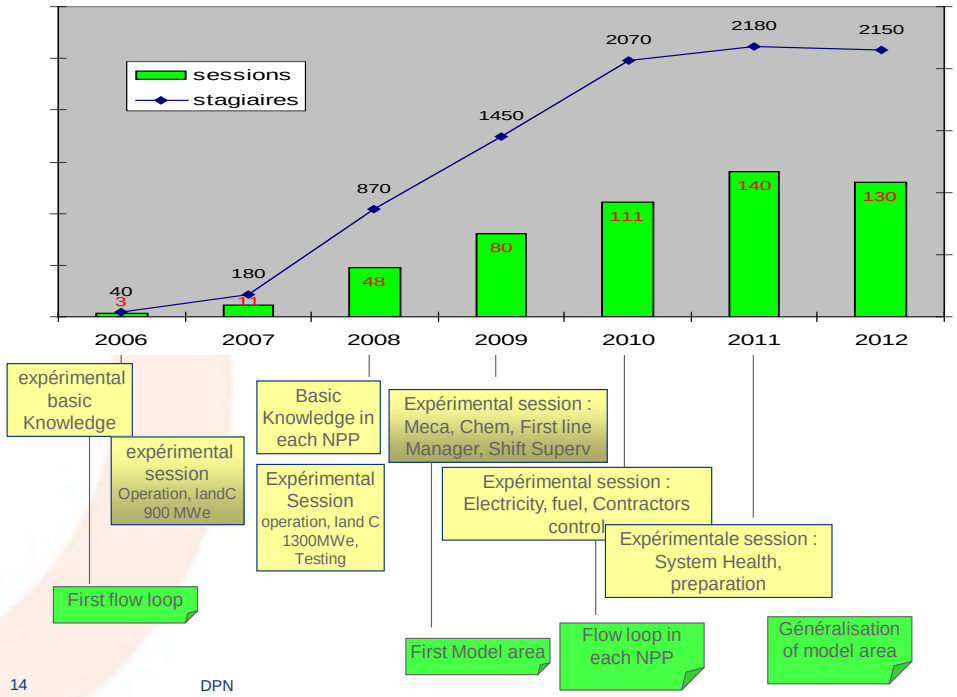
10 days training

9 training sessions (180 people) in 2009

10 sessions/year from 2010 onwards

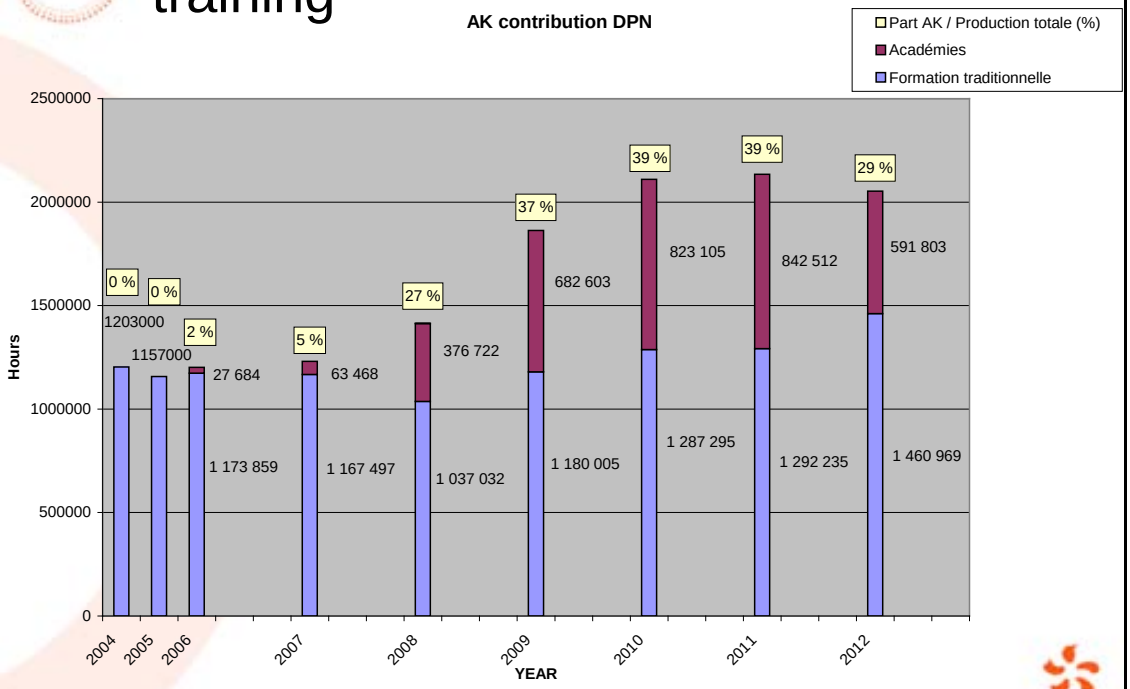
13 DPN

2006 ➔ 2012 : Nuclear Academy Evolution

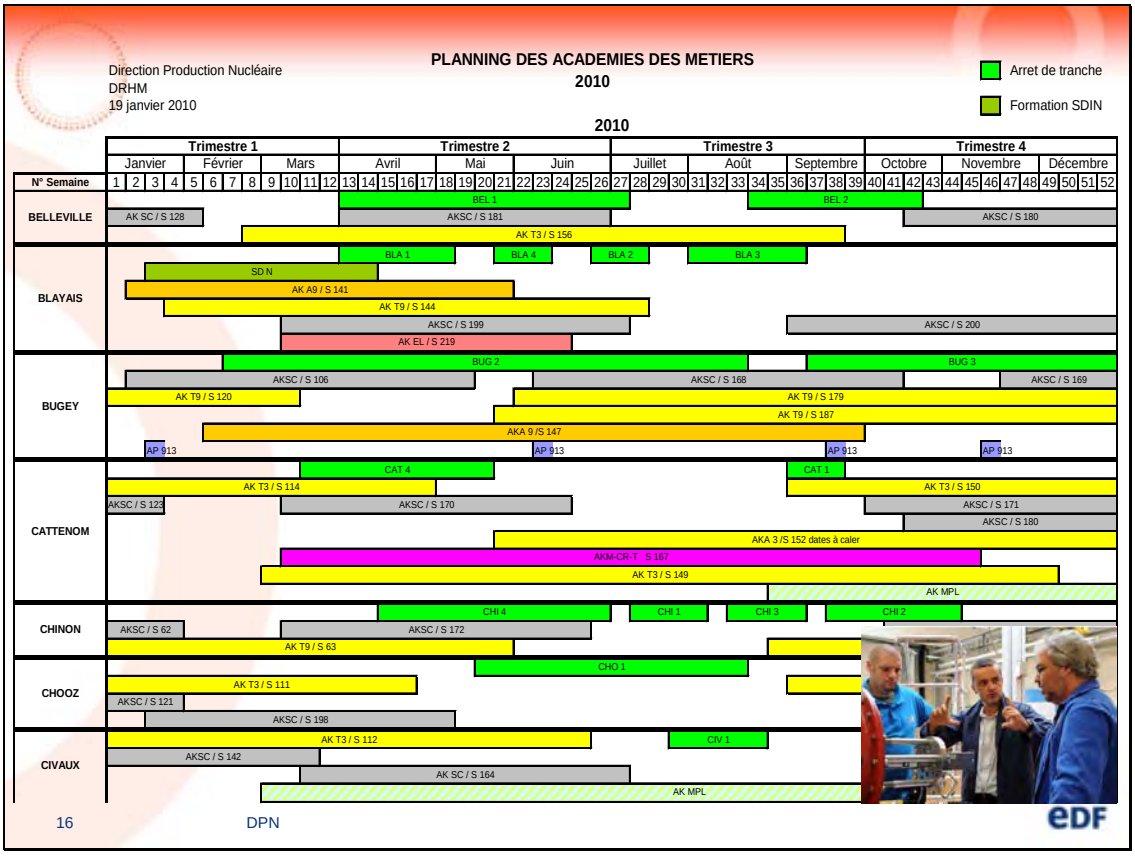


14 DPN

Contribution from the Academy to training



15 DPN



16 DPN

Nuclear Academy Event


GRAND ANGLE Express

Le 5 octobre 2007

Depuis le 1er octobre, les centrales nucléaires de Paluel, Penly et Flamanville et l'agence de maintenance EDF de la région nord-ouest, ont mis en place leur "académie des métiers". Objectif : adapter et renouveler les compétences de leurs intervenants.

Académie des métiers du nucléaire : c'est parti !

L'Académie des métiers du nucléaire accueille depuis le 1er octobre, sur le site EDF de Paluel en Seine-Maritime, une première promotion de trente stagiaires, salariés de l'entreprise dont 5 issus de Flamanville.

L'Académie des Métiers a un double objectif : former et transmettre les savoirs et savoir faire. Il s'agit en effet de faire en sorte que les anciens, avant leur départ en retraite, transmettent leurs compétences et leurs connaissances des installations nucléaires aux nouveaux intervenants.

L'Académie a par ailleurs vocation à rassembler et à créer de la cohésion entre les différents participants qui, pendant 4 mois, partagent une période dite "d'acculturation" aux exigences de l'industrie nucléaire.

Au cours de cette formation, les nouveaux intervenants vont acquérir les bases théoriques et pratiques sur le fonctionnement d'une centrale, la sécurité ou la radioprotection. Ce premier cycle de formation se termine par une semaine d'évaluation globale au terme de laquelle est délivrée l'habilitation minimale indispensable pour intervenir sur une centrale nucléaire.

Cette formation initiale sera complétée de formations de 12 à 18 mois sur un métier en particulier (électriciens, automaticiens, ...). Ouverte pour le moment aux salariés d'EDF nouvellement arrivés au sein des centrales nucléaires et aux nouveaux embauchés d'EDF, l'Académie des Métiers devrait s'ouvrir rapidement aux entreprises partenaires d'EDF.


TAM-TAM

SÛRETÉ Notre priorité n° 1

PRESTATAIRES De nombreuses actions lancées

DISPONIBILITÉ "Sécuriser" le Kd

MÉTIERS Réorganisation chez les Auto

9 AGENTS DE ST-LAURENT À L'ACADÉMIE DES MÉTIERS

AK LOIRE & VIENNE : MOTEUR!

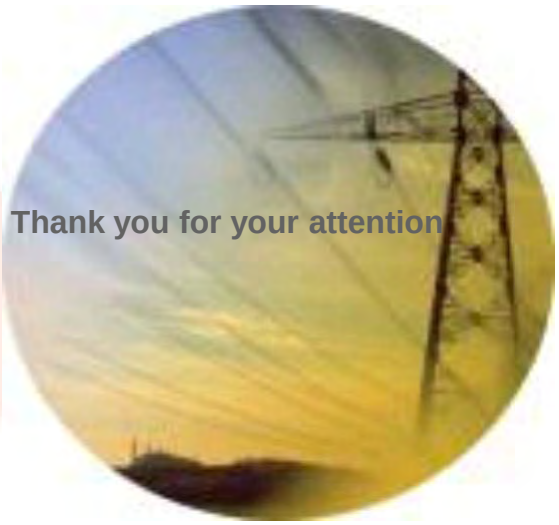
17 DPN

Nuclear Academy : Lessons learnt

- Training a new generation needs a strong process to transfer knowledge and behaviour especially in running Nuclear Power Plants .
- Listening an experience story is far more efficient than reading a book or watching a Power Point Presentation.
- It is possible to perform a better training more quickly when done in the field, by managers and peers with effective tools.
- Team building training gets new comers quickly involved in the company goals and gets the company well connected with the younger generation.

18 DPN

END



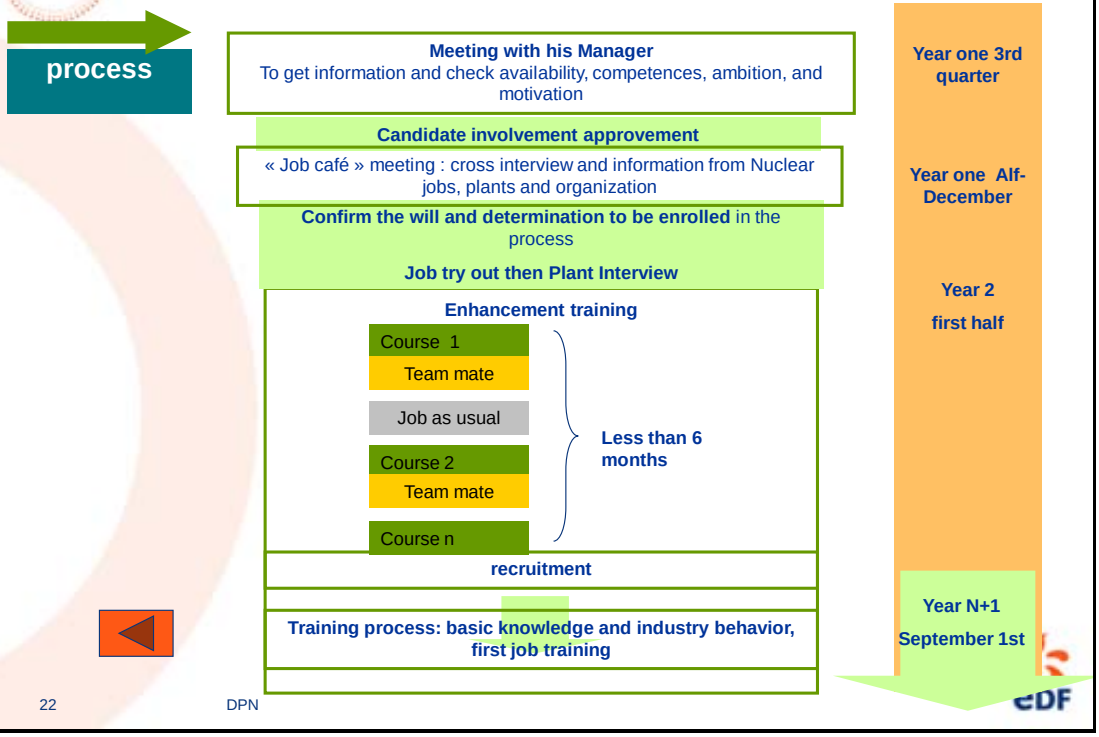
Annexe 1
-
INTERNAL MOVING PROCESS

Safe and succesfull workforce renewal, by recruiting EDF internal employees

- To succeed in internal replacing **AND** meet nuclear expectation,a process has been implemented
- EDF applicants :
  - Are evaluated by their potential and motivation and not by their skills
  - Pass cognitive tests
    - spatial representation, logic, ability to stop and go….
  - Are interviewed by several NPP staff in regional meetings
  - Follow individual Enhancement Technical Training Program (ETTP) to reach the same competences as external recruits
    - from 1 month to 9 months depending on the initial level
  - Start the **nuclear academy** as an external recruit does

21 DPN

Internal moving



22 DPN

Internal Moving Process

Job Area : Operation, Control & Instrumentation, Maintenance, Chemistry, Electricity, Health Physic.

For each kind of job :

- **A requirement regarding qualification and update training needed**
- **A detection process based on a technical form describing the job, requirement, Knowledge ability test, …),**
- **A process enrollment based on a (job café meeting, cross interviews, job try out),**
- **Company regional employment supervision**

23 DPN

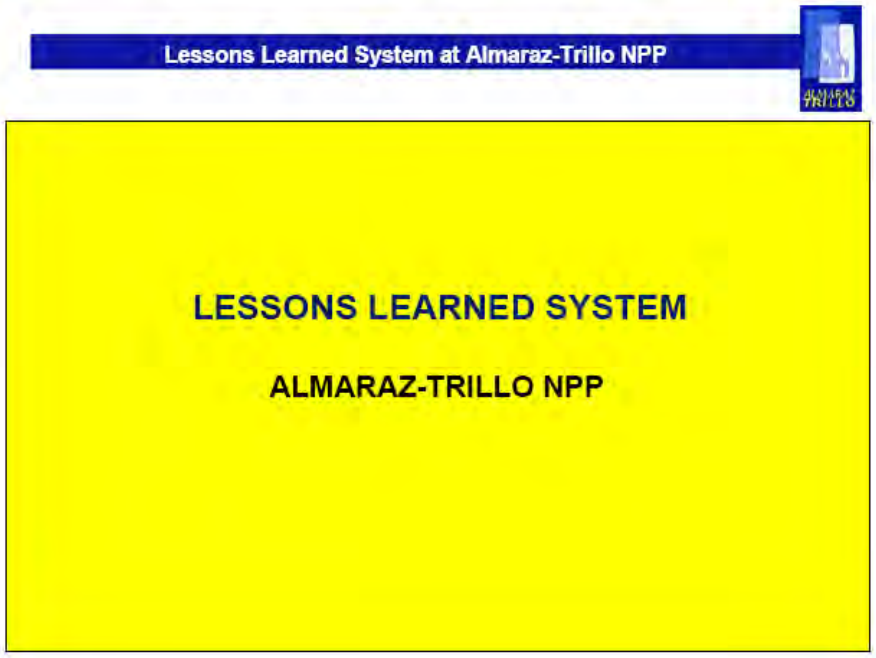
Safe and succesfull workforce renewal, by recruiting EDF internal employees

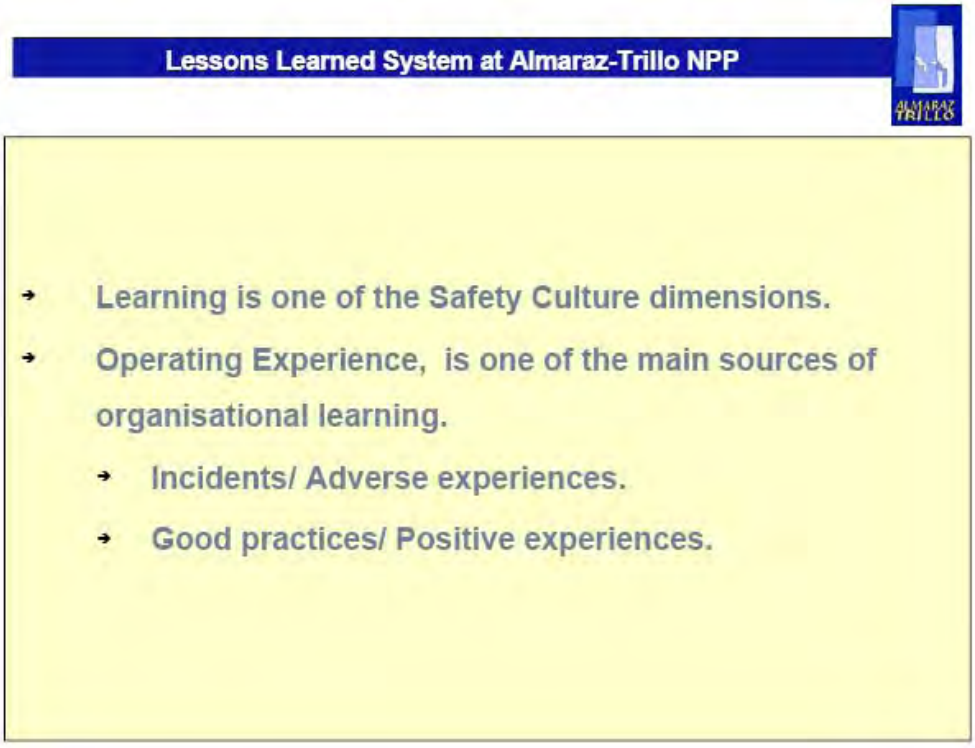
After 2 years, the lessons learnt :

- Managers feel confident while hiring employees trained in ETTP
  - Non technical people can achieve nuclear skills !
- Our project also catches the attention of motivated people from non technical departments of EDF
  - Applicants are reassured by the process of recruitment and the ETTP
- The high number of female applicants (from non technical dep) promotes diversity !
  - You find less than 12 % of women in NPP
  - 30 % female applicants in this process..

24 DPN

Luis Asensio, Amaraz Nuclear Power Plant Manager
Implementing Lessons Learn

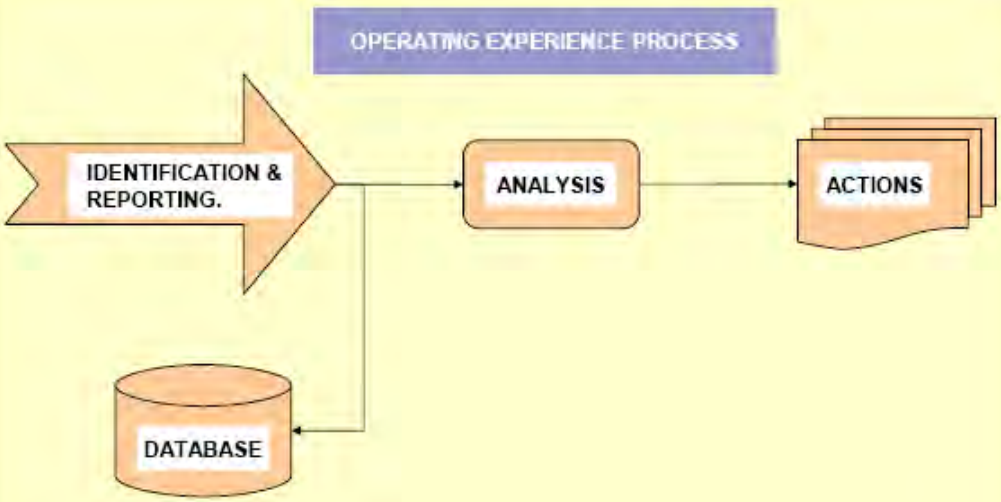




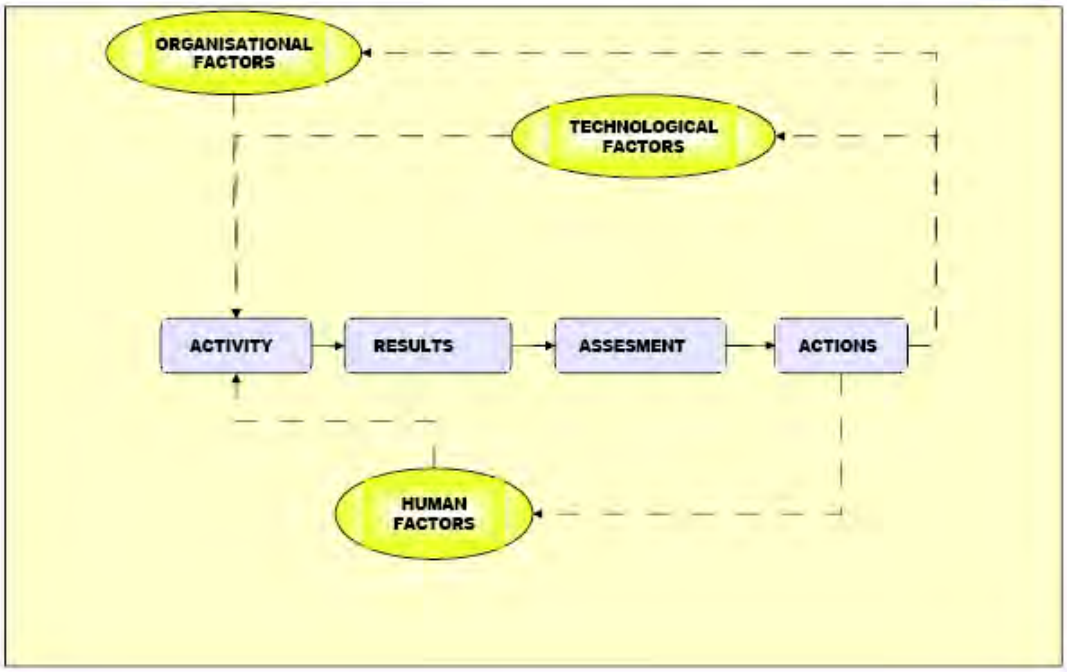
Lessons Learned System at Almaraz-Trillo NPP

- **Good practices ——> Proposal for improvements of the processes:**
  - Outages
  - Big projects
  - Industry Operating Experience
  - Internal Operating Experience/Implicit knowledge.
- **Incidents ——> Corrective actions**

Lessons Learned System at Almaraz-Trillo NPP

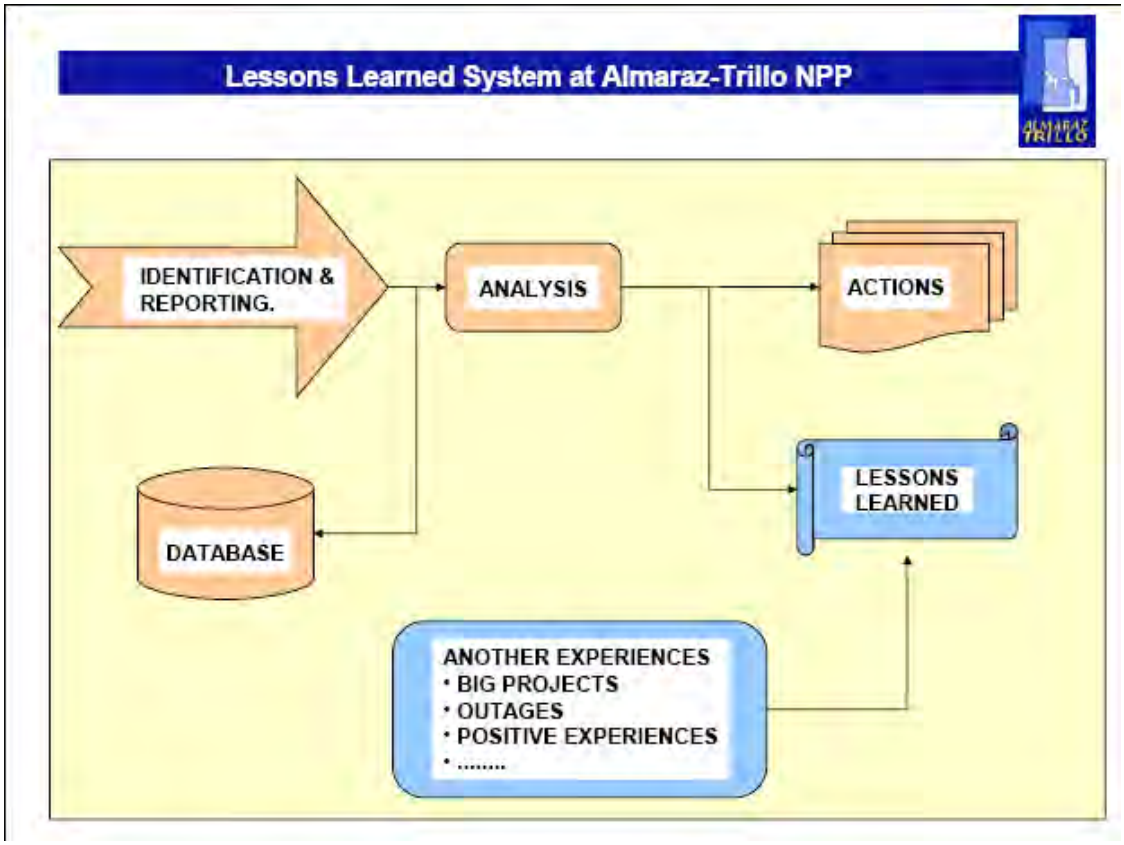


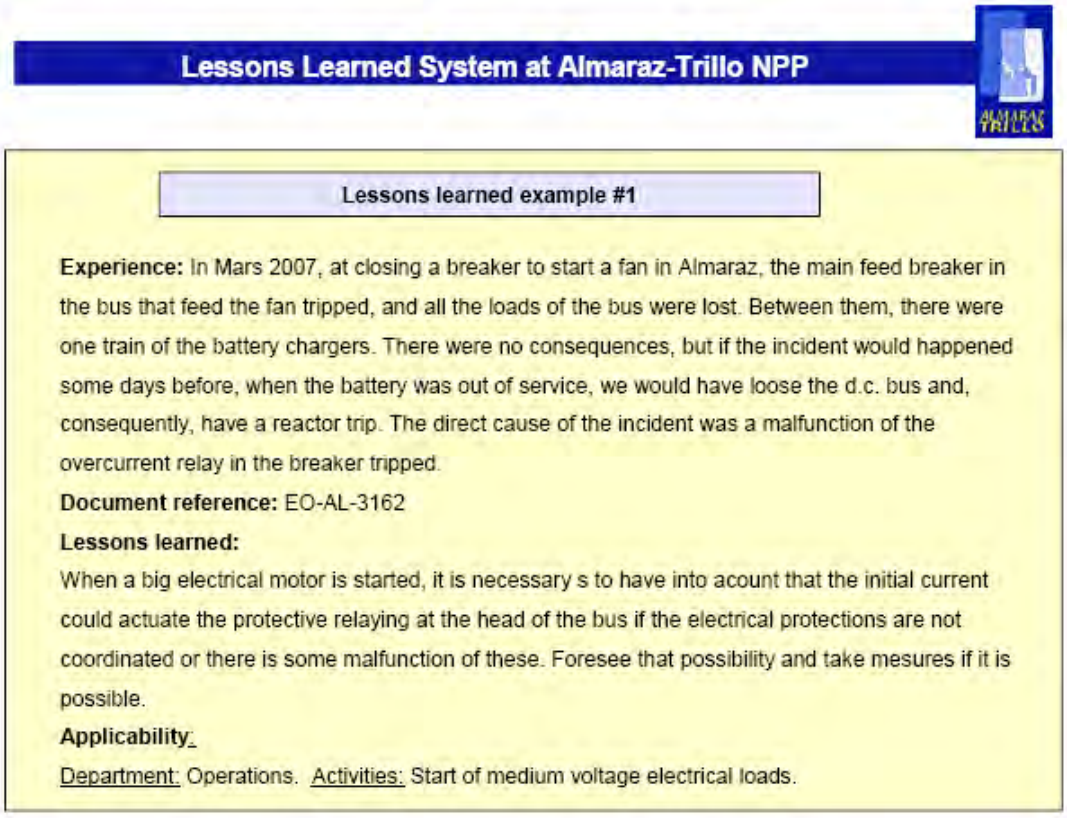
Lessons Learned System at Almaraz-Trillo NPP



Lessons Learned System at Almaraz-Trillo NPP

FACTORS TO MODIFY	EXAMPLES OF ACTIONS
TECHNOLOGICAL	•Design modifications •Set point modifications •Software/Database modifications •Operations, maintenance, test procedure changes.
ORGANISATIONAL	•Responsibility changes/definitions •Management process changes
HUMAN	•Training •Sharing experiences/Be aware •Reinforcing or discouraging attitudes/behaviours


Lessons Learned System at Almaraz-Trillo NPP
IDENTIFICATION & REPORTING.
ANALYSIS
ACTIONS
LESSONS LEARNED
DATABASE
ANOTHER EXPERIENCES
• BIG PROJECTS
• OUTAGES
• POSITIVE EXPERIENCES
• .....


Lessons Learned System at Almaraz-Trillo NPP
Lessons learned example #1
Experience: In Mars 2007, at closing a breaker to start a fan in Almaraz, the main feed breaker in the bus that feed the fan tripped, and all the loads of the bus were lost. Between them, there were one train of the battery chargers. There were no consequences, but if the incident would happened some days before, when the battery was out of service, we would have loose the d.c. bus and, consequently, have a reactor trip. The direct cause of the incident was a malfunction of the overcurrent relay in the breaker tripped.
Document reference: EO-AL-3162
Lessons learned:
When a big electrical motor is started, it is necessary s to have into acount that the initial current could actuate the protective relaying at the head of the bus if the electrical protections are not coordinated or there is some malfunction of these. Foresee that possibility and take mesures if it is possible.
Applicability:
Department: Operations. Activities: Start of medium voltage electrical loads.

Lessons Learned System at Almaraz-Trillo NPP

Lessons learned example #2

Experience: Industry Operating Experience. Reactivity management events.

Document reference: SOER-2007-1, EO-AL-3241

Lessons learned:

All changes in core reactivity must be done in a deliberate manner and careful controlled. Not use more than one method simultaneously to change reactivity.

Applicability:

Department: Operations. Activities: Power change. Reactivity core change.

Lessons Learned System at Almaraz-Trillo NPP

Lessons learned example #3

Experience: In October 2007, there was in Almaraz an accident due to arc flash when an worker was handling a breaker in a low voltage bus bar (380 V) without the needed precautions.

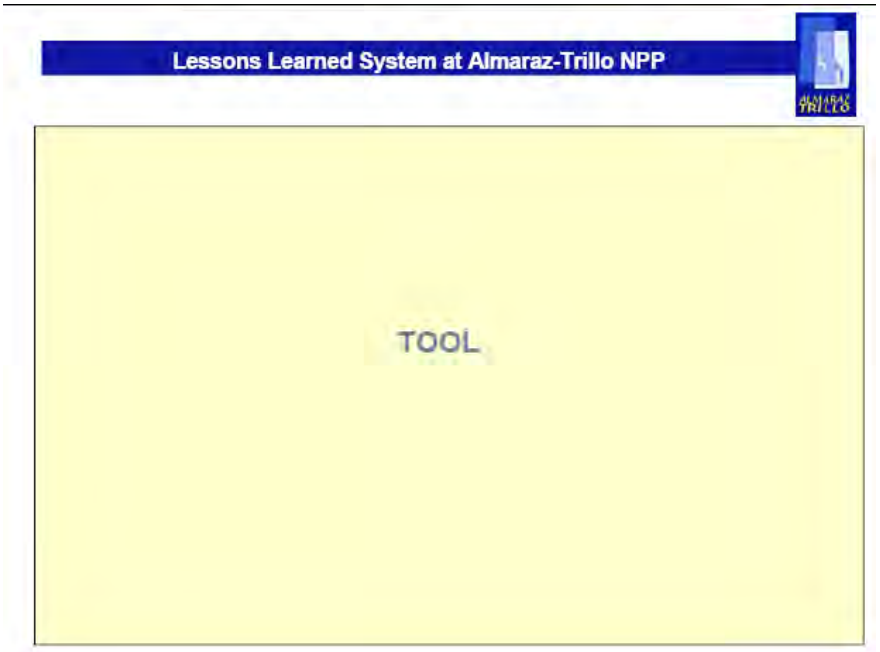
Document reference: EO-AL-3266

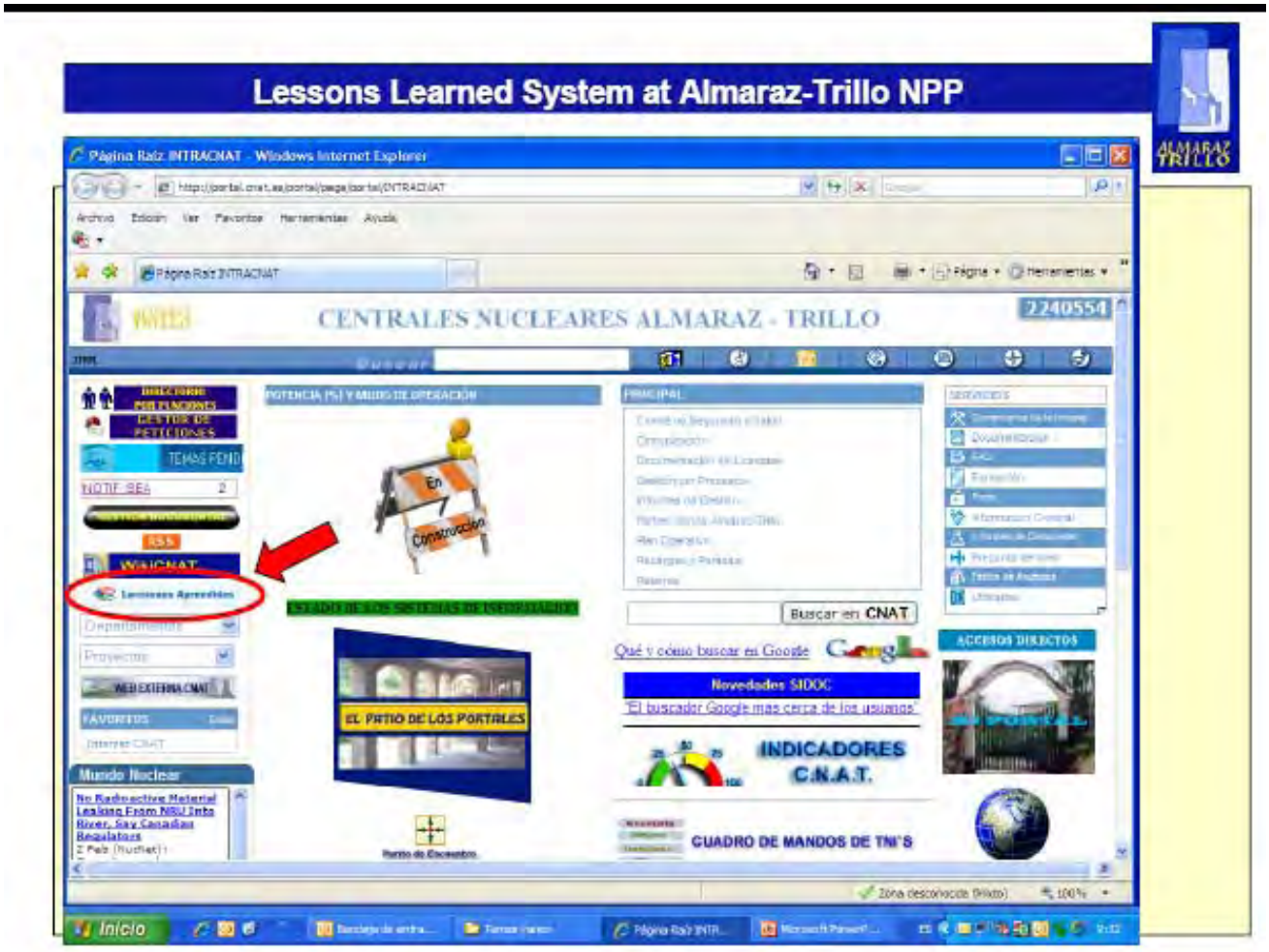
Lessons Learned:

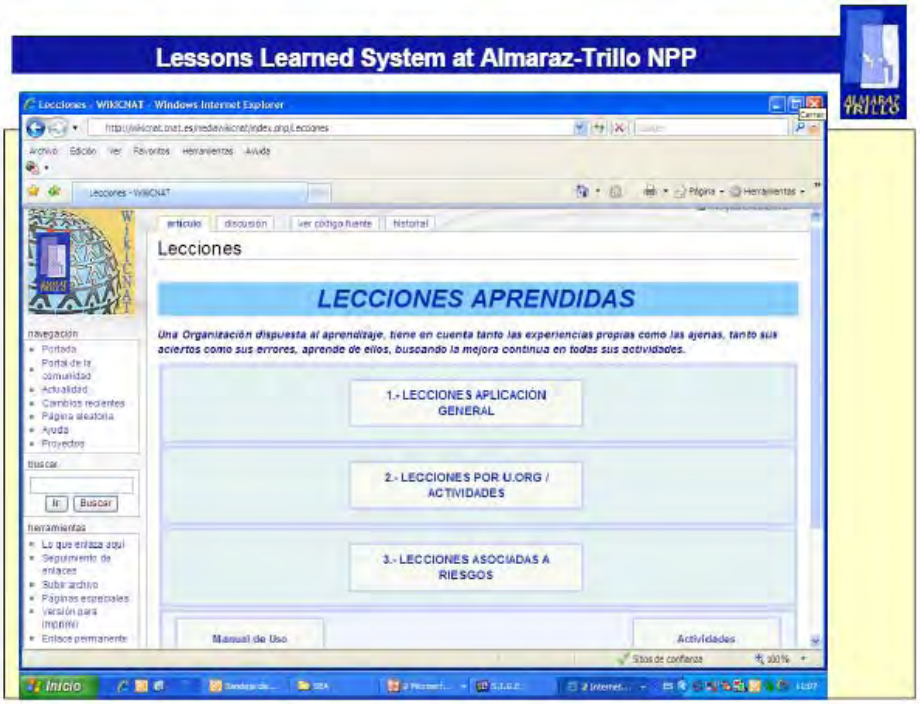
Before handling equipment at voltage, the equipment must be deenergiced and tagged or, in other case, if it is not possible, the worker must wear personnel protective equipment adecuate to the electrical risk.

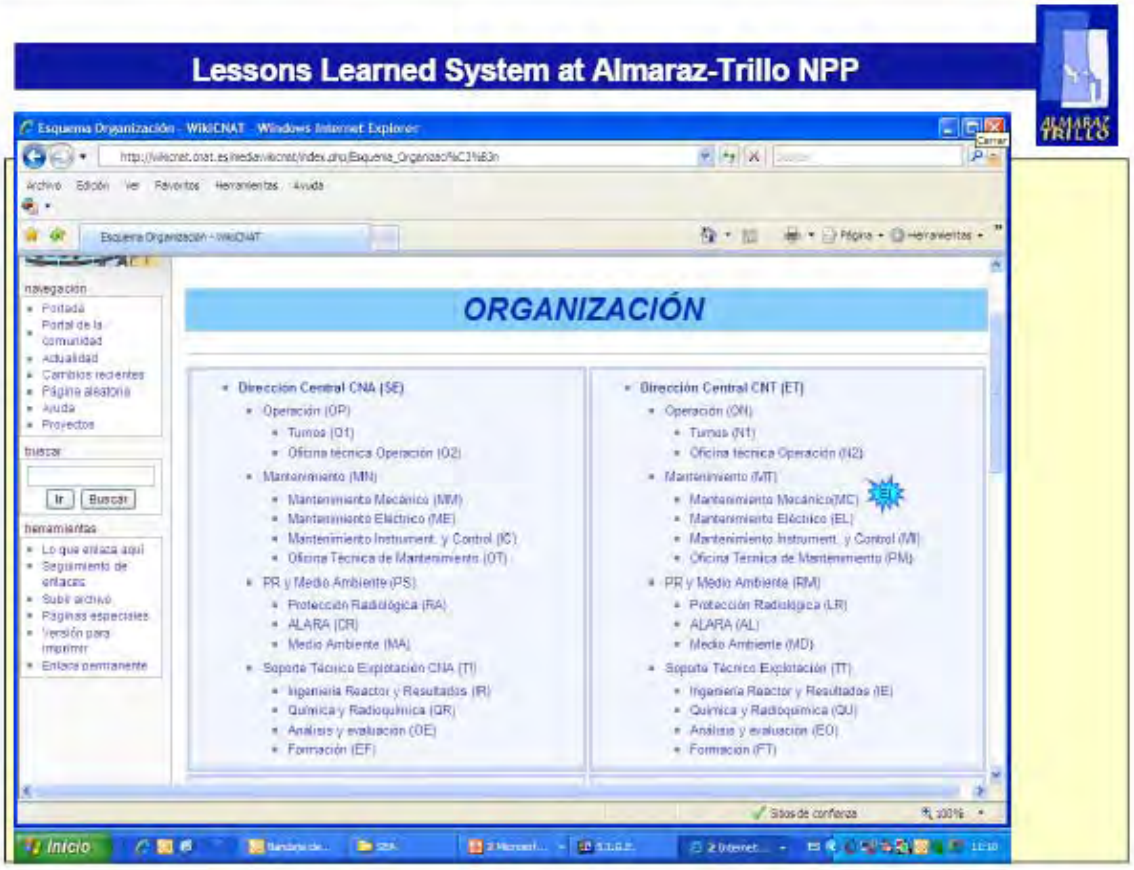
Applicability:

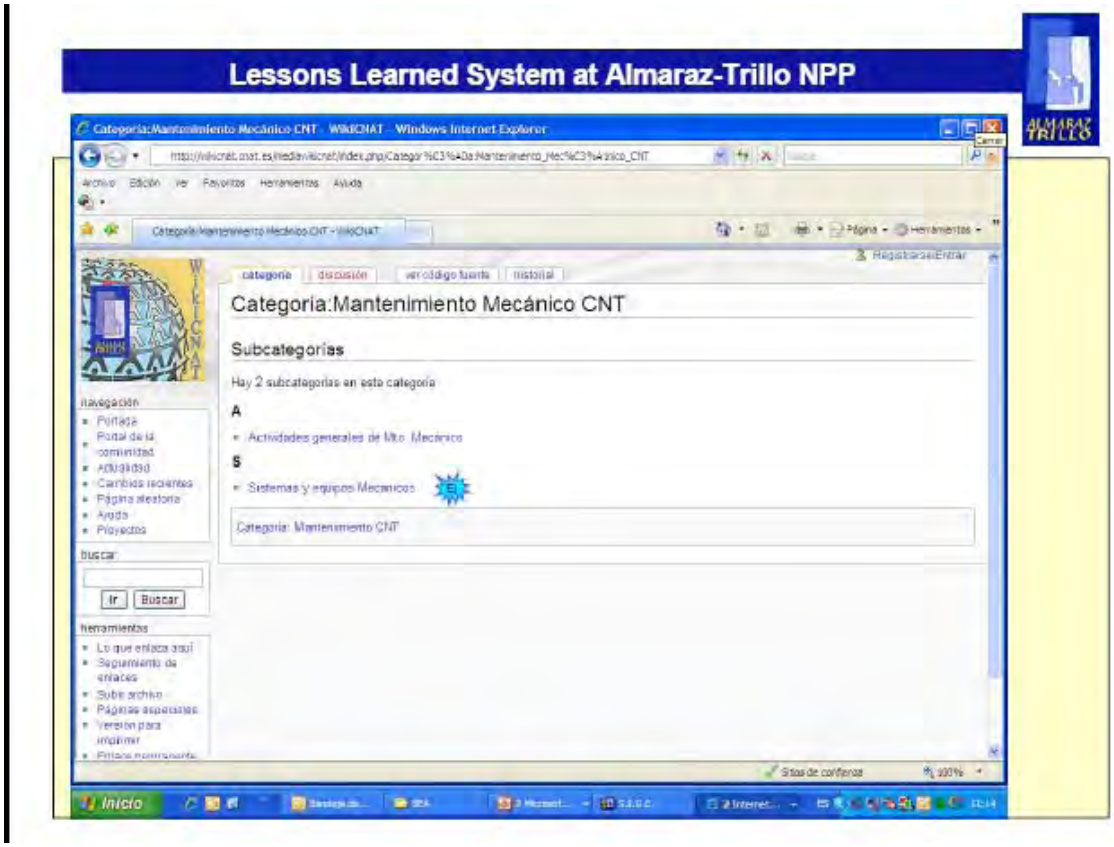
Departments: Electrical Maintenance. Activities: Electrical bus maintenance or Troubleshooting in electrical bus

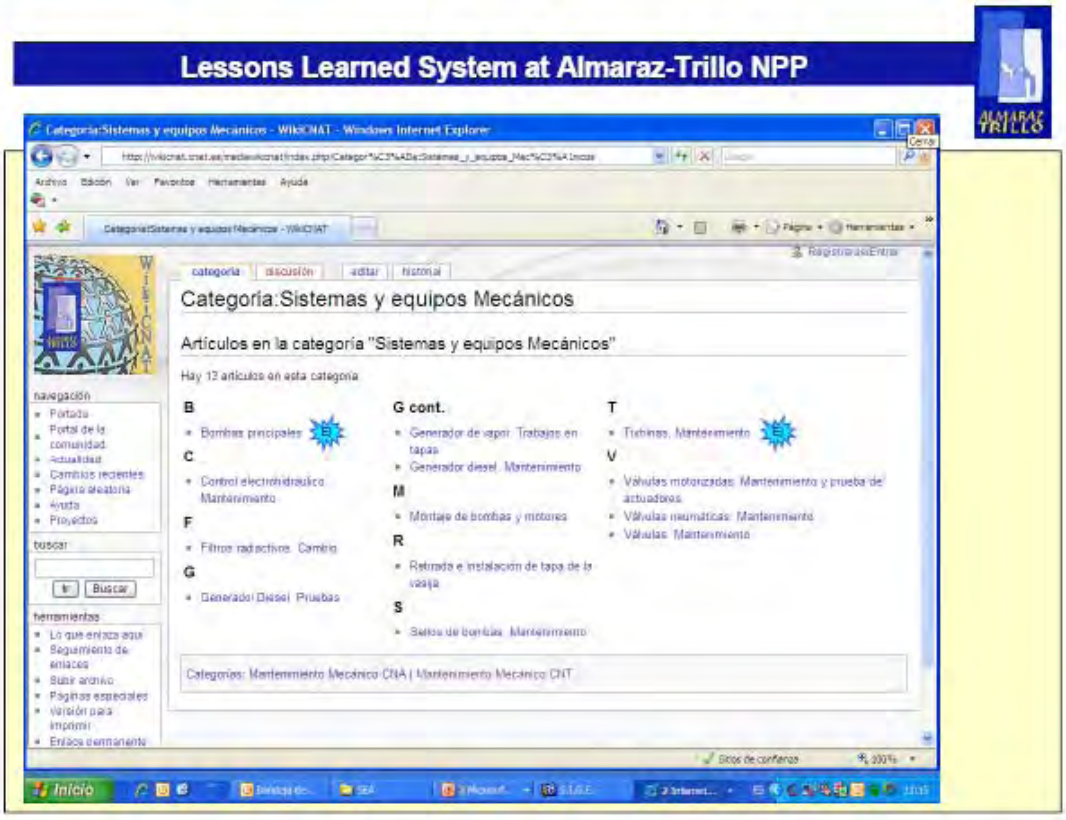

Lessons Learned System at Almaraz-Trillo NPP
TOOL

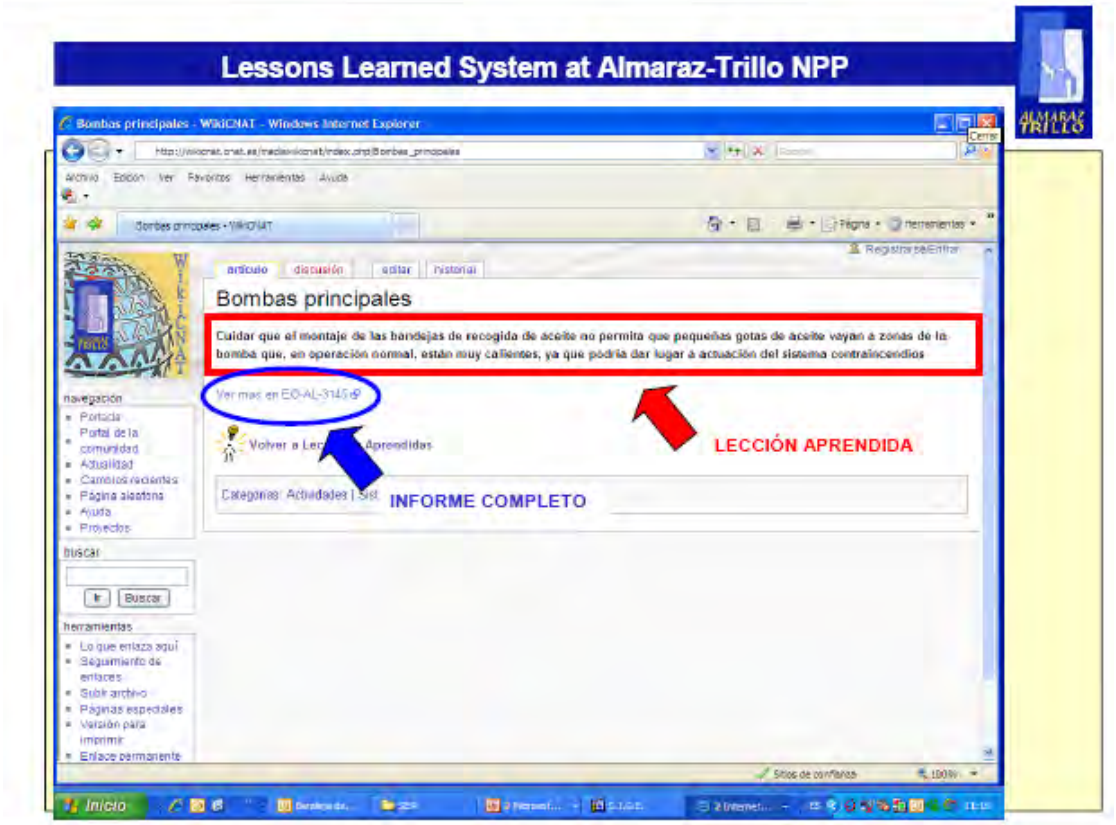

Lessons Learned System at Almaraz-Trillo NPP
Página Raíz INTRACNAT - Windows Internet Explorer
CENTRALES NUCLEARES ALMARAZ - TRILLO
2240554
Lecciones Aprendidas
Buscar en CNAT
Novedades SIDOC
INDICADORES C.N.A.T.
CUADRO DE MANDOS DE TN'S
EL PATIO DE LOS PORTALES
Mundo Nuclear
Inicio

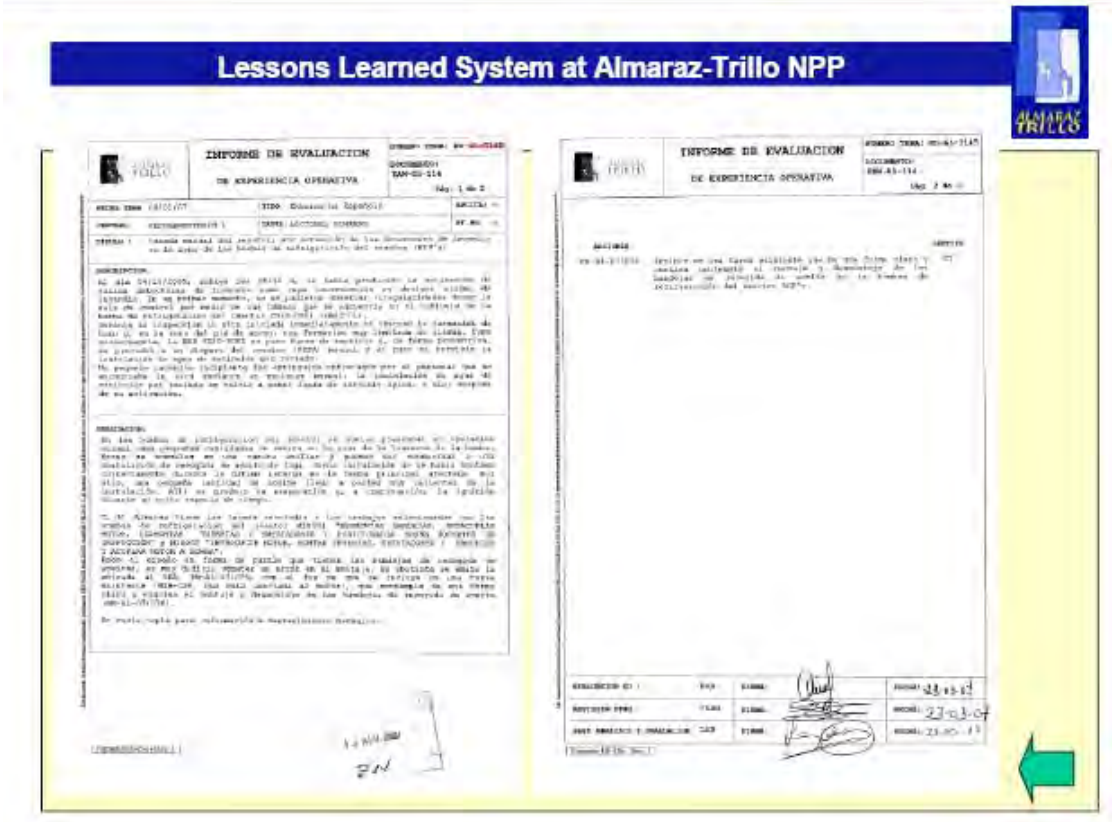

Lessons Learned System at Almaraz-Trillo NPP
Lecciones - WIKICNAT - Windows Internet Explorer
Lecciones
LECCIONES APRENDIDAS
Una Organización dispuesta al aprendizaje, tiene en cuenta tanto las experiencias propias como las ajenas, tanto sus aciertos como sus errores, aprende de ellos, buscando la mejora continua en todas sus actividades.
1.- LECCIONES APLICACIÓN GENERAL
2.- LECCIONES POR U.ORG / ACTIVIDADES
3.- LECCIONES ASOCIADAS A RIESGOS
Manual de Uso
Actividades

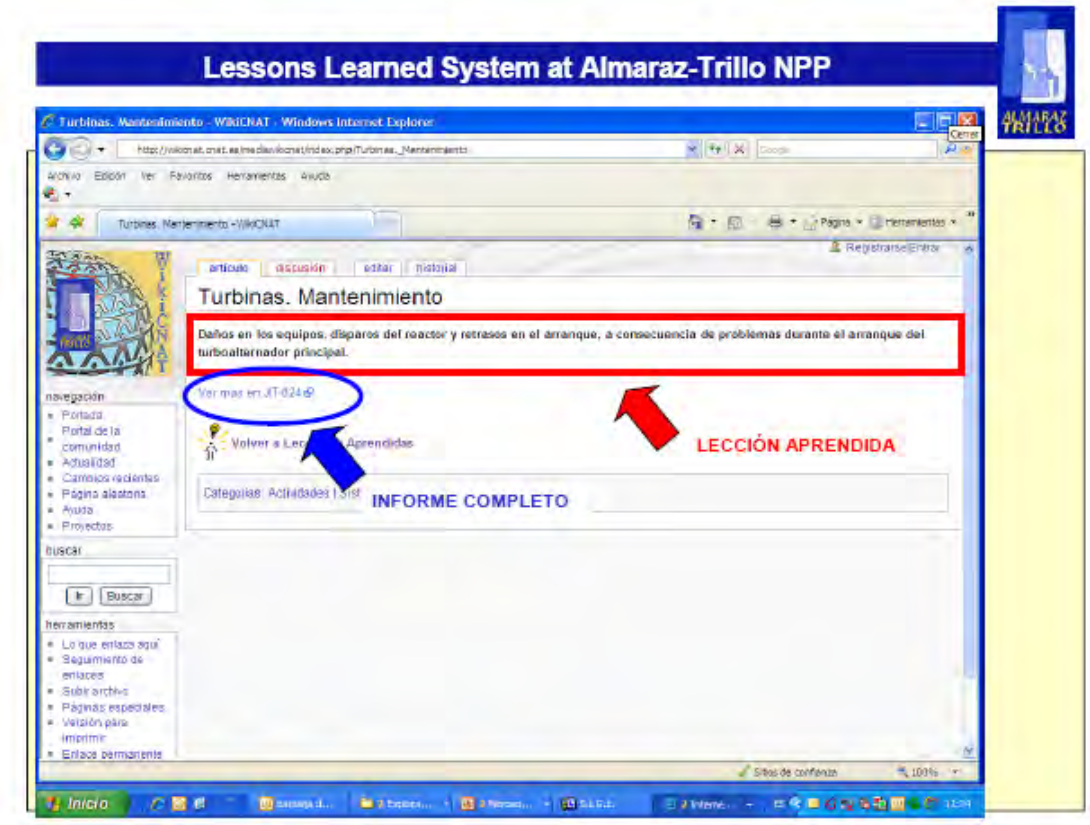

Lessons Learned System at Almaraz-Trillo NPP
Esquema Organización - WIKICNAT - Windows Internet Explorer
ORGANIZACIÓN
Dirección Central CNA (SE)
Operación (OP)
Turnos (O1)
Oficina técnica Operación (O2)
Mantenimiento (MN)
Mantenimiento Mecánico (MM)
Mantenimiento Eléctrico (ME)
Mantenimiento Instrument. y Control (IC)
Oficina Técnica de Mantenimiento (OT)
PR y Medio Ambiente (PS)
Protección Radiológica (RA)
ALARA (CR)
Medio Ambiente (MA)
Soporte Técnico Explotación CNA (TI)
Ingeniería Reactor y Resultados (IR)
Química y Radioquímica (QR)
Análisis y evaluación (OE)
Formación (EF)
Dirección Central CNT (ET)
Operación (ON)
Turnos (N1)
Oficina técnica Operación (N2)
Mantenimiento (MT)
Mantenimiento Mecánico(MC)
Mantenimiento Eléctrico (EL)
Mantenimiento Instrument. y Control (MI)
Oficina Técnica de Mantenimiento (PM)
PR y Medio Ambiente (RM)
Protección Radiológica (LR)
ALARA (AL)
Medio Ambiente (MD)
Soporte Técnico Explotación (IT)
Ingeniería Reactor y Resultados (IE)
Química y Radioquímica (QU)
Análisis y evaluación (EO)
Formación (FT)

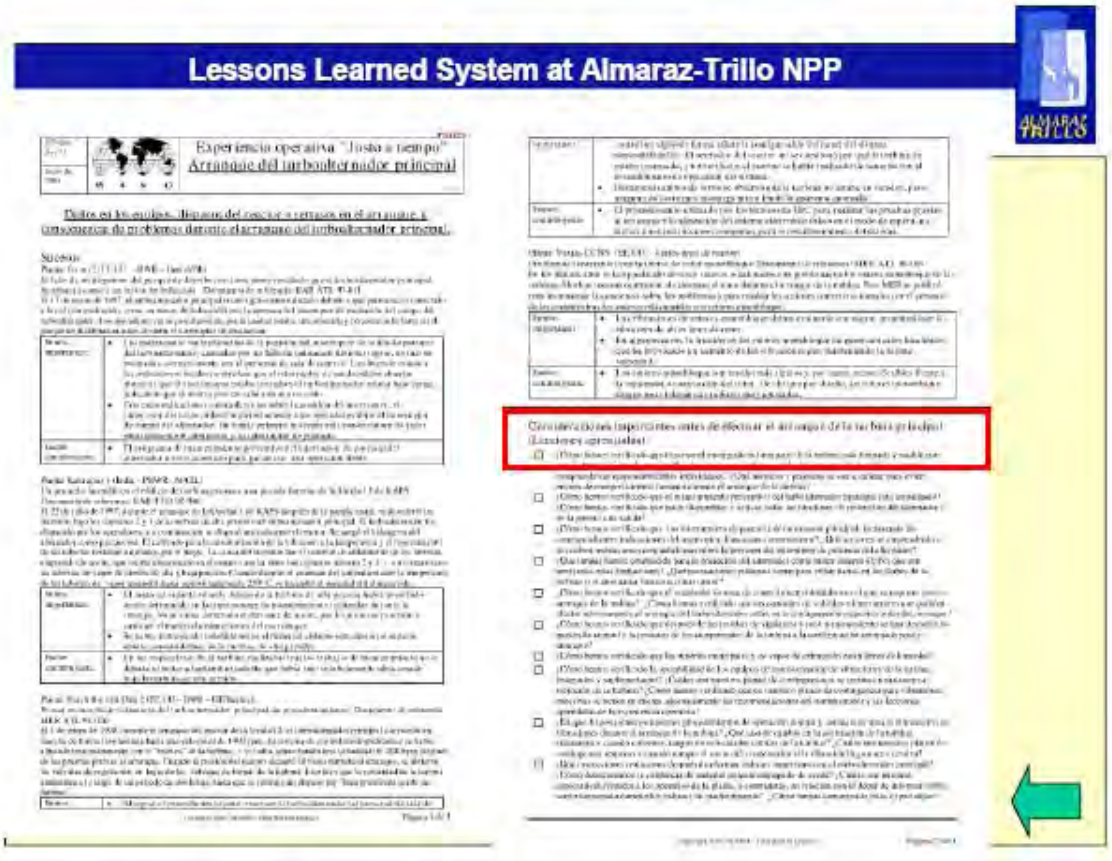

Lessons Learned System at Almaraz-Trillo NPP
Categoría:Mantenimiento Mecánico CNT
Subcategorías
Hay 2 subcategorías en esta categoría
A
Actividades generales de Mto. Mecánico
S
Sistemas y equipos Mecánicos
Categoría: Mantenimiento CNT

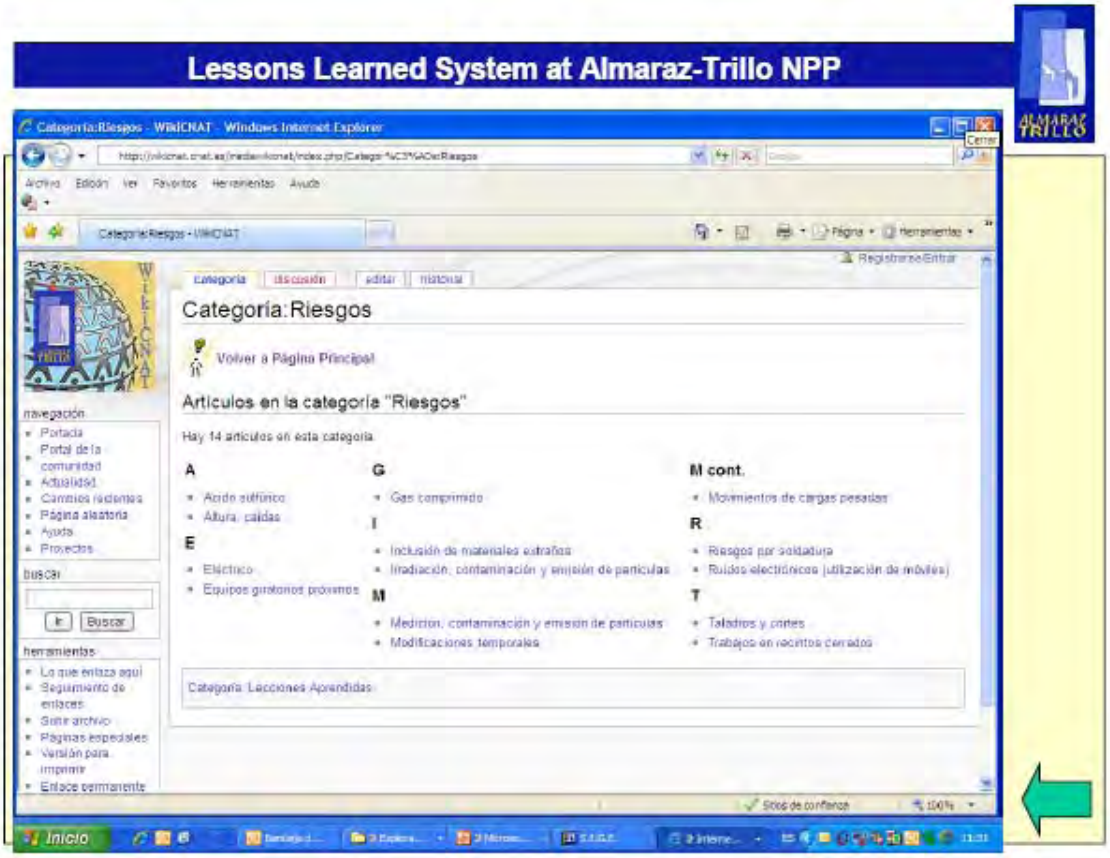

Lessons Learned System at Almaraz-Trillo NPP
Categoría:Sistemas y equipos Mecánicos
Artículos en la categoría "Sistemas y equipos Mecánicos"
Hay 12 artículos en esta categoría
B
Bombas principales
C
Control electrohidráulico. Mantenimiento
F
Filtros radiactivos. Cambio
G
Generador Diesel. Pruebas
G cont.
Generador de vapor. Trabajos en tapas
Generador diesel. Mantenimiento
M
Montaje de bombas y motores
R
Retirada e instalación de tapa de la vasija
S
Sellos de bombas. Mantenimiento
T
Turbinas. Mantenimiento
V
Válvulas motorizadas. Mantenimiento y prueba de actuadores
Válvulas neumáticas. Mantenimiento
Válvulas. Mantenimiento
Categorías: Mantenimiento Mecánico CNA | Mantenimiento Mecánico CNT

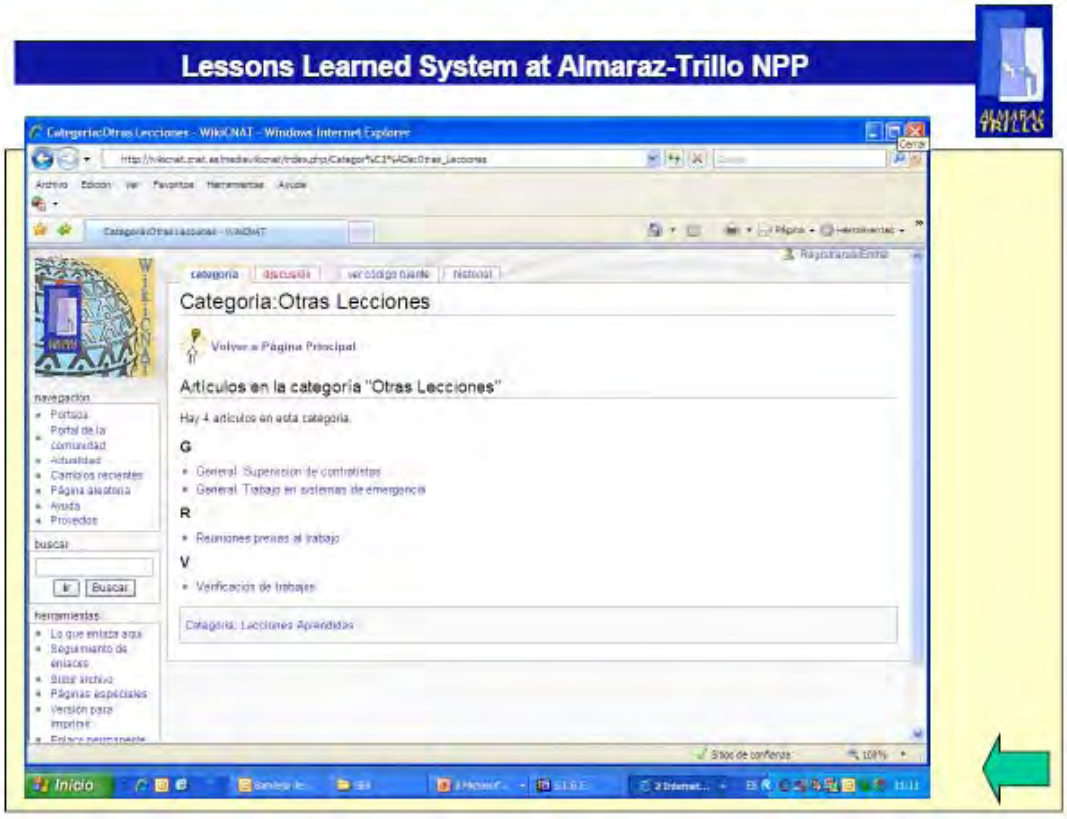

Lessons Learned System at Almaraz-Trillo NPP
Bombas principales - WIKICNAT - Windows Internet Explorer
Bombas principales
Cuidar que el montaje de las bandejas de recogida de aceite no permita que pequeñas gotas de aceite vayan a zonas de la bomba que, en operación normal, están muy calientes, ya que podría dar lugar a actuación del sistema contraincendios
Ver más en EO-AL-3145
LECCIÓN APRENDIDA
INFORME COMPLETO

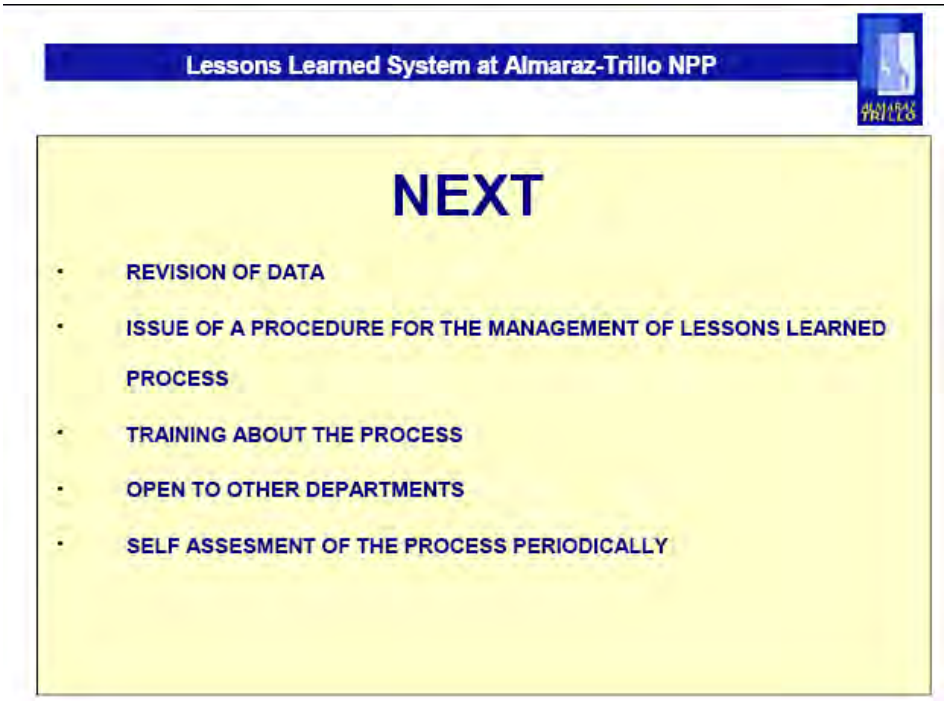

Lessons Learned System at Almaraz-Trillo NPP
INFORME DE EVALUACION
DE EXPERIENCIA OPERATIVA
INFORME DE EVALUACION
DE EXPERIENCIA OPERATIVA


Lessons Learned System at Almaraz-Trillo NPP
Turbinas. Mantenimiento
Daños en los equipos, disparos del reactor y retrasos en el arranque, a consecuencia de problemas durante el arranque del turboalternador principal.
Ver mas en JT-024
LECCIÓN APRENDIDA
INFORME COMPLETO


Lessons Learned System at Almaraz-Trillo NPP
Experiencia operativa "Justo a tiempo"
Arranque del turbogenerador principal

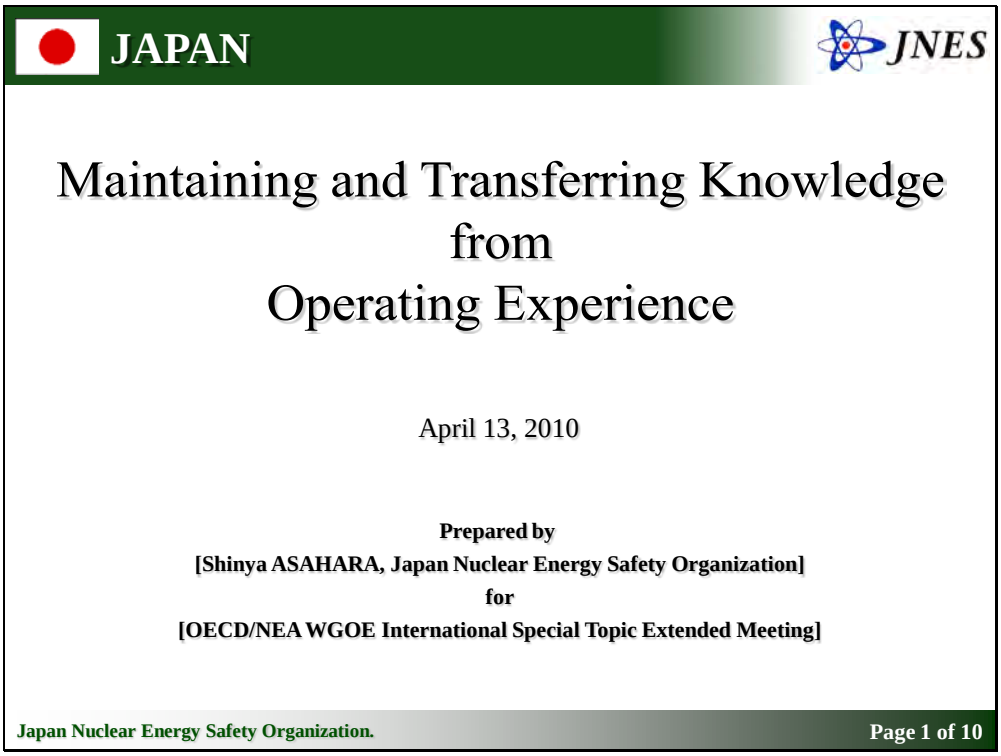

Lessons Learned System at Almaraz-Trillo NPP
Categoría:Riesgos - WikiCNAT - Windows Internet Explorer
Categoría:Riesgos
Volver a Página Principal
Artículos en la categoría "Riesgos"
Hay 14 artículos en esta categoría.
A
Acido sulfúrico
Altura, caídas
E
Eléctrico
Equipos giratorios próximos
G
Gas comprimido
I
Inclusión de materiales extraños
Irradiación, contaminación y emisión de partículas
M
Medición, contaminación y emisión de partículas
Modificaciones temporales
M cont.
Movimientos de cargas pesadas
R
Riesgos por soldadura
Ruidos electrónicos (utilización de móviles)
T
Taladros y cortes
Trabajos en recintos cerrados
Categoría: Lecciones Aprendidas
navegación
Portada
Portal de la comunidad
Actualidad
Cambios recientes
Página aleatoria
Ayuda
Proyectos
buscar
Buscar
herramientas
Lo que enlaza aquí
Seguimiento de enlaces
Subir archivo
Páginas especiales
Versión para imprimir
Enlace permanente
Inicio


Lessons Learned System at Almaraz-Trillo NPP
Categoría:Otras Lecciones - WikiCNAT - Windows Internet Explorer
Categoría:Otras Lecciones
Volver a Página Principal
Artículos en la categoría "Otras Lecciones"
Hay 4 artículos en esta categoría.
G
General: Supervisión de contratistas
General: Trabajo en sistemas de emergencia
R
Reuniones previas al trabajo
V
Verificación de trabajos
Categoría: Lecciones Aprendidas
navegación
Portada
Portal de la comunidad
Actualidad
Cambios recientes
Página aleatoria
Ayuda
Proyectos
buscar
Buscar
herramientas
Lo que enlaza aquí
Seguimiento de enlaces
Subir archivo
Páginas especiales
Versión para imprimir
Enlace permanente
Inicio


Lessons Learned System at Almaraz-Trillo NPP
NEXT
REVISION OF DATA
ISSUE OF A PROCEDURE FOR THE MANAGEMENT OF LESSONS LEARNED PROCESS
TRAINING ABOUT THE PROCESS
OPEN TO OTHER DEPARTMENTS
SELF ASSESMENT OF THE PROCESS PERIODICALLY

Shinya Asahara, Japan

Maintaining and Transferring Knowledge from Operating Experience: the JNES Perspective



The Regulatory Body of JAPAN

JNES

The Organization of RB

Regulatory Enforcement

Corresponds Domestic Event

- The NISA
  Disaster Prevention Division,
  Office of Accident or Failure.
  Inspection Division.
  Other division of the NISA.

- The JNES
  Analyze events and assist NISA

Corresponds Overseas Event

- The NISA and the JNES.
  Analyze events.
- The other division of the NISA
  in case assist event analysis.

Current Situation of OE/KM

JNES

Domestic OE/KM

Current Situation of OE/KM

JNES

Overseas OE/KM

Safety Information Review Meeting (SIRM)

JNES
Screening Event

NISA

Feedbacks to the Regulatory
Notice Overseas Events

Plant Operators

Overseas OE Information.

Capture or Collect Lessons Learnt

JNES

Current OE Tools and Process for Share Lessons Learnt

Capture

Simple Data Entry Tools
Ms Access Application

OE Data Base
Ms Access DB

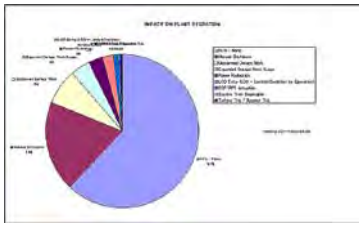
Retrieve

Ms Access Application

Store

JNES
Expert Meeting
Cause Analysis
Keyword Definition
etc.

Analyze



Ms Excel Application

Monthly
Event Report

Transfer or Share the Knowledge

JNES

to Current Staff

In House Seminar
And OJT

e-Learning

Knowledge Transfer

Technical Information
Portal

Current Staff

Tech-Info
DB

Information Sharing

Transfer or Share the Knowledge

JNES

to Future Staff.

In House Seminar
And OJT

e-Learning

Knowledge Transfer

Technical Information
and Knowledge Portal

Expert Community

Knowledge Wiki

etc

Tech-Info
DB

Knowledge
Store

Knowledge Share

Current Issue.

JNES

Policy and Strategy.
NISA/JNES KM

Requirement.

Management Issue

Task Issue

- Rule and Methods for OE/KM
- ICT Infrastructure Upgrade.
- The Methods Effectiveness.

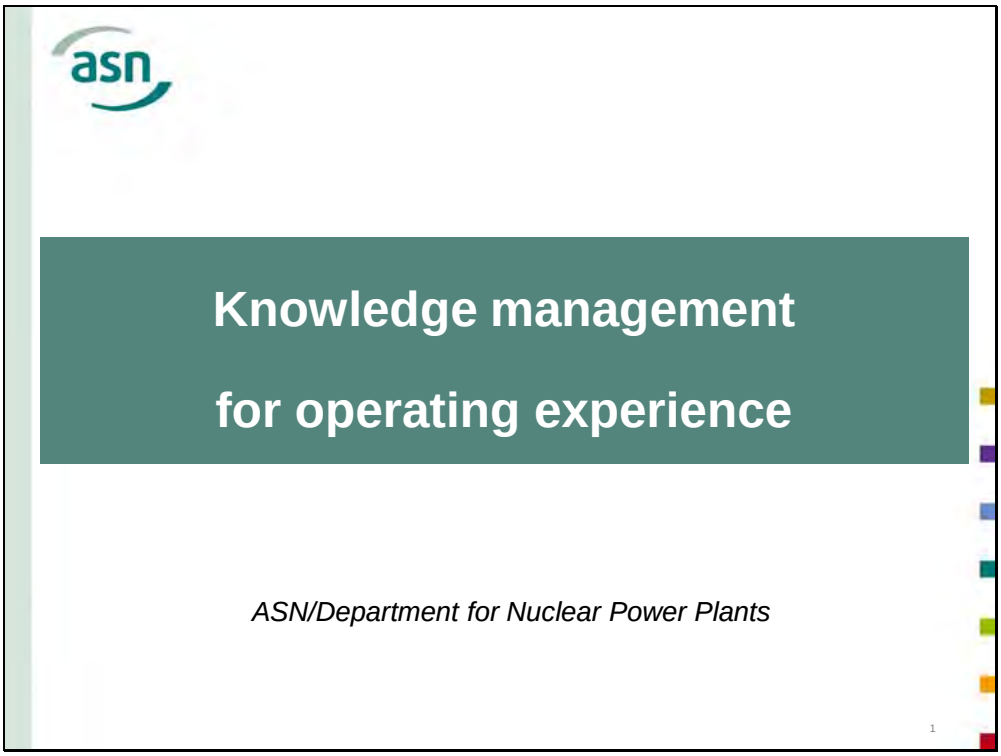
Perspective

JNES

The JNES is preparing preliminary project planning work about improvement of Knowledge management; Advancing tools utilization; Transfer or share the lesson learnt, etc.

Requirement.

Laurianne Giroud, ASN
Knowledge Management at ASN



Human resources

- **Who are the people involved ?**
  - ASN human resources :

Total workforce : about 440 people (+ 66% in 6 years)

Diversification of experience and qualification

High turn over but average stay at ASN is increasing

  - Operating experience :

No one dedicated to the subject

ASN directorate (Paris) : Op. E. Unit (transverse activity rather than line activity)

ASN regional units : 1 people part time in charge of Op. E.

3

Summary

- Human resources
- Knowledge management for operating experience

4

Knowledge management for operating experience

- **French context**

➢one organisation operating a large number of identical or similar reactors (58)

➢Actually about 800 safety significant event are reported each year (in which radiation protection, environment and transport events account for 212 incidents)

➢ a huge advantage for OEF

5

Knowledge management for operating experience

- **Capture / collecting**
  - ➢ ASN database

contains every event and their subsequent analysis by the licensee

  - ➢ Supplementory information reported at quarterly meetings

selection of events to be reviewed by ASN, IRSN and the licensee

  - ➢ Information exchanged in the context of international co-operation (WGOE…)
  - ➢ Yearly summary

- For each NPP : yearly report of all events written by inspectors
- National review : summary of all site reports

6

Knowledge management for operating experience

- **Transfer / sharing**
  - ➢ Training of inspectors
    2 days specifically dedicated to Op. E.
  - ➢ IRSN staff - technical experts to ASN generalists
    lower turn over, give advice to ASN inspectors
  - ➢ Communication : ASN directorate to regional units

- the Op. E. Unit select the events most interesting for inspectors (based on a weekly review)
- suggestion of subjects to be checked by inspectors

  - ➢ Op. E. Unit actions
    Advice given to inspectors (reporting criteria, INES level, actions for inspectors…)

7

Knowledge management for operating experience

- **Transfer / sharing : Which Tools ?**
  - ➢ ASN database of events and their analysis
  - ➢ Op. E. Unit
    E-mail box and specific telephone number
  - ➢ ASN Guidelines

- written by Op. E. Unit
- introduced during training of inspectors (reporting criteria, INES level, …)

8

Knowledge management for operating experience

- **Organising / storing**
  - ASN national database of events / ASN guidelines
    Free access for every ASN inspector
  - Advisory Committee for Reactor Safety (GPR)
    - Periodic examination of significant incidents every 3 years
    - In-depth analysis of incidents (safety studies…)
    - Objectives are : to put forward modifications of equipment or mode of operation

9

Knowledge management for operating experience

- **Effectiveness evaluation**
  - Periodical ASN audit
  - ASN directorate / regional units meetings
    – Every 3 months
    – Feedback from regional units to directorate
    – Presentation of directorate actions

10

Jean Chipot, IRSN
Knowledge Management in French TSO

SUMMARY

- Knowledge management by training and tutoring
- Common information means in IRSN
- International relevant activities in IRSN

1A – PURPOSES OF TRAINING

- **To maintain a high level of competences**

1B - MAIN SUBJECTS IN IRSN TEACHING ACTIVITIES

- **Nuclear safety**
  - Core physic behaviour (neutron flux, thermalhydraulics...)
  - PWR design, operation and maintenance
  - PWR simulation (transients, accidents...)
  - Main hazards (external hazards, internal such as criticality, fire ...)
  - Fuel cycle
  - Nuclear materials controls
- **Radiation protection**
  - For radiologists, nuclear medicine, dentists, medical physics ...,
  - Optimisation principle in medical applications for patients radioprotection
  - For industrial and research techniques (gammagraphist...)
  - Exposed workers, radiation protection experts
  - Radiation protection for waste management
  - Radioecology

IRSN TRAINING : SAFETY – ABOUT 20 TC/YEAR

- **The main training course : "Knowledge, analysis and engineering of nuclear safety" (following page) since 1982 by IRSN managers**
- **Additional training depends on the evaluation activity in the field of IRSN expertise (reactors, plants, factories...)**
- **For PWR reactors, the additional training is, most often :**
  - INSTN complementary training in accordance with specific needs
    - Neutron management and core behaviour in PWR
    - PWR operation (systems, start-up, shutdown, load changes ...)
    - Probabilistic safety assessment
    - Material features (metallurgy, corrosion, chemistry U/Pu ...)
    - In the field of a partnership between INSTN and IRSN, IRSN teachers may be involved in INSTN training courses
  - IRSN training courses on its simulator
- **For evaluation about fuel cycle, complementary training is often provided by INSTN**
  - Fuel cycle
  - Spent fuel reprocessing
  - Waste management

1C - THE MAIN TRAINING COURSE (PARTS 1 AND 2)

- **General safety principles**
  - General presentation of a PWR standard plant and fuel cycle
  - The safety control by authorities
  - The technical support by IRSN
  - Radiation protection : principles, appliance, issues, medicine use
- **General issues of nuclear safety**
  - External hazards
  - Human factors
  - Criticality hazards
  - Fire hazards
  - Containment of installations
  - Regulations and safety about transportation
  - Dismantling
  - Emergency plans and crisis management in IRSN

THE MAIN TRAINING COURSE (PART 3)

- **Nuclear safety in fuel cycle facilities**
  - Main hazards
  - Relevant documents
  - The upstream cycle installations
  - The fuel and waste reprocessing
  - Containment assessment
- **Laboratories and other factories, spent fuel management**
  - Spent fuel facilities
  - Waste management (processing, conditioning, encapsulation)
  - Incident analysis
  - Waste storage (on surface and in-depth)

THE MAIN TRAINING COURSE (PART 4)

- **Nuclear safety about reactors**
  - PWR design (core design, safety analysis, electric control)
  - Accident studies (LOCA, SGTR, SLB, emergency operation, PSA level 1 and 2, severe accidents)
  - Qualification and civil works
  - Safety in operation (surveillance of RCS, main documents, safety re-evaluation, testing in operation, case studies)
  - Other reactors (Generations III and IV, testing reactors, fast breeders)

1D - PWR SIMULATOR TRAININGS

- **IRSN has a PWR simulator since 1992**
- **Main purposes of the simulator**
  - Accident studies
  - Analysis of incidents during plant operation
  - Preparing exercises for crisis testing
  - Training (3 courses)
- **The training courses**
  - SP0 : normal operation (3 days)
  - SP1 : design basis accidents (4,5 days)
    - LOCA
    - SGTR
    - SLB
  - SP2 : other accidents (3 days)
    - Loss of CCWS and/or ESWS
    - Loss of ability of SG's to cool RCS
    - Loss of all electricity supply including Diesel generators

1E - RADIATION PROTECTION TRAINING

- **Training for medical, industrial and research applications with**
  - University,
  - Engineer schools
  - INSTN

2 – INFORMATION MEANS IN IRSN

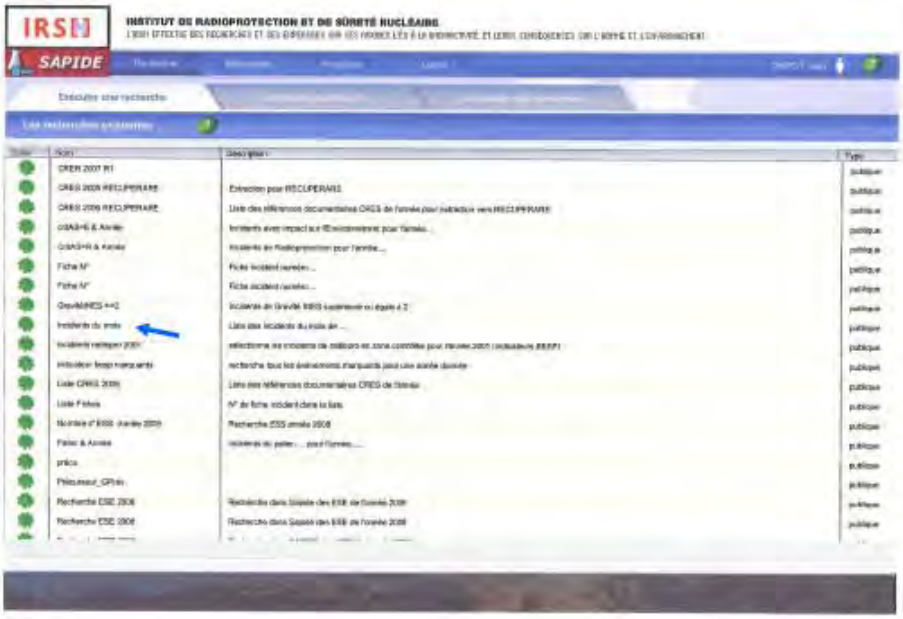
- **SAPIDE database and associated tool RECUPERARE**
- **Computer-driven tools**
  - PLEIADE
- **Operation feedback documentation**
  - Groupe Permanent reporting
  - SEREP reports
  - Event analysis
  - About IRS

2A - SAPIDE DATABASE

Support to analysis of problems, incidents and operation difficulties

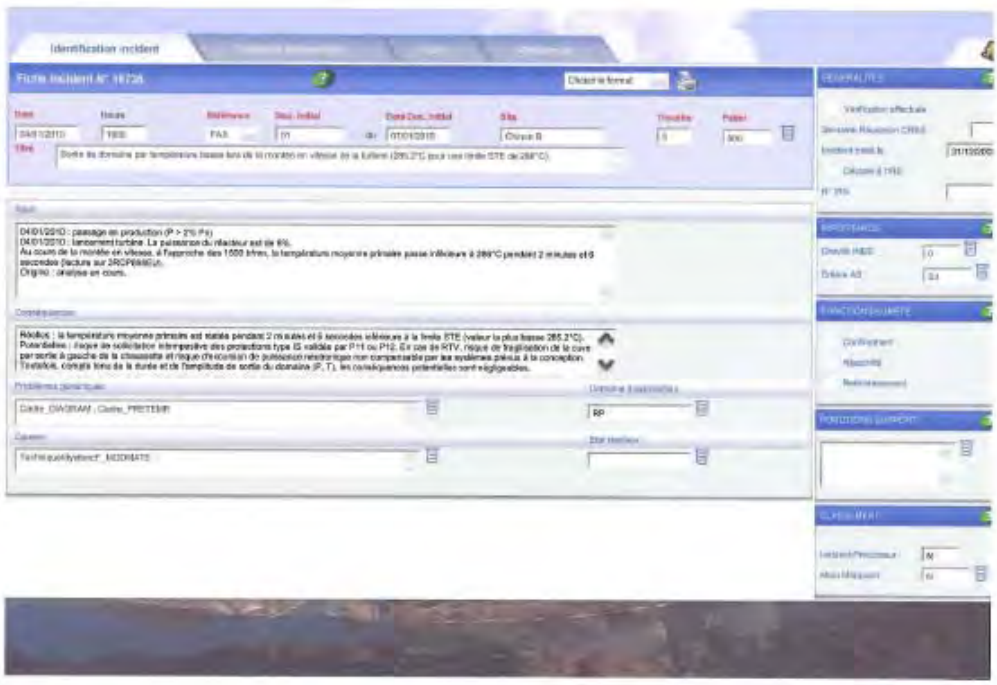
SAPIDE DATABASE : PURPOSE

- **Possibilities : to give information about significant safety-related events occurred on French PWR plants**
- **General data about significant events**
  - About one per month and per unit
    - 2008, 626 events
    - 2009, 709 events
  - 10 criteria to state about events (significant or not)
    - Reactor trip
    - Safeguard signal
    - Overtaking a limit, diagram, specification …
    - Extern hazards
    - Intended actions
    - Release to environment
    - Radiation protection event (exposure, unavailability …)
    - Abnormality following inspection, control …
    - Injuries
    - Abnormality leading the operation conditions out of the limits
    - Other cases decided either by the utility or the safety authority



SAPIDE : DATABASE – SIMPLE STANDARDIZED RESEARCH

- **Some examples**
  - A specified number of event (now, about 18000 events are implemented since 1973)
  - Incidents level 2 or more in IAEA/INES scale
  - Incidents radiation protection related
  - Events occurred during a specified month (see example next page)
  - Events occurred during a specified year on 900 (including CP0 plants), 1300 or 1500
  - Events stated to IRS and precluding more severe situations
  - …

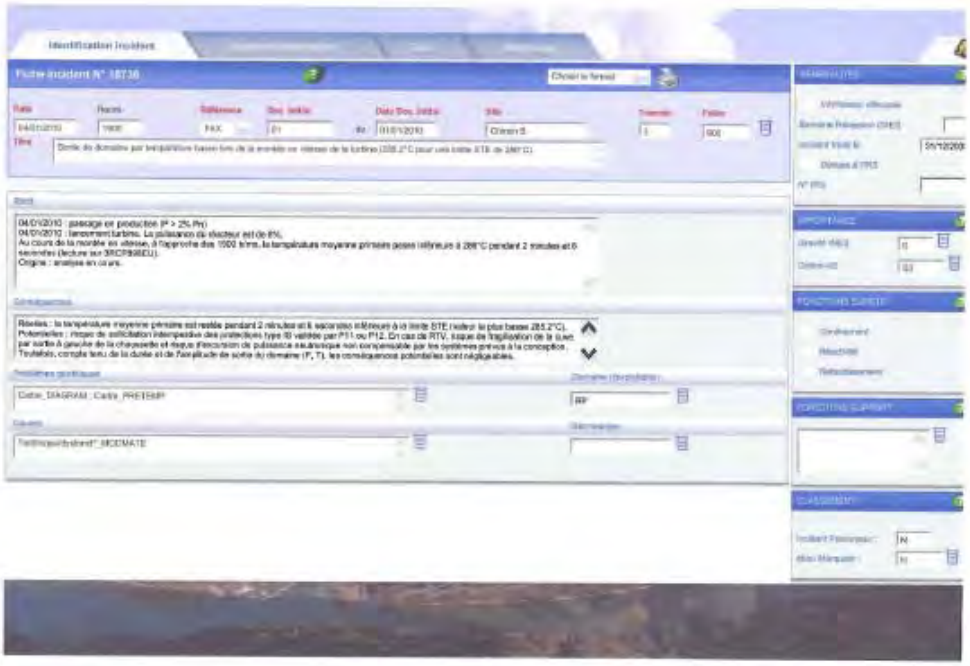


IRSN

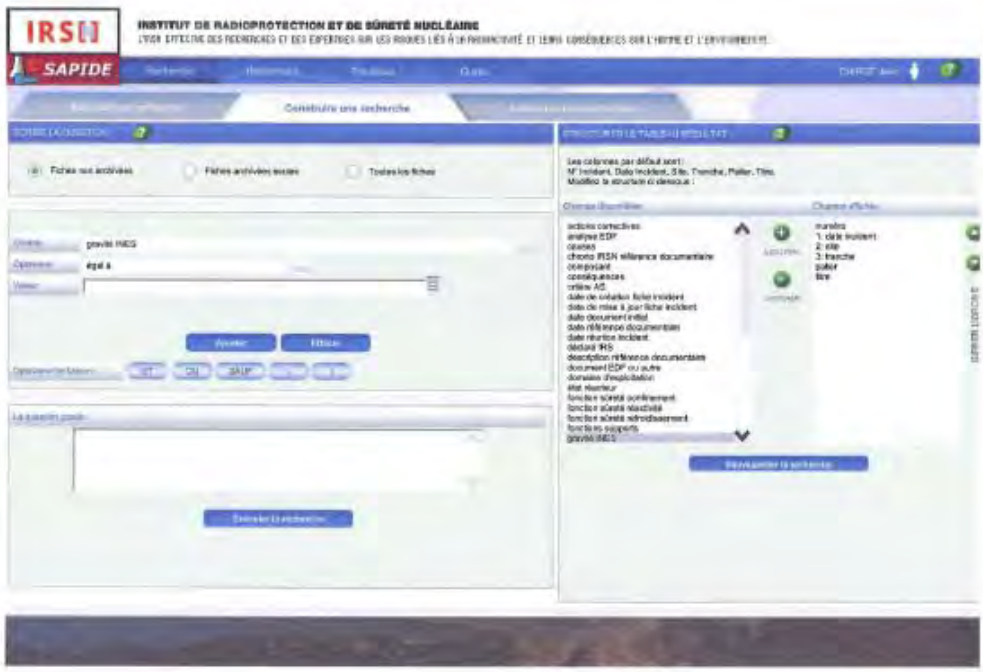
SAPIDE : DATABASE – ON REQUEST RESEARCH

- **The "on request" system allows more elaborate research**
- **Criteria are made by combination of pre-established criteria**
  - For every request, several criteria are combined by AND, OR, EXCEPTED, (,)
  - Some of them require a close answer, examples
    - Involved component
    - Stated to IRS (Y or N)
    - Operating conditions when the event occurred (RCD, APR, API, ANRRA, ANGV, RP) likely completed by reactor status
    - Safety functions (involved : Y or N)
    - INES scale
    - ...
  - Other may be implemented by a free text
    - Title and short description of the event
    - Root causes ...

IRSN



OECD, April 13, 2010 – J. CHIPOT, IRSN – Page 19 IRSN



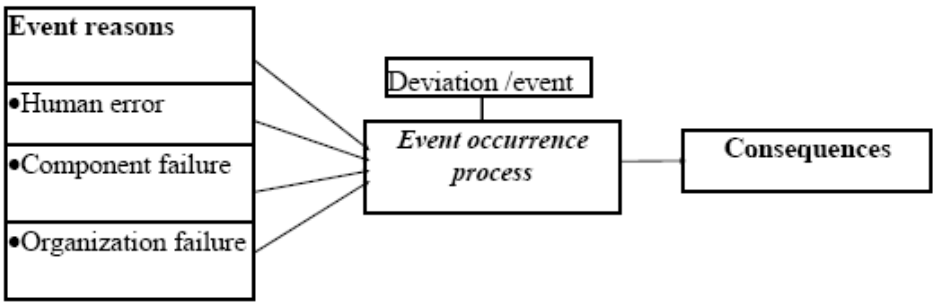
OECD, April 13, 2010 – J. CHIPOT, IRSN – Page 20 IRSN

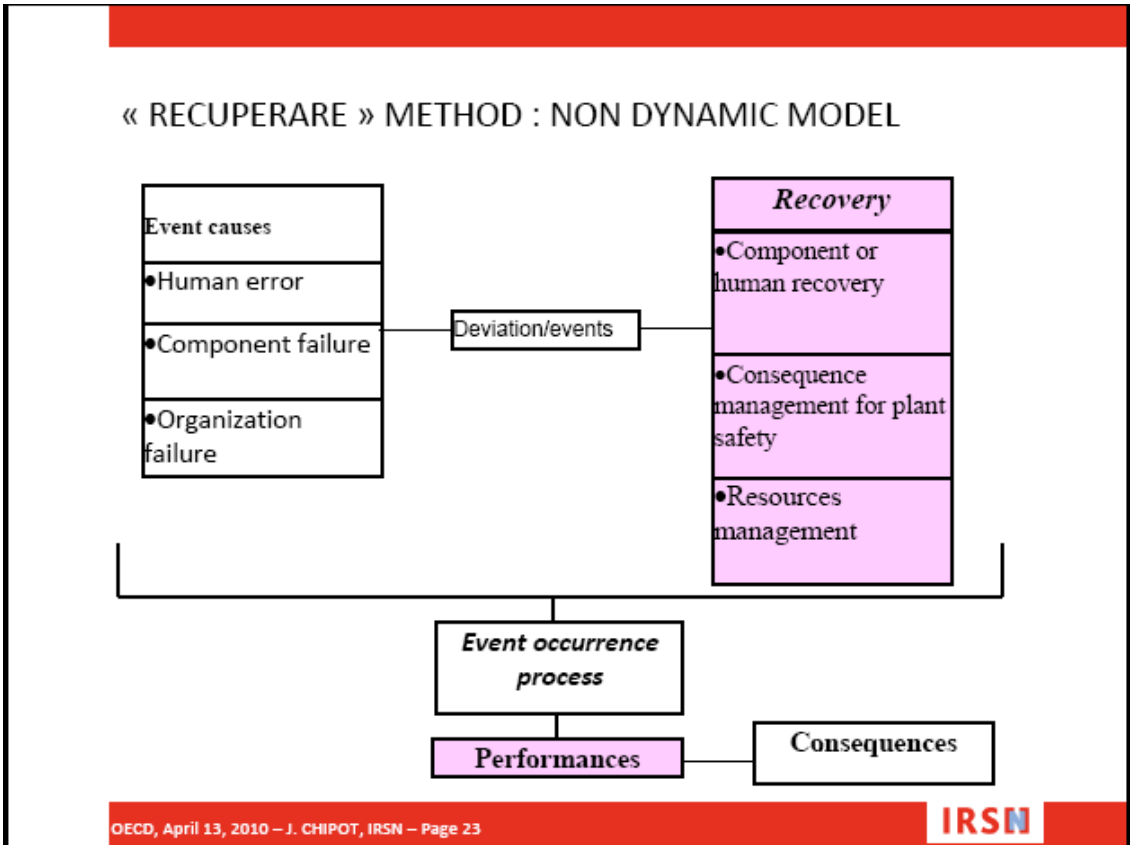
« RECUPERARE » TOOL

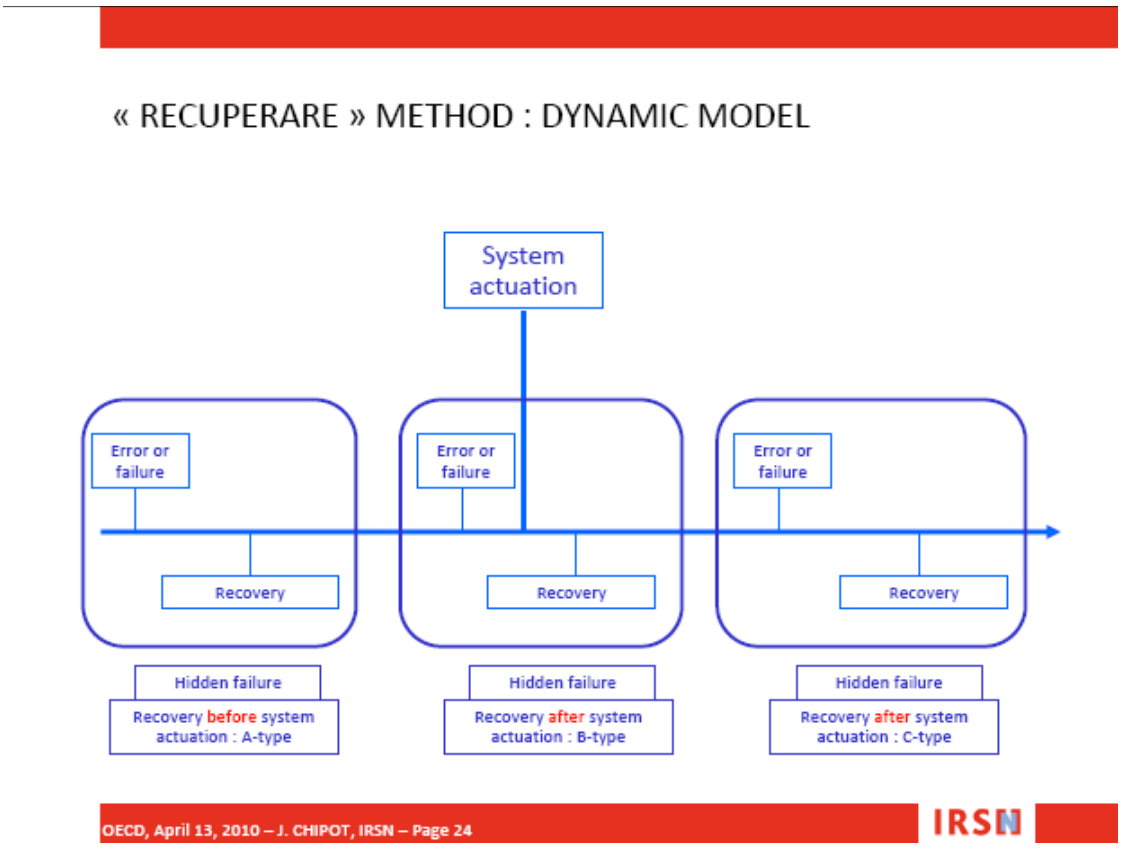
- **Some incidents are more deeply investigated in IRSN**
  - More elaborate analysis
  - PSA links
  - Barriers or defence-in-depth levels likely involved ...
- **RECUPERARE aims at studying all events among different factors**
  - Human factors
  - Technical factors
  - Organization
- **Methodology**
  - By a statistic approach of events and event management, contribute to the French approach of PWR safety
  - Allows to improve the nature and the rate of events, for example year by year
  - Give information about event management and associated performance

« RECUPERARE » TOOL

Comparison between general method and RECUPERARE method : General




« RECUPERARE » METHOD : NON DYNAMIC MODEL
Event causes
•Human error
•Component failure
•Organization failure
Deviation/events
Recovery
•Component or human recovery
•Consequence management for plant safety
•Resources management
Event occurrence process
Performances
Consequences
OECD, April 13, 2010 – J. CHIPOT, IRSN – Page 23
IRSN


« RECUPERARE » METHOD : DYNAMIC MODEL
System actuation
Error or failure
Recovery
Hidden failure
Recovery before system actuation : A-type
Error or failure
Recovery
Hidden failure
Recovery after system actuation : B-type
Error or failure
Recovery
Hidden failure
Recovery after system actuation : C-type
OECD, April 13, 2010 – J. CHIPOT, IRSN – Page 24
IRSN

FAILURES AND RECOVERIES

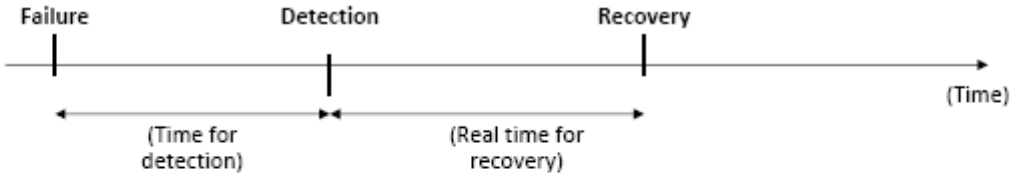
- **Three categories identified**
  - Association failure/recovery A-type : hidden failure found and recovered before system actuation,
  - Association failure/recovery B-type : hidden failure found and recovered after system actuation,
  - Association failure/recovery C-type : hidden failure found and recovered after system actuation when the system is already operating

6 FAMILIES OF EVENTS

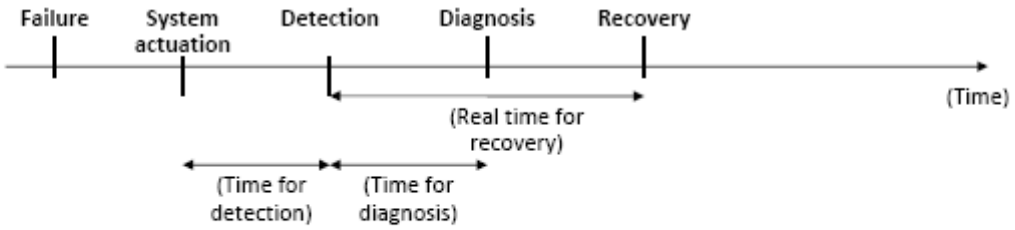
Type of event	Association « Failure and recovery »	Number of associations
A - type	A - type	1
B - type	B – type	1
C – type	C - type	1
D - type	All are possible	Several
O – type	Organization-related	-
R - type	Radiation protection related	

TIME ALLOWED

A - type



B - type

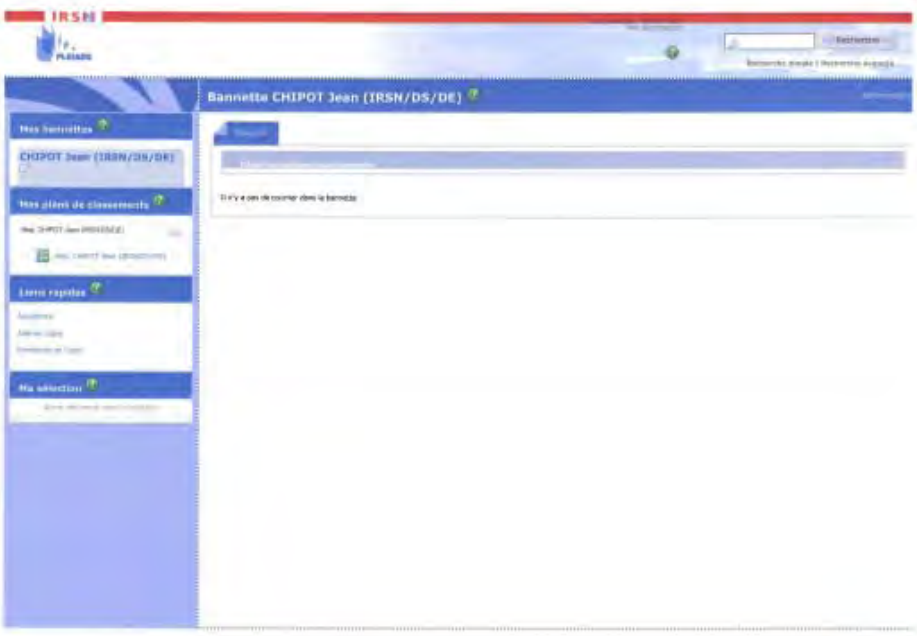


« RECUPERARE » USE

- **Safety analysis**
  - Particular features of every NPP
  - Evaluation of tendencies
  - Instruction for safety indicators
- **Particular studies about**
  - Safety commissions (Groupe Permanent) about human factor (risk analysis, communication between operators, functions and roles of safety engineer, operation manager ...)
  - Safety commissions about operation feedback : studies on systems behaviour

2C - « PLEIADE » TOOL

- **Meaning : "platform for automatic information reading and for electronic mailing"**
- **Why PLEIADE ?**
  - Deep review in IRSN about means of mailing since 2005
  - Gather every opinion or proposal which could push the current limits in mailing practice and management
- **Combination of daily work done by dedicated teams which convert every paper document into computerized document**
- **It is possible to introduce criteria in order to**
  - Share documents
  - Put limits in the mailing when specific documents (staff management, classified information for defence purposes ...)



2D – OTHER REPORTING

- **Most part of this reporting should be available by PLEIADE software**
- **GROUPE PERMANENT reports**
  - Opinion and recommendations of IRSN about a topic important for safety
- **SEREP reports, about significant events**
  - Precluding DBA or unlikely situations
  - Having effects on probabilistic safety results
- **Other information means by reporting**
  - Event analysis
  - IRS reporting
  - ...

EXAMPLES OF SEREP REPORTING

- **GRAVELINES 1 & 2 (2002)**
  - Unavailability of RCS pressure-testing pump
  - Consequences on defence-in-depth provisions
    - This pump is necessary in case of loss of off-site and on-site power
  - Probabilistic impact
- **CHINON 2 (2003)**
  - Blast on a main transformer followed by loss of main electric power supply
  - Consequences : weaknesses in defence-in-depth levels
    - Reactor trip and/or ATWS
    - Linked to auxiliary electric power supply and Diesel generators
    - If necessary, reactor cooldown
  - Evaluation of probabilistic subsequent impact
- **DAMPIERRE 3 (2003)**
  - Unsuitable unlocking of permissive P11 function, automatic safety injection actuation, overfilling of RCS, safety valves opening and break on safety disks on pressurizer discharge tank

EXAMPLES OF SEREP REPORTING

- **ALL (2004)**
  - Unconformities in connection of electric valves on accident-qualified valves
  - Consequences
    - In case of SLB or LOCA we were not sure of good opening and/or closure of the concerned valves
- **GRAVELINES 3 (2006)**
  - Unusual provisions made on SI automatic signal inhibition : this inhibition was impossible in case of need
  - It was impossible to change SI operation from direct injection to sump recirculation phase
- **BLAYAIS 3 (2008)**
  - After periodic testing on HHSI injection boron tank, boron deposits on 2 HHSI pipes (there are 3 pipes, 1 per RCS loop)
  - Boron makeup, in case of SLB or rod ejection, could have been delayed

3 - ENSTTI PROJECT – ETSON TRAINING : PURPOSE

- **Growing need to train in the field of nuclear safety**
- **Possible interested people**
  - Stakeholders involved in nuclear industry (vendors, developers)
  - NRA (Nuclear regulatory Authorities)
- **Associated goals**
  - To maintain a high level of competences in nuclear safety for all organizations in European and cooperating countries
  - To deliver the curse in a modular way
  - To develop a main common core that would be shared by all trainees
  - To be able to train any kind of staff who would enter the nuclear safety field
  - To define and develop additional specialist modules
- **1st course : 2010, July and September**
- **Next years, other specific modules will be introduced**

ENSTTI PROJECT – ETSON TRAINING : PROGRAM

- **Module 1 : basics and worldwide view in nuclear safety (1 week)**
  - Introductive part only for 2010
- **Module 2 : safety of nuclear reactors (1 week)**
- **Module 3**
  - Part A : nuclear events analysis (1 week)
  - Part B : assessment methods (4 days)
- **Module 4 : fuel cycle and waste management (1 week)**
- **Module 5 : radiation protection and emergency preparedness (1 week)**
- **Working groups during the training cycle**