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# Utilisation of Operating Experience in the Regulatory Inspection Programme and of Inspection Findings in the National Operating Programme and Operating Experience and Inspection Insights from the Non-conformance of Spare Parts

International Operating Experience Workshop Proceedings
Helsinki, Finland
14-16 June 2011

*Workshop hosted by STUK, Nuclear Regulatory Authority of Finland*

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NUCLEAR ENERGY AGENCY

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NUCLEAR ENERGY AGENCY
**COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES**

NEA/CNRA/R(2012)3
**Unclassified**

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**English text only**

## 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 exchange of information and experience among regulatory organisations. To the extent practical, 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 or avoid unwarranted disparities 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 alignment with the NEA Strategic Plan, the Committee shall promote co-operation among member countries to use the feedback from this experience to ensure high standards of safety, to further enhance the efficiency and effectiveness of 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 existing power reactors and 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 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.

## ABSTRACT

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 regulatory body's and industry's efforts to maintain and improve the 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 1970s. 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. The IAEA now 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.

These proceedings cover the International Operating Experience Feedback Workshop. The workshop was hosted by the STUK, Finnish Nuclear Safety Authority. It took place in Helsinki, Finland, from 14 – 16 June 2011.

The focus of this workshop was to address the following two topics concerning the connection between the operational experience feedback activities and inspection activities:

- Utilisation of operating experience in the regulatory inspection programme and of inspection findings in the operating experience programme.
- Operating experience and inspection insights from non-conformance of spare parts.

This report as any CNRA reports is available on-line at: http://www.oecd-nea.org/nsd/docs/indexcnra.html.

## FOREWORD

The main purpose of the Workshop was to provide a forum for the exchange of information on the connections between regulatory national operational experience feedback (NOEF) programmes and inspection activities and to identify commendable practices for the transfer of operating experience information that will be of use to the inspector and the transfer of information from the inspectors to the regulatory operating experience programme and also operating experience and inspection insights from non-conformance of spare parts.

Participants had the opportunity to meet with their counterparts from other countries and organisations to discuss current and future issues on the selected topics. To facilitate discussions during the Workshop participants were also requested to respond to a questionnaire in these areas. Conclusions were developed regarding these issues and methods were identified to help improve the NOEF and inspection programmes of the participants. Due to the unique nature of the topics, the working group on operating experience (WGOE) and working group on inspection practices (WGIP) supported this workshop.

In spring 2010, the use of operating experience in the inspection programme was brought forth as a potential task topic in the working group on inspection practices. The topic was discussed in both the working group of inspection practices and operating experience meetings. Both working groups were of the opinion that the topic would have maximum results if the workshop engaged both the inspectors and the operating experience personnel in one discussion, and would jointly inform both programmes to improve the efficiency and effectiveness of the regulatory body

At the spring 2010 WGOE meeting, the discussion topic for the item of generic interest was the non-conformance of spare parts. From the WGOE discussion, all members agreed that the issue was of regulatory concern although it was recognised that the identification of the non-conformance of spare parts would not be reportable as an incidence by itself. Where the regulatory body may address the issue most often is through inspections. It was decided that this issue merited additional discussion within operating experience, and that the effectiveness of the discussion would be enhanced if the operating experience and inspectors joined together. At the fall 2010 WGOE meeting, the discussion topic for the item of generic interest was counterfeit, suspect and fraudulent items (CSFI). Although most countries have not experienced issues directly, members agreed that this issue (as a subset issue of substandard or non-conforming parts) was an important issue to raise the awareness of the regulatory body. The questionnaire was slightly expanded to include CSFI.

Between the WGOE and the WGIP, it was decided that a workshop environment would best suit the two-way communication. At the June 2010 CNRA meeting, the Committee supported the workshop topic to discuss the two-way communication between collecting and utilising operating experience and inspection information to increase the effectiveness of both programmes.

## ACKNOWLEDGEMENTS

Members of Organising Committee wish to acknowledge the excellent planning and arrangements made by the staff of the hosting organisation, the STUK, Finnish Nuclear Safety Authority. Special appreciation is given to Mr. Jukka Laaksonen, Mr. Petteri Tiippana, and Ms. Seija Suksi of the host organisation; Dr. Michael Maqua, Chairman of WGOE and Workshop Chairman; and Mr. Stephen Lewis, Chairman of WGIP; Ms. Diane Jackson, NEA Technical Secretariat for WGOE and WGIP. Additional thanks to Mr. John Nakoski, NEA Technical Secretariat, and Ms. Elisabeth Mauny and Ms. Marie-Laure Peyrat, NEA Assistants, in the preparation of the proceedings.

Special acknowledgement is given to the members of WGOE and WGIP who worked as facilitators and recorders for each of the topics, including from WGOE: Ben Poulet (Canada), John Thorp (USA), Frederik van Iddekinge (the Netherlands), and Laszlo Juhasz (Hungary), and from WGIP: Julio Crespo (Spain), Tim Kobetz (USA), Olivier Veyret (France), and Kees Des Bouvrie (the Netherlands).

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# 1. EXECUTIVE SUMMARY

The main objectives of the Workshop were to provide a forum for the exchange of information on the connections between national operational experience feedback (NOEF) programmes and regulatory inspection activities and to identify commendable practices for the transfer of operating experience information that will be of use to inspectors and for the transfer of information from the inspectors to the regulatory operating experience programme. The non-conformance of spare parts was provided as an example of an operating experience issue that does not universally require reporting as an incident by itself but is of interest to the regulatory body.

Approximately sixty (60) participants from twenty-one (21) different countries and a regional organisation (European Commission) took part in the workshop. Participating countries included: Argentina, Belgium, Canada, Czech Republic, Finland, France, Germany, Hungary, India, Korea, Mexico, the Netherlands, Poland, Russian Federation, Slovenia, Spain, Sweden, Switzerland, United Arab Emirates, the United Kingdom and the United States.

As part of the registration, the participants were requested to provide answers to a questionnaire describing the connection between their NOEF programmes and their regulatory inspection programmes in each of the topic areas. The complete compilation of questionnaire responses is contained in an Appendix (separate report) to this document.

Four (4) discussion groups were established for the working group sessions. The members of each group were chosen to create a diversity of views for each of the topics. Discussions groups met for two separate sessions to review the individual topics. The exchange of ideas and opinions between participants was active and the groups formulated conclusions based on the discussions.

The evaluation of the workshop results are based on questionnaire responses received from the participants at the closing of the workshop. The results of the evaluation reflect that the approach used was effective at encouraging the active exchange of information between the participants and resulted in meaningful conclusions that could be taken back to the participants' organisations for consideration as enhancements to their NOEF and inspection programmes.

Overall discussions between the various participants both in discussion group sessions and throughout the workshop were extensive and meaningful. Ideas and practices regarding the use of operating experience to enhance the inspection programme and for feedback from inspectors on how the operating experience programme could be enhanced. Based on discussions, the WGOE members agreed that it was essential for the regulatory bodies to understand what operating experience the inspectors needed to accomplish their inspection activities. This included how the information should best be provided to them. It was determined that:

- Routine meetings should be conducted with inspectors that include specialists knowledgeable on the technical details of the operating experience. These meetings should be documented and key elements should be discussed with the operators, when appropriate.
- Inspectors should be encouraged to both formally and informally exchange information between themselves and also with NOEF staff.
- NOEF staff should develop specific inspection requirements for inspectors if it is to follow up on specific operating experience.

One of the most important findings of the workshop was that regulatory bodies should develop an all-encompassing database to track the resolution of all OE. The database would:

- Identify OE that applies to specific plants.
- Provide specific inspection guidance.
- Provide specific guidance on how to report the findings and convey the information back to the NOEF staff.
- Trend the operating experience.

However, there are several challenges that the above approach faces:

- More operating experience exists than can reasonably be evaluated.
- Attention should still be given to low-level events that may actually identify significant longstanding problems.
- Individuals within a regulatory body may carry out multiple roles which could dilute and/or inhibit the exchange of information.

Other issues that should be considered are:

- How to incorporate operating OE into construction and start-up inspection activities.
- How to incorporate OE into periodic safety reviews and reactor relicensing.
- How to address OE when modifying regulatory and policy decisions.

The groups concluded that any process should involve the capability to transfer operating experience transparently between regulatory and industry sources (e.g., Nuclear Energy Agency, International Atomic Energy Agency, European Union, and World Association of Nuclear Operators), NOEF staff, and inspection staff. To be the most effective, the following elements should be included:

- Specific guidance should be developed on the process.
- Non-nuclear events and experience should be included.
- Risk insights should be used as appropriate.
- Organisations should not operate independently.
- Inspector's views should be sought out.
- Meetings between organisations should be held on a routine basis.
- NOEF programmes should include design, maintenance, and human performance problems.
- Periodic self-assessments, and independent assessments, should be conducted.

With regards to non-conforming items and counterfeit, suspect, and fraudulent items (CSFI), there is a clear recognition that the potential scope of this issue is not fully understood or recognized by all of the participants. However, there has not been wide spread examples of where non-conforming items and CSFI have had a significant impact on public health and safety. It is recognized, though, that with the increased demand for parts and components for new nuclear power plant construction, coupled with the ongoing need for replacement parts to maintain the existing aging nuclear power plants, that the potential for the introduction of non-conforming items or CSFI into safety-related applications needs to be better understood by both the nuclear power industry and regulatory authorities to minimize an impact on public health and safety.

# 2. ORGANISATION/OVERVIEW OF WORKSHOP

## 2.1 Planning

Preliminary planning for this workshop began following the meeting of the WGIP in Spring 2010 when it was decided that there would be benefit to both the operating experience and inspection practices working groups to jointly discuss how operating experience is used in the inspection programme. The decision to expand the scope of the workshop to include the non-conformance of replacement parts and components occurred as a result of discussions during the WGOE meeting in Spring 2010. The WGOE took the lead for planning and implementing the workshop with significant support from WGIP.

The workshop was hosted by STUK, the Finnish Nuclear Safety Authority. It took place in Helsinki, Finland on 14-16 June 2011.

## 2.2 Topic Introductions

At the beginning of the workshop, each topic was introduced by working group members selected in advance to review the responses to the questions in a specific area and to prepare and present the results of their review. For the first topic, the use of operating experience in the inspection programme, John Thorp, U.S. Nuclear Regulatory Commission (USNRC) provided the introduction. Mr. Thorp's introduction covered the analyses of the responses to the questions related to the use of operating experience in the inspection programme and how operating experience affects the inspection programme. The second topic was introduced by Julio Crespo, Consejo de Seguridad Nuclear (CSN) the regulatory authority in Spain. Mr. Crespo's introduction covered the analyses of the responses to the questions related to the regulatory bodies' inspections of licensees' programmes for identification and control of non-conforming spare parts. Both presentations provided an overview of the responses to the questionnaire.

***Utilisation of operating experience in the regulatory inspection programme and of inspection findings in the operating experience programme***

Following most major events, lessons learned show that similar events occurred prior to the major event. Further, if the operating experience events or trends were more effectively identified, shared and addressed, many major events may have been avoided. The assessment, communication and effective use of operating experience is without question a critical element to maintain nuclear safety. However, the means and the extent to which operating experience is provided to inspectors and the format used, as well as the expectations for its use by inspectors vary from country to country. Likewise, inspection information supplied into an operating experience feedback programme enhances a regulatory body's efforts to identify and correct trends early. The examination of this diversity of approaches may provide valuable insights for all participants to improve the operating experience programme, inspection programme, and the communication between the two programmes.

***Operating experience and inspection insights from non-conformance of spare parts***

The "non-conformance of spare parts" refers to problems raised from replacement parts not conforming to original design standards. Non-conformance may be a result of several issues, such as, the inability to acquisition of original type of spare parts; fabrication might be closed down; changes in type or standards; changes in materials; etc.; chemicals and supportive materials used in components and equipment (safety classified products – deficiencies in their quality or grading bases). These safety-related spare parts are nuclear quality - not warehoused. The issue “Non-conformance in spare parts” came forward in Olkiluoto nuclear power plant in connection of IRS-reported event “Common-cause failure in main steam line outer isolation valve actuator (2009-05-12)” (IRS 8029).

This topic is timely and important because:

- Non-conformances of replacement (spare) parts of safety-related equipment or systems and supportive materials (lubricants/greases) used in safety-classified systems may lead to unavailability of safety system/inoperability of safety function and elevated risk of severe accident.
- Non-conformances of replacement (spare) parts of safety-related equipment or systems and supportive materials can result to common cause failure.
- Non-conformances or failures of safety-critical replacement (spare) parts if observed at the storage or at the maintenance workshop are not notified or recorded as those observed at the plants and do not always receive the same kind of safety assessment.
- Clarification of an actual root cause of a failure or malfunction resulted from non-conformances of spare parts or supporting material may not be prioritised leading to misinterpretation of failure and to unfavorable decision making e.g. to continue/start-up of production.
- Conformance of spare parts or supportive materials cannot be observed or verified in the acceptance inspection and utility has to trust on manufacture’s quality certificate.

## 2.3 Announcement and Pre-Workshop Activities

***Workshop Announcement***

The workshop announcement was transmitted in the NEA members and associated countries of both the WGOE and the WGIP to maximize the results of the workshop by engaging both the inspectors and the operating experience personnel in one discussion. This approach jointly informed both the NOEF and inspection programmes such that an integrated effort could be undertaken by the participants to improve the efficiency and effectiveness of the regulatory body. The announcement was initially sent to the potential participants in December 2010 to solicit participation of interested organisation and individuals.

***Facilitator Training***

Prior to the start of the workshop, facilitators and recorders attended a pre-workshop meeting. Each discussion group had a lead team composed of a one member from WGOE and one from WGIP. Dr. Michael Maqua, WGOE chair, and Mr. Steve Lewis, WGIP chair, reviewed the general objectives of the workshop and outlined the various characteristics required of a good facilitator. They noted the importance of the leader’s role in guiding the group and reviewed various methods required to manage an effective discussion.

***Reception***

A meet-and-greet welcome reception was held following delegate registration at the workshop venue. The participants were given the opportunity to meet, socialise and exchange information in an informal setting in order to familiarise themselves with each other. Mr. Jukka Kupila, Finnish WGIP representative, from STUK, made welcoming remarks to the participants to the workshop.

## 2.4 Overview of Workshop

The format of the workshop used a modification of the process that was first utilised by the WGIP workshop in 1992 at Chattanooga and has evolved over time based on a number of previous workshops held by the NEA. The two topics were discussed over three days. For each topic, there was an opening session to establish the context of the discussions, following which the participants were divided into four smaller groups for detailed discussion. After the group discussions, a closing session was held to review the results of the discussions, conclusions, and commendable practices that were identified. Conclusions and commendable practices are extracts from the topics, which were discussed by the workshop participants and were thought to be reference for member countries. These are neither international standards nor guidelines. Each country should determine how best to incorporate the conclusions and commendable practices, considering its own historical, social and cultural backgrounds recognizing that the commendable practices can be useful references when each country looks to improve its processes for the safe use of nuclear power.

Based on NEA experience with similar workshops and to facilitate the exchange of information and assist participants in their preparation, several WGOE and WGIP members volunteered to collect and analyse the responses to the questionnaires as well as act as lead facilitators during the workshop.

The participants in each of the four discussion groups were decided on in advance to provide a diverse group of backgrounds, opinions, and regions. For each topic there were separate group discussions held, with the discussion starting on day one for the first topic and the discussion on the second topic starting on the afternoon of day two. A facilitator and recorder worked with each group to stimulate and encourage discussions. The discussion groups are identified below:

**Group 1**

Laszlo Juhasz, Hungary*
Timothy Kobetz, USA**
Didier Wattrelos, France*
Mikhail Lankin, Russian Federation*
Gerald Degreef, Belgium*
Hans-Rudolf Fierz, Switzerland**
Ales Janezic, Slovenia**
S.A. Bhardwaj, India
Anna Raitanen, Finland (TVO)
Yrjo Hytonen, Finland
Kirsi Leva, Finland
Jorma Rantakivi, Finland
Montserrat Casero, Spain
Barry Kaufer, UAE

**Group 2**

John Thorp, USA*
Kees des Bouvrie, the Netherlands**
Rob Campbell, United Kingdom*
Karel Matejka, Czech Republic*
Yvonne Kilian-Hulsmeyer, Germany*
Jouko Turpeinen, Finland (FORT)*
Thomas Sigrist, Switzerland*
Luis Miguel Gutierrez Ruiz, Mexico**
Klas Idehaag, Sweden**
Ji-Tae Kim, Korea
Milka Holopainen, Finland
Riku Mattila, Finland
Veli Riihiluoma, Finland
Silvia Perez, Argentina
Salem Hafidah, UAE

**Group 3**

Frederik van Iddekinge, the Netherlands*
Olivier Veyret, France**
Elena Verduras Ruiz, Spain*
Durk Hun Lee, Korea*
Leopold Vrankar, Slovenia*
Burton Valpy, Canada**
Andrzej Glowacki, Poland**
Tarja Nurminen, Finland (P)
Kirsi Alm-Lytz, Finland
Hanna Kuivalainen, Finland
Mika Kaijanen, Finland
Stanislovas Ziedelis, European Commission
Daniel J. Pasquale, USA
Haitham Al Senaani, UAE

**Group 4**

Benoit Poulet, Canada*
Julio Crespo, Spain**
Julien Husse, France*
Kenneth Broman, Sweden*
Devendra Gawande, India*
Gyula Fichtinger, Hungary**
Jukka Kupila, Finland**
Matthias Schneider, Germany**
Anne Niemi, Finland (TVO)
Erja Kainulainen, Finland
Ann-Mari Sunabacka-Starck, Finland
Antti Tynkkynen, Finland
Tim Frye, USA
Helal Al Khafili, UAE

Note: * WGOE Members
** WGIP Members

## 3. OPENING SESSION

Opening the workshop was Dr. Michael Maqua, WGOE chair and workshop chair. He welcomed all of the participants and emphasized the important role each of the participants had to the success of the workshop. Mr. Petteri Tiippana, Director of Radiation and Nuclear Safety (STUK) provided welcoming remarks on behalf of the host organisation and encouraged the active participation of the members in sharing their knowledge and insights on the workshop topics. Ms. Diane Jackson, NEA technical secretariat, welcomed the participants and discussed the importance of workshops like this to provide a forum for sharing experiences, practices, and insights on topics that enhance the safe operation of nuclear power plants, and the importance of taking back the information to each regulatory authority or organisation to apply the knowledge and insights gained during the workshop. Mr. Stephen Lewis, WGIP chair, finished the welcoming remarks by encouraging the exchange of information between members of WGOE and WGIP on these topics so that meaningful insights could be shared to enhance the participants' processes for interactions between the NOEF and inspection programmes and their assessment of licensees' practices for addressing non-conforming spare parts.

# 4. TOPIC 1

## UTILISATION OF OPERATING EXPERIENCE IN THE REGULATORY INSPECTION PROGRAMME AND OF INSPECTION FINDINGS IN THE NATIONAL OPERATING EXPERIENCE PROGRAMME

### 4.1 Topic 1 Opening Presentation

Opening the discussions for topic 1 on using operating experience in inspection programmes was Mr. J. Thorp from the U.S. Nuclear Regulatory Commission. In his introduction he emphasized that Operating Experience (OE) is a critical element to maintaining nuclear power plant safety and recognized that the National OE feedback (NOEF) programmes vary from country to country. The variations allowed the participants in this workshop to examine a diversity of approaches while recognizing that alignment is not important, but leveraging the strengths identified in other programmes within individual national programmes is.

An overview of the method and purpose of the evaluation was conducted of the questionnaire responses. To understand the information provided during the opening, it was pointed out that the review was a qualitative evaluation of the responses with a goal of indentifying NOEF programmes standards. In the discussion, the term "Most" countries indicates that more than 50% of the responses were similar; "Some" countries indicated that more than 25% (but less than 50%) responded similarly, and "Few" countries indicated that less than 25% of the countries responded in the same manner. During the review of the responses potential good practices to share, as well as potential challenges for the group to consider resolving, were identified for consideration by participants. Specific information related to the responses to each of the questions was provided by Mr. Thorp as discussed below.

For the first question on sharing OE with inspectors, including what type of information is provided, how the information is provided, and what inspectors are expected to do with the information, the responses varied. All of the respondents indicated that information on domestic nuclear power plant (NPP) events and foreign NPP events were provide to the inspectors. In some of the countries, non-conformances for NPP components as well as the root causes and corrective actions for events were provided. In a few countries the inspectors were provided with relevant non-nuclear event information. Based on the review of the responses a candidate good practice was identified for inspectors to be provided non-conformance reports and root cause and corrective action information for events.

In response to the area of how information is provided to inspectors, most countries indicated that email was used along with a database to collect and analyze OE. Some of the countries also indicated that periodic reports and meetings or conferences were used to share OE with inspectors. In all of the countries, inspectors are expected to review the relevant OE. In some of the countries inspectors are expected to collect and report data back to the OE organisations, follow-up on operator responses to OE, and to report on completion of licensee corrective actions. In a few countries the inspectors are expected to share the OE with operators and to assist in resolving open questions related to the OE.

Question 2 focused on how the OE influences inspection programmes (e.g., type of inspections conducted, procedures used, etc.), how inspectors use the information in the implementation of the inspection programme, and how they report the results of their activities. Most of the countries use OE to influence the type of inspection by suggesting targeted or reactive inspections based on the OE. Further, most countries use OE during the development of their annual inspection plans. With regards to inspection procedures, most of the countries indicated that based on OE inspection procedures are adjust as well used to change the scope or periodicity of inspections. Some of the countries also indicated that prior to starting an inspection OE is used during pre-inspection briefings.

All of the countries expect their inspectors to consider OE and report on their activities in their inspection reports. Further, follow-up on a case-by-case basis for some OE is conducted to inform specific inspections and assessments are done to determine the need for further inspections. Inspectors are also expected to ensure that NPP operators are aware of new OE. Some of the countries noted that inspectors use OE inconsistently. A challenge area identified by the review of the responses was in standardizing how inspectors apply OE.

The emphasis of the third question was on feedback from the inspectors to the NOEF programmes, including how the OE programmes were improved through the use of the inspectors' feedback. All of the countries consider the feedback in some form or other. Most of them use an ad hoc process for receiving the feedback during meetings, personal communications or through management recommendations. Some of the countries have established more defined processes for obtaining feedback that include management assessments using databases to store the information and meetings to discuss the feedback. A challenge that was identified by the review of the responses was on the systematic collection of programmatic feedback.

The responses on how the NOEF programmes have improved based on the feedback provided by inspectors differentiated between process improvements and improvements made as a result of the consideration of OE. Some of the countries use inspector suggestions to adjust the content and structure of their NOEF programmes and have adopted a customer focus in their communications procedures, adjusted their review processes, are looking at providing real-time information to inspectors, and have reviewed the scope of information on OE that is available. As a candidate good practice, it was suggested that the ISO 9001 process for continuous improvement be leveraged for improving the OE programmes based on inspector feedback.

The final question for this topic related to improving how the NOEF programme communications with inspectors, including addressing the potential for "information overload" when providing OE to inspectors, and the role of management interaction with NOEF personnel and inspectors to ensure sufficient cooperation. Most countries agreed that communications with inspectors could be improved. This could be accomplished by providing regular presentations and seminars involving both NOEF personnel and inspectors. Other ideas suggested in the responses were to collect information through a survey on communications between the NOEF programme and inspectors and translating more events into the domestic language of the inspectors. A few countries, especially those with newer programmes, identified communication between the NOEF programmes and inspectors as a challenge for their NOEF programme. A challenge that continues to be faced is to remain vigilant on providing an excessive amount of information.

With regard to "information overload", all of the countries responded that they are aware and sensitive to the potential of providing excessive information to inspectors. Most of the countries optimize information through a front-end analysis and targeted reporting. However, the question remains on what are the benefits and drawbacks of providing OE to inspectors. A candidate Good Practice for discussion is the practice of targeting OE information to inspectors accordingly.

Management's interactions with OE personnel and inspectors is important to ensure sufficient cooperation and in most countries management personnel facilitate the execution of the NOEF programmes through direct involvement, frequent NOEF meetings and the review of NOEF information. This direct involvement allows management to prioritize resources of the regulatory body to effectively implement their NOEF programmes. In addition to direct involvement, management receives periodic program status reports, establishes and maintains intra-organisational relations.

In conclusion, Mr. Thorp reminded the participants that the purpose of the workshop was for them to discuss and develop ideas both from the perspective of the OE personnel and from the inspectors with emphasis on better understanding and improving the delivery of useful OE to the inspection programme; and better understanding and improving the feedback to the NOEF from inspectors.

### 4.2 Discussion Group Sessions

There were 4 separate discussion groups that were created to exchange insights and feedback on the interaction between the OE and inspection programmes. Each group carried out active and varied discussions based on the participants in the group. Following the group discussions, the eight leaders (from WGIP and WGOE) from the four groups met and discussed the feedback from all of the discussion groups. The results were collected and used as the basis for the closing session on Topic 1.

***Attributes and/or elements of a strong process for exchanging information between Operational Experience and Inspection.***

Discussion group 2 explicitly discussed and defined the elements that are needed to have a strong process to exchange information about national and international events between the Operational Experience staff and the Inspectors of nuclear facilities. Many of these elements were included in the final conclusions. However, the conclusions were common or agreeable elements. This is not meant to minimise any group's discussion, just represent the similar or agreed upon conclusions. For Group 2, the discussions consisted hand written charts that were requested to be included in the proceedings, as follows:

- The information given by the OEF-staff to the inspectors should be:
  - Practical, brief and safety focused.
  - Rapid disseminated and accurate.
  - Identifies for action, wanted information and priorities.
  - Provides capability for disciplined-base interrogation.
  - Enhances inspector knowledge including knowledge management and transfer (KM/KT), if possible provides lessons learned and potential solutions for others.
  - Documents and identifies good practices.
- Modern IT-tools should be in place in a way that:
  - data access is able to drill down and ability to support trending/analyses.
  - Associated source databases are kept up to date and used by all (OEF staff and inspectors).
  - It has the capability of responding flexibly to special requests.
  - It has bespoken tools to help the inspector to feed back the results of his/hers findings.
  - commonly understood abbreviations and terms are used (use IAEA glossary).
  - It is not bothered by bureaucracy and passwords.

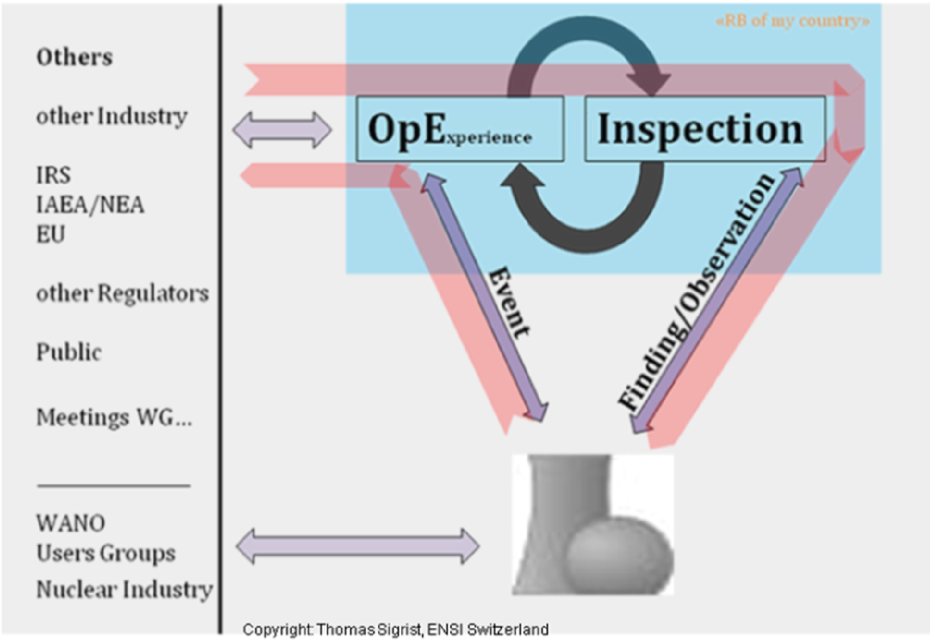
  NB: A simple IT-platform is also required to document and communicate lower level concerns between inspectors.
- The information given by the inspector to the OEF-staff should be:
  - Any follow-up is documented (also in data base).
  - New issues raised through inspections can be feed back.

  NB: The inspector should provide regular and effective feedback to operators.
- The information exchange process must be strong in a way that:
  - Easy, clear multiple means of two-way communication is present.
  - Clear objectives are proceduralised to identify all interfaces and customers.
  - It challenge the inspector to give feedback of the received OE.
  - Give inspectors time and resources to review and prepare to perform their inspections.
  - It is evaluated on a regular basis.
- A good exchange of OE/inspection related information with others should be:
  - Shared through international databases, peer reviews WGOE and WGIP meetings, standards, publicity accessible databases, bilateral exchanges training and joint inspections and WANO user groups.
  - Have commitment and strong participation.
  - All encompassing info i.e. OE-inspection findings.

  - Consider also non-nuclear OE.
  - Reviewed and discussed with RB/vendors/research institutes in country at periodic meetings.
  - Harmonised in approach, coding and classification in order to have a good input/output agreement.
  - Lever the use of international OEF to improve the national OEF-system.
  - Publicise potential lessons for/from other industries.

- Internal use of information received from OEF and inspection.
  - Bilateral/joint inspection teams need a good mix of expertise and disciplines.
  - Use information in updating standards, regulations and license conditions/Technical specifications and inspection procedures.
  - Feedback of experience to IAEA-NEA to improve their processes.
  - Database improvements to share responses internationally.

**Discussion model to obtain a strong process**




***OEF informing inspection***

- Easy, clear multiple means of two-way communication.
- Proceduralised clear objective identify all the interfaces/customers.
- OE communications are practical and brief and safety focussed.
- Use modern tools; Data access ability to drill down and ability to support trending/analysis.
- Rapid dissemination of early (accurate) information.
- Evaluation is necessary.
- Associated source databases are kept up to date and used by all.
- Documents and identifies good practices.
- OE provides lessons and potential solutions for others.
- Provides capability for discipline-base interrogation.
- Harmonised coding and classifications.
- Not bothered by bureaucracy and passwords.
- Identifies for action/info/priority.
- Capability of responding flexibly to special requests.

***Inspection to OEF – Inspector use of OEF and subsequent feedback***

- Give inspectors time and resources to review and prepare to perform their inspections.
- Give inspectors clear criteria for prioritisation.
- Document any follow up.
- Provides for inspector feedback for quality of OE.
- OEF enhances inspector knowledge including knowledge management and transfer (KM/KT).
- New issues raised through inspections need to be feed back.
- Provides simple means to document/communicate lower level concerns.
- Inspector/licensee communications are effective and regular.
- Bespoke IT-tools help the inspectors to feed back info findings.
- IT tools need a good search facility.
- Commonly understood abbreviations and terms (use of IAEA glossary).
- Proceduralise these elements and identify interfaces.
- Provides regular feedback to operators.

***Exchange of OE/inspection related information with others***

- Sharing information through:
  - international databases.
  - Peer reviews.
  - WGOE/WGIP.
  - Standards.
  - Publicity accessible databases.
  - Bilateral exchanges, training; joint inspections.
  - WANO user groups.
- Commitment and strong participation.
- All encompassing info i.e. OE-inspection findings.
- Non-nuclear OE should be considered.
- Periodic meetings to review and exchange info between RB/vendors/research institutes-in-country.
- Harmonisation of approach should be a goal.
- Interface input/output agreement.
- Leverage the use of international OEF to improve national OEF-system.
- Potential lessons for/from other industries should be publicised.

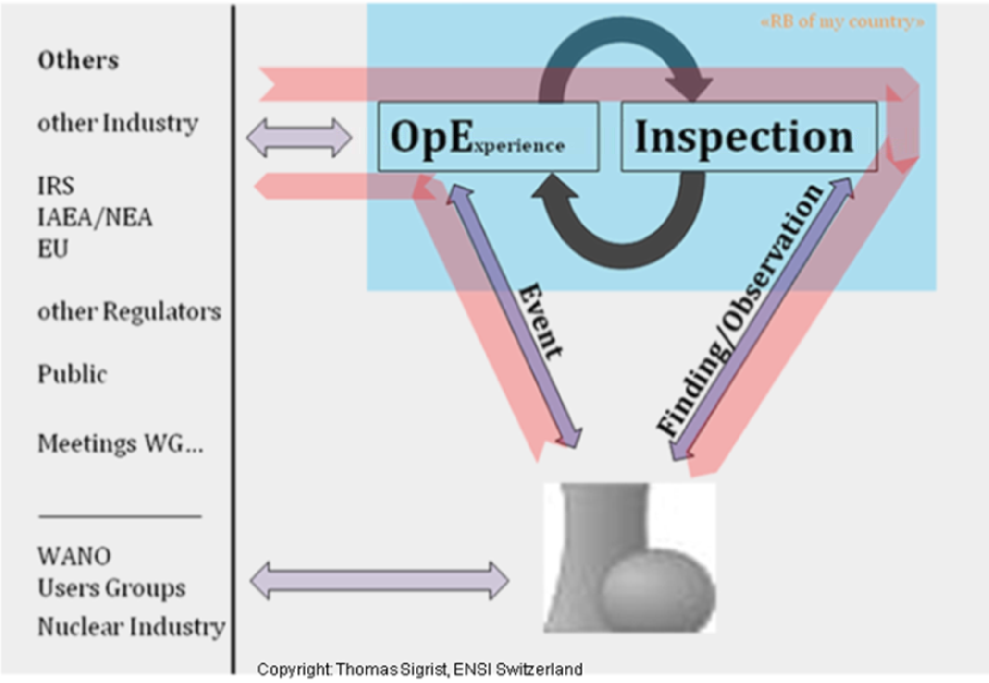
***Internal use of information received from OEF and inspection***

- Bilateral/joint inspection teams need a good mix of expertise and disciplines.
- Use information in updating standards, regulations and license conditions/Technical Specifications and inspection procedures.
- Feedback of experience to IAEA-NEA to improve their processes.
- Database improvements to share responses internationally.

### 4.3 Topic 1 Conclusions

Mr. Timothy Kobetz, U.S. Nuclear Regulatory Commission, led the closing discussions for topic 1 on using operating experience in inspection programmes. He restated the workshop objectives of exchanging information on OE for use in inspection programmes and feedback from inspectors on NOEF programmes to identify challenges and commendable practices. The discussions focused on the elements of a strong process for incorporating OE into inspection activities and into the NOEF programmes; the importance of providing OE information to inspectors; and for inspectors to provide feedback into the NOEF programme.

Elements of an overall strong process provide a clear transfer of information between inspectors and OE staff and identify specific outcomes for inspection activities. The process also contains a systematic approach to transfer information among the regulatory staff and with the licensees, including international experience. Elements of a strong OE programme, that include feedback from the inspection programme and provide OE information to inspectors, were described using the model diagramme.




When summarizing the discussions of the group sessions on Topic 1, it was noted that caution should be used when providing information on recent events or events that were still in progress. Further, a strong overall NOEF process captures information on non-nuclear events and experience in areas that include digital instrumentation and controls; significant events like the terrorist attack on 11 September 2001 and major oil spills; events at fossil fuel power plants, manufacturing, chemical, and refinery plants; events at nuclear fuel cycle facilities; events on the medical uses of radioactive materials; experiences in the aviation and aerospace industry; and others on a case-by-case basis. A strong process also includes the appropriate use of risk insight to prioritise inspection activities and follow-up. A strong process uses OE to plan future inspection activities and inspectors views are sought when developing OE for inspections. The NOEF process captures insights and information on design, maintenance, and human factors. In addition, information from vendors and licensees on non-conforming parts should also be included in a strong NOEF process. As with many strong processes, periodic self-assessments should be performed to monitor the effectiveness of the process and to identify areas for enhancements.

With regards to sharing OE with inspectors, the discussions within the group sessions focused on what information the inspectors need on routine OE and emergent, safety significant OE. Further, discussions covered what specific inspection requirements, if any, should be developed and how the information should be provided to the inspectors. A commendable practice identified from the group sessions was to conduct routine OE meetings with the inspectors, to include knowledgeable specialists, and to provide written documentation of the meeting as a follow-up. During the meetings, specific inspection focus is necessary and when appropriate the meeting should include technical support organisations and licensees. Other commendable practices identified during the group discussions include:

- Encouraging the exchange of OE between inspectors.

- Using a database to:
  - Identify applicability to specific nuclear facilities.
  - Track status and completion of inspections.
  - Provide a regulatory basis for the inspector (if applicable).
  - Link the OE to specific inspection procedures.
  - Provide a basis for generic applicability.
  - Trend OE.
- Specific information regarding OE that should be provided to the inspectors.
  - How the OE was discovered:
    - Self-revealing.
    - Licensee, vendor, manufacturer, or contractor.
    - Regulatory body.
  - The technical assessment of the event.

The discussions in the group sessions related to how inspection results are fed back into the operating experience programme, focused on what feedback is needed by the OE staff, how the inspection information should be provided, and what happens to the information provided by inspectors. A number of commendable practices were identified, including:

- A mechanism to transfer findings to OE staff should be provided that includes:
  - Written guidance and procedures.
  - Conduct of routine meetings regarding inspection findings with OE staff.
  - Provide written inspection reports to OE staff highlighting findings.
  - A database should be used to incorporate inspection information into OE.
- Documentation expectations for inspectors should be clearly defined.
- Specific outcomes should be identified for the assessment of inspection information provided by inspectors.

However, the group sessions also identified a number of challenges that could impact the effectiveness of the feedback process that include:

- More information exists than can be evaluated.
- Competing interests of multiple regulatory authorities.
- Tracking for low-level events.
- Individuals carrying out multiple roles.

And finally, the group sessions on topic 1 identified other issues that need to be considered regarding the application of OE within the regulatory framework. For example, OE should be incorporated into the planning and conduct of construction and start-up test inspections. OE input into NPP life management inspections should support periodic safety reviews (PSR) and life extension (relicensing and license renewal) inspections. In addition to the impact on the inspection programme, the assessment of OE needs to consider the broader impact on regulations and policies.

# 5. TOPIC 2

# OPERATING EXPERIENCE AND INSPECTION INSIGHTS FROM NON-CONFORMANCE OF SPARE PARTS

## 5.1 Opening Presentation

Mr. Julio Crespo, Consejo de Seguridad Nuclear (CSN) the regulatory authority in Spain, opened the discussions for topic 2 on different NOEF approaches and practices for regulatory authorities' inspections of licensees' identification and handling of non-conformances of spare parts. Mr. Crespo began his presentation by discussing recent information related to the impact of non-conforming items on safety and on the regulator's role in overseeing licensee's procurement activities. Specific examples he highlighted included Finland's presentation on Non-conformance of spare parts from the 7$^{th}$ WGOE Meeting held in Paris, France on 14-15 April 2010; the IRS event report 8150; the April 2010 WGOE meeting questionnaire on CSFI (Counterfeit, Suspect and Fraudulent Items); and the NEA publication NEA/CNRA/R(2011)4, "The Nuclear Regulator's Role in Assessing Licensee Oversight of Vendor and Other Contracted Services."

For topic 2 there were nine (9) questions in three (3) subtopics. The first set of four (4) questions focused on regulatory actions in response to operating experience related to the non-conformance of spare parts. In response to question 1A on whether the regulatory body (RB) has taken national generic action on non-conformances of spare parts, with a brief description of the national approach, Mr. Crespo reported that most of the countries make reference to their quality assurance (QA) programmes and associated inspections to provide the regulatory framework for overseeing licensees' activities in this area. Some of the countries have added statements related to replacement part strategy that required the use of parts of equivalent quality to the original part. A few countries have taken specific actions on non-conformances of spare parts such as:

- Campaign on the way the licensees contract services.
- Oversight of the sub-contractors chain.
- Specific inspection related to spare parts control.
- RB vendor inspectors use of Generic Communication tools and 10 CFR 21 communications.

The responses to question 1B on the main causes identified by the RBs (if any) concerning the non-conformance of spare parts and whether different main causes have been identified by the licensees indicated that some of the countries have not identified main causes and that there was no difference between causes identified by the licensees or the RBs. In the workshop announcement it indicated that a contributing cause could be that fabrication facilities might be closed down. The responses supported this as a contributing factor noting that (many original equipment) manufacturers have closed down and many existing manufacturers are inexperienced in the nuclear field and have had problems meeting quality assurance requirements. The workshop announcement noted that the inability to acquire original types of spare parts could contribute to this issue. Obsolescence of some parts was noted in the responses as a challenge that could contribute to the non-conformance of spare parts. Consistent with the workshop announcement, the responses noted that changes to the type or standards of materials and processes, including the design process, were contributing factors to the non-conformance of spare parts. Other contributing factors identified in the responses were inadequate oversight of contractors by operators/licensees, and less than adequate oversight by contractors on their subcontractors. Further, human errors, deficient work practices, and an increase in inadequate processes or the failure to proper implement processes for commercial grade dedication were identified as contributing factors to non-conformances in spare parts.

Question 1C related to whether the NOEF programme is influenced or is involved in developing or writing inspection procedures for the inspection of spare parts, and if so how. In the presentation, it was noted that for many countries the answer is the NOEF program is not directly involved in developing or writing inspection procedures, however it was highlighted in the responses that NOEF programmes have influenced the oversight of licensees' programmes on non-conforming spare parts that include:

- OE inspections including in their scope the non-conformance of spare parts.
- Modifications in the maintenance program.
- New guides for spare parts inspection.
- Specific QA inspections on spare parts.
- Inspection procedures to control obsolescence.
- Some controls have been added during outages.

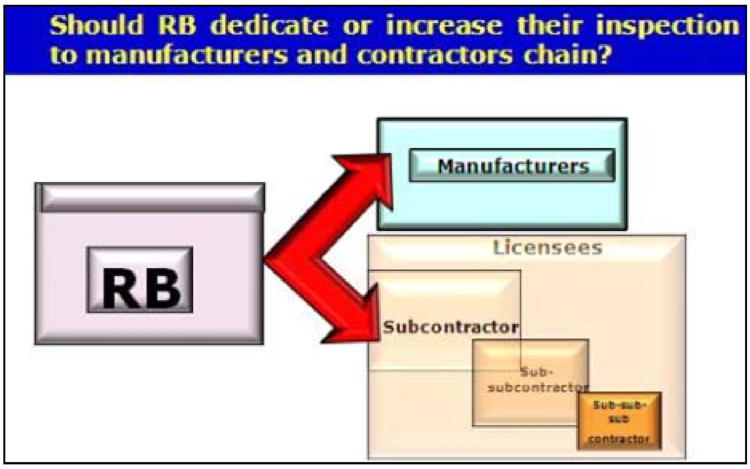
Question 1D focused on the measures that operators' are taking to prevent the procurement and installation of counterfeit, fraudulent and suspect items (CSFI) and what actions the RBs are taking in light of concerns in other countries. In response, most of the countries indicated that they relied on QA systems and programmes, and on a case-by-case basis applied other specifications that include:

- Operator has setup categories of spare-parts.
- Spare parts must be acquired directly from the manufacturer.
- Procurement audits (e.g. CANPAC).
- In-situ surveillance at manufacturers.
- Sensitization and training of RB and licensee's inspectors.

Information was also presented from a survey of prime and sub-contractors that have encountered counterfeit electronics. This survey information related to the time it takes to report counterfeits to the government authorities. The survey was conducted by the U.S. Department of Commerce, Office of Technology Evaluation and was presented by the NRC at the 7 June 2011 CNRA Meeting. From this survey it was noted that 46% of the respondents to this survey did not report counterfeit items to government authorities. Another 13% took more than a month to report the information. The remaining 41% reported information on counterfeit items in 30 days or less.

Based on the responses to the question in this subtopic area and the information on reporting of counterfeit items to government authorities a number of issues were identified for discussion during the group sessions. Specifically:

- Are licensees and RBs adequately inspecting CSFI?
- Do the licensees test, qualify and/or control components, specifically small electronic spare parts in order to avoid CSFI?
- Should there be improvements in the licensee and RB inspectors' training on CSFI and spare-parts?
- Should the regulatory framework be modified by adding specific clauses to prevent CSFI in the licensees' procurement orders?
- Could there be improvements in licensee's data bases by adding information on manufacturers and root causes for non compliances of spare-parts?
- Should RB add or develop more specific inspections on the procurement of spare parts?
- Should there be more specific controls developed and implemented on spare replacements, particularly during outages?




The next set of questions focused on inspection related aspects of the RBs' oversight of licensee programmes on the non-conformance of spare parts. The first question on this subtopic (2A) sought information on whether the RB inspected the issue and if so, is there was a specific inspection for spare parts and how is it conducted. In response, most countries related the answer to oversight of the licensees' QA programmes through the performance of QA inspections. Also, inspections on performed on a reactive, case-by-case, basis. Other specific aspects provided in the responses included:

- RB inspectors included as observers in audits carried out by licensees.
- Additional controls included in the Maintenance process.
- RB inspections on receiving and storage process.
- RB inspections on management control and use of spare parts.
- Increase of RB oversight on commercial grade dedication processes.

The next subtopic related to the type of OE that was provided to or is available to inspectors on the non-conformance of spare parts, who provides the information, and what inspectors are expected to do with the information (Question 2B). In general, the responses indicated that the current OE programme information is considered enough to provide the inspectors with the information needed to address the non-conformance of spare parts. Specific information related to spare parts was being provided to the inspectors depending on safety significance of the parts being replaced. Further, the responses indicated that inspectors are expected to use the information during the planning and performance of their inspections and to proactively sharing information with the licensees and other inspectors.

The final question in this subtopic area related to the RBs' position regarding the inspection of the measures taken by the operators to avoid the procurement and installation of CSFI and what specific guidance is provided to inspectors regarding CSFI (question 2C). The response indicated that until now many countries, particularly in Europe, do not consider how licensees face this potential threat, and there is no specific guidance or inspector training provided. Many of the responses indicated that there is confidence in the licensee's QA system.

Based on the evaluation of the response to the question for this subtopic, issues for discussion where identified that included:

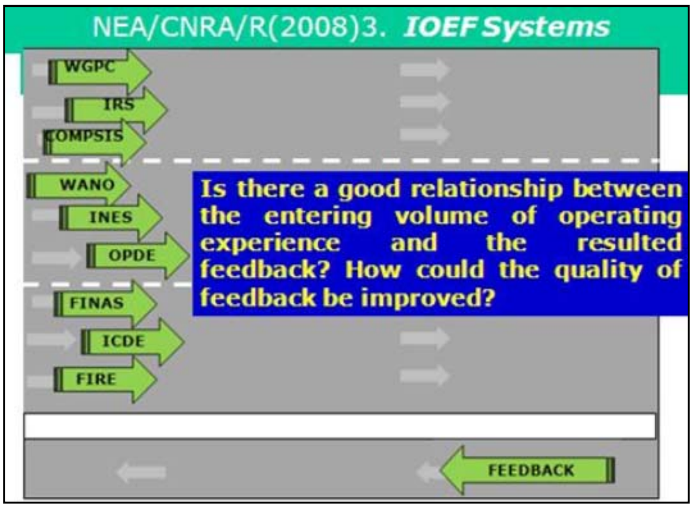
- Should the RBs inspect licensees' general policy for spare parts management and maintenance, in addition to the inspection of specific controls on aspects of spare parts?
- Should the RBs' inspectors increase their participation in procurement audits carried out by licensees, including inspection on the receiving and storage process?

The last two questions for topic 2 focused on inspection feedback on non-conforming spare parts (questions 3A and 3B). The focus of the first question on this subtopic was on how inspectors report the results of their inspections, to whom (including whether it includes reporting to the NOEF programme), and it is required by the inspection programme. The responses indicated that there are no special requirements for providing feedback on non-conforming spare parts inspections. The results of inspections are provided through the normal processes used including documentation in inspection reports, finding assessments, and through the control and oversight of licensee actions in following up on the results of inspections.

With regard to whether the RB's plan to take any actions with the compilation of all of the inspector's results from non-conformance inspections, with a brief description if they do (questions 3B), the responses in general indicated that there was not enough information or clear trends to promote specific actions, but RBs could expect some tasks related to:

- The way contracted services are handled by licensees.
- Whether there is assurance that all requirements are adequately implemented.
- Whether feedback is adequately used in the planning and performance of inspections.

From the responses to the questions in this subtopic area it was suggested that the discussions in the group sessions should consider whether there is a good relationship between the entering volume of operating experience and the resultant feedback and how could the quality of feedback could be improved.




## 5.2 Discussion Group Sessions

There were 4 separate discussion groups that were created to exchange insights and feedback on the RBs' oversight of licensee programmes on non-conforming items and CSFI. Feedback from the discussion groups was collected and used as the basis for the closing session on Topic 2 (see Section 4.4). Two of the discussion groups (groups 1 and 2) submitted written input that provided an overall description of the discussions that took place within their groups.

Discussion Group 1 provided an overview of the discussions provided by the participants related to the challenges they face in dealing with the non conformances of spare parts and CFSI that included:

(HUN) We have no set requirements in this area and have not seen any challenges to-date. Need to identify the safety significance.

(USA) Licensees are responsible for safety, and for identifying specific components or parts used in unique circumstances (i.e., Digital I&C) that are suspected to be CFSI.

(BEL) Two steps taken so far – letter written and inspection performed. Need better understanding of the issue and determination of commendable practices to proceed.

(SWI) Inspections are centred on verification, but it is difficult to determine or validate certain components (digital equipment). Main area of concern is in the replacement of parts.

(GER) Large difference between non-conformance and CFSI. No known cases of CFSI. Responsibility of licensee.

(RUS) Licensee issue, special rules apply to imported components which includes possible foreign inspection.

(UAE) Licensee is responsible for safety and requirements are quite clear concerning reporting. Difficult to assess the safety significance of this issue at this time, however the current information shows the need to be vigilant

(FRA) Similar to German understanding. Some events related to spare parts (non-conformance). Not considered as a challenge at this time. Problems at this time mostly related to Human Factors (poor documentation).

(IND) Use international standards and inspections are carried out to meet these, mainly focused on safety systems. Extensive testing is performed on a sample lot. No major problems have been discovered to-date

(FIN) No known cases of CFSI, but there have been issues related to non-conformance with spare parts.

One Discussion group provided the following written input:

FLIP-CHART BULLETS:

1. How are non-conformances of parts discovered?
   - Equipment failures and events during normal operation.
   - Equipment failures during demands/testing.
   - Reportable events.

2. Aspects/sources/causes of non-conformances.
   - Non-Conformances include Counterfeit/Suspect/Fraudulent Items (CSFI).
   - Specification Changes (in design, procurement specifications).
   - Changes to test regimes.
   - Poor Design Change Controls.
   - Ordering or Choice Errors.
   - Manufacturers’ changes without proper notification, or consultation with customers.
   - QA/QC weaknesses in vendor of licensee requirements/arrangements.
   - Measuring & Test Equipment deficiencies/calibration.
   - Shelf life management & storage conditions.
   - Procurement Practice shortfalls, e.g., accounting for obsolescence.
   - Fit/Form/Function assumptions.
   - Vendor Recommendations ignored.
   - Failure to follow MODS Process (form/fit/function - fff).

3. Techniques and tools to mitigate the possibility of non-conformance.
   A. Regulatory authority current practices/options.
      - Inspections of licensee procurement arrangements.
      - Inspection of vendors’ activities (infrequent, with licensees or not).
      - Oversight of Licensees’ Vendor QA audits/inspections.
      - Accreditation & Use of 3rd Party Inspection Agencies.
      - Not much, if any, data trending going on.
      - More comprehensive inspections of all elements of QA/MS arrangements.

- Themed/specific inspections in relation to spare parts important to safety.
- Non-conformance of spare parts not taken that seriously, influenced by levels of awareness.
- Use of generic communications to notify industry of non-conforming parts/defective materials/services.
- Ensure licensees are trending and monitoring (see if their RCAs find/identify non-conformances/defects).
- Track reportable events of various types.
- Perform pro-active maintenance.

4. Licensee practices (for controlling quality of spare parts).
   - Utility and Joint Utility Vendor Audits.
   - Participate in owners/users groups.
   - Monitor equipment unavailable hours.
   - Sharing of Operating Experience, sometimes quite rapidly.
   - Follow Codes and Standards.
   - Controlled life cycle maintenance plans.
   - Repair and Replacement Plans.
   - Database tracking and trending (time between failures) (effectiveness varies).
   - Obsolescence planning.
   - Maintenance Programs.
   - Surveillance Test Programs.
   - Release for Shipment practices.
   - Software QA & Engineering.
   - Approved Supplier Lists.
   - Receipt Inspection.
   - QA Program and Management System.
   - Procurement Specifications.
   - Use of/requirement for Certified Material Test Report (CMTR) and other certifications.
   - Maintenance of controlled warehouse/storage conditions.
   - Post Installation Testing.
   - Operability Testing.
   - Modifications Process and Associated Requirements (Equivalency Evaluations for spare parts when OEM parts not available to assure critical characteristics are met, in addition to "Fit-Form-Function".

5. Licensee QA program limitations.
   - Personnel resources limited/shrinking.
   - Budget dollars/euros declining.
   - World Rapidly Changing.
     i. Business Cycles (companies forming/failing).
     ii. Technology changes.
     iii. Cost Cutting in many places, including suppliers.
   - Competence (Technical and process).
     i. Training and qualifications.
     ii. Knowledge Management and Transfer.
   - Sampling a necessity – can't do 100% inspection/audit.
   - Increased costs due to low volume production of replacement parts/equipment – potential unique challenges/non-conformances not identified by QA organisation.

### 5.3 Topic 2 Conclusions

Mr. Ben Poulet, Canadian Nuclear Safety Commission, led the closing discussions for Topic 2 on regulatory body's oversight of licensee programmes on non-conforming items. He restated the workshop objectives of exchanging information on the topic of the non-conformance of spare parts; defining the main issues and challenges with overseeing licensee programmes on this issue; developing potential solutions to address these challenges; and to identify commendable practices being used by participants for consideration as improvements to existing inspection programmes.

With regard to exchanging information, the first point he discussed was the need for a better understanding of "non-conformances", including how and where non-conformances are discovered. He pointed out that the discussion groups indicated that there should be a review of current licensee and RB practices and a better understanding of the potential safety implication of non-conformances. With regard to CSFI, there needs to be a better understanding and exchange of information on its relation to non-conforming items. Also, the discussion groups recognized that CSFI is a potential emergent issue for some member countries. Further, as practices are reviewed, exchanging information on the role of NOEF and IRS for collecting and analyzing information on non-conforming items and CSFI should be considered. To broaden the perspective on sharing information on non-conforming items and CSFI, insights on the current practices of non-nuclear industries when reviewed should be shared. And with the increased demand for parts and components for new builds, exchanging information on the difference in the implications of non-conforming items and CSFI to new builds versus operating units should be conducted.

The discussion groups identified a number of issues and challenges that should be considered as the participants take the insights gained from the workshop back to their respective organisations. A challenge that was identified was the lack of common understanding of CSFI and therefore there is a limited awareness of the extent of the problem that may exist. The extent of the current status of CSFI and the impact of non-conforming items on nuclear safety is not well known. With the existing open markets there is an increased vulnerability to CSFI and non-conforming items to be introduced into the nuclear power supply chain. The increase openness of the market and the unavailability or obsolescence of spare parts can also facilitate the introduction of CSFI as vendors and suppliers broaden the sources of their sub-tier suppliers. From a regulatory perspective, there is limitation on the direct, and often indirect, regulatory authority to oversee the supply chain. Coupled with limited resources available to regulatory authorities, it is a challenge to effectively define the scope of the potential problem of non-conforming items and CSFI and its impact on the supply chain for the nuclear power industry..

Other challenges identified by the discussion groups related to issues associated with specific processes or activities being implemented by licensees, vendors, and sub-tier suppliers that have the potential to allow non-conforming items or CSFI to be introduced into the nuclear power supply chain. For example:

- Improper application of Commercial Grade Dedication Process (CGDP) may result in non-conformances.
- Varying competence levels and certification practices.
- Availability, Access, and Quality of Records and Databases.
- Adequacy of Licensee and Supplier Configuration Control.
- Re-introduction of rejected or discarded parts in the supply chain.

To address the major issues and challenges the group discussions identified a number of potential solutions that the participants should consider as they assess the effectiveness of their programmes and processes at overseeing the licensees' activities on non-conforming items and CSFI. Examples include:

- Harmonisation and adequacy of the coding of non-conformance discoveries.
- Improve oversight of licensee activities to identify and address non-conformances.

- Use of non-conformance information in periodic reviews and licensing activities.
- Require licensees to implement adequate staff training, practices, and resources.
- Promote better licensee use of vendor supplied information.
- Ensure licensees are trending and monitoring non-conformances.
- Ensure reporting framework includes non-conformances.
- Ensure adequate licensee configuration control processes (including the substitution of spare parts).
- Require licensee to ensure the vendor notifies the licensee when a part or component has changed.
- Ensure licensees evaluate the impact of the changed part or component.
- Commercial part or component certification for nuclear application.
- Improved vendor awareness of potential safety impact.
- Three-part strategy to ensure adequate part or component quality level:
  - Direct inspection.
  - QA Program Certification.
  - Part or component testing (including destructive testing).

In closing the discussion on topic 2, Mr. Poulet highlighted a number of commendable practices that were identified during the group discussions, including:

- Direct and regular inspection or audit of the licensee management system (policies & procedures) as it applies to QA, procurement, and testing of spare parts.
- Direct inspection of the supply chain by the RB as appropriate (2 methods).
- Training of RB staff on the conduct of supply chain inspections.
- Requirement for vendors to notify both the licensee and regulator when significant defects or non-conformances are identified.
- Promote early exchange of significant non-conformance information between RBs (including CSFI).
- Direct inspection of licensee commercial grade dedication process.
- Prompt regulatory follow-up on plant operability determination when installed non-conforming parts are discovered.
- Non-conforming parts discovered prior to installation are reported to RB.
- Regulatory inspections of activities related to the repair and replacement of parts (including requalification of the part or system).
- RBs should promote licensee understanding of CSFI and its detection.

# 6. CLOSING PLENARY SESSION

## 6.1 Workshop Closing Remarks

Dr. Michael Maqua, Chairman of WGOE, led the workshop closing session. In his presentation he provided an overview of the discussions held during the workshop on the two topics, using operating experience in inspection programmes and inspection insights in OEFP, and the recent operating experience and inspection insights of non-conforming spare parts. The focus of his presentation was on the conclusions, commendable practices, and challenges identified during the discussions.

The main findings for the first topic related to identification of the elements of an overall strong process for sharing information between the NOEF and inspection programmes. With regards to sharing OE with inspectors, it was noted that a strong process for sharing specific information with inspectors includes routine meetings between OE staff and inspectors, the use of common databases, and the exchange of information on OE. Also it was noted that strong OE programmes include the use of inspections to follow-up on OE. For the process of transferring inspection findings and feedback into the OE programme it was noted that strong programmes include clear expectations on the documentation of inspection findings to support their use in assessing OE. The main challenges identified related to sharing information with inspectors were information overflow (overload), competing interests of multiple regulatory authorities (including non-nuclear), and relying on individuals that fulfil multiple roles within an organisation. In addition to challenges related to sharing information with inspectors, it was noted that the tracking of low level events was a challenge.

For the second topic related to non-conforming items, the main issues and challenges identified during the workshop included:

- Limited awareness regarding CSFI.
- Extent of current status unknown.
- Open markets increases vulnerability.
- Unavailability or obsolescence of spare parts may facilitate introduction of CSFI.
- Limitation on direct and indirect regulatory authority over the supply chain.
- Varying competence levels and certification practices.
- Limited resources.

Potential solutions that were discussed include:

- Harmonisation and adequacy of the coding of non-conformance discoveries.
- Ensure reporting framework includes non-conformances.
- Licensees' activities:
  - adequate staff training, practices, and resources.
  - adequate licensee configuration control processes (including of spare parts).
  - licensees are trending and monitoring non-conformations.
  - Improve licensee-vendor communication.
- Regulatory body's activities:
  - Use of non-conformance information in periodic review and licensing activities.
  - Improve oversight of licensee activities to identify and address non-conformances.
- Commercial part or component certification for nuclear application.
- Three-part strategy to ensure adequate part or component quality:
  - Direct inspection.
  - Quality Assurance (QA) Program Certification.
  - Part or component testing (including destructive testing).

Commendable practices include:

- Inspection of the licensee management system.
- Inspection of the supply chain by the licensee and the regulatory body.

Based on the discussion during the Plenary Session the outcomes of the workshop for topic 1 on the interactions between the NOEF and inspection programmes include:

- Adaption of the International Reporting System for Operating Experience (IRS) database to the needs of inspectors.
- Training of inspectors on international systems.
- Distribution of topical reports based on IRS.
- Distribution of workshop results (several workshops get to similar findings without visible consequences).
- Level of the regulatory body's confidence on the licensee's OE programme

In wrapping up the discussions on the workshop, Dr. Maqua, emphasized the importance of taking the insights and information developed and discussed during this workshop back into the participants' OE and Inspection programmes. Specifically, he encouraged the WGOE and WGIP members to thoroughly review the outcomes of the workshop for use within their respective working groups; emphasized that the CNRA should take care to ensure that working group and workshop results are adequately distributed; and encouraged IRS to take into account the wider use of the IRS database. Finally, he emphasized that everybody should go home and communicate their findings.

In closing, Dr. Maqua, on behalf of all of the participants, thanked the organisations and participants that made the workshop possible, including:

- The presenters from STUK and the Finnish operators that discussed Finnish OE and spare part related events.
- Mr. John Thorp and Mr. Julio Crespo for their introductory topic presentations.
- Mr. Ben Poulet and Mr. Tim Kobetz for their closing topic presentations.
- Facilitators for the working group sessions.
- WGOE and WGIP members participating in the workshop for their excellent co-operation.
- NEA and Diane Jackson for making the workshop possible.
- STUK for its efforts to volunteer and host the workshop.
- Ms. Seija Suksi and the STUK staff for all the organisation and the nice reception dinner.
- and to all of the participants for their active participation in the workshop.

### 6.2 General Workshop Conclusions

The following conclusions emerged from the workshop and provide an overview of the conclusions and commendable practices identified by the participants in the workshop. The workshop conclusions and commendable practices are based on workshop discussions and do not reflect a consensus all NEA member country opinions. Nevertheless, they can be utilised as a general benchmark for basic comparisons of those issues which inspectors from participating countries share.

Overall the workshop provide an effective means for the participants to share their knowledge and insight on exchange of information between the NOEF and inspection programmes, and regulatory activities related to the oversight of licensee programmes on non-conforming items and CSFI. A number of commendable practices were identified that the participants were encouraged to take back to their organisations with the goal of enhancing their regulatory programmes to improve their nuclear safety oversight missions and to better capture and share OE information within their own organisations and to the broader international community.

With regards to non-conforming items and CSFI, there is a clear recognition that the potential scope of this issue is not fully understood or recognized by all of the participants. However, there has not been wide spread examples of where non-conforming items and CSFI have had a significant impact on public health and safety. It is recognized, though, that with the increased demand for parts and components for new nuclear power plant construction, coupled with the ongoing need for replacement parts to maintain the existing aging nuclear power plants, the potential for the introduction of non-conforming items or CSFI into safety-related applications needs to be better understood by both the nuclear power industry and regulatory authorities to minimize the potential for impact on public health and safety.

***Topic 1 Commendable Practices***

With regards to the interaction and exchange of information between the NOEF and inspection programmes, a commendable practice was identified for the conduct of routine meeting regarding OE with the inspectors that includes knowledgeable specialists with written documentation of the meeting as a follow-up. Other commendable practices identified during the workshop related to Topic 1 include:

- Encouraging the exchange of OE between inspectors.
- Using a database to:
  - Identify applicability to specific nuclear facilities.
  - Track status and completion of inspections.
  - Provide a regulatory basis for the inspector (if applicable).
  - Link the OE to specific inspection procedures.
  - Provide a basis for generic applicability.
  - Trend OE.
- Specific information regarding OE that should be provided to the inspectors.
  - How the OE was discovered?
    - Self-revealing.
    - Licensee, vendor, manufacturer, or contractor.
    - Regulatory body.
  - The technical assessment of the event.
- A mechanism to transfer findings to OE staff should be provided that includes:
  - Written guidance and procedures.
  - Conduct of routine meetings regarding inspection findings with OE staff.
  - Provide written inspection reports to OE staff highlighting findings.
  - A database should be used to incorporate inspection information into OE.
- Documentation expectations for inspectors should be clearly defined.
- Specific outcomes should be identified for the assessment of inspection information provided by inspectors.

***Topic 2 Commendable Practices***

Building upon the discussions for topic 2 on regulatory bodies' oversight of licensee programmes on non-conforming items, including CSFI, a number of commendable practices were identified, including:

- Direct and regular inspection or audit of the licensee management system (policies & procedures) as it applies to QA, procurement, and testing of spare parts.
- Direct inspection of the supply chain by the RB as appropriate (2 methods).
- Training of RB staff on the conduct of supply chain inspections.
- Requirement for vendors to notify both the licensee and regulator when significant defects or non-conformances are identified.
- Promote early exchange of significant non-conformance information between RBs (including CSFI).
- Direct inspection of licensee commercial grade dedication process.

- Prompt regulatory follow-up on plant operability determination when installed non-conforming parts are discovered.
- Non-conforming parts discovered prior to installation are reported to RB.
- Regulatory inspections of activities related to the repair and replacement of parts (including requalification of the part or system).
- RBs should promote licensee understanding of CSFI and its detection.

# 7. WORKSHOP EVALUATION

## 7.1 Workshop Evaluation Form Results

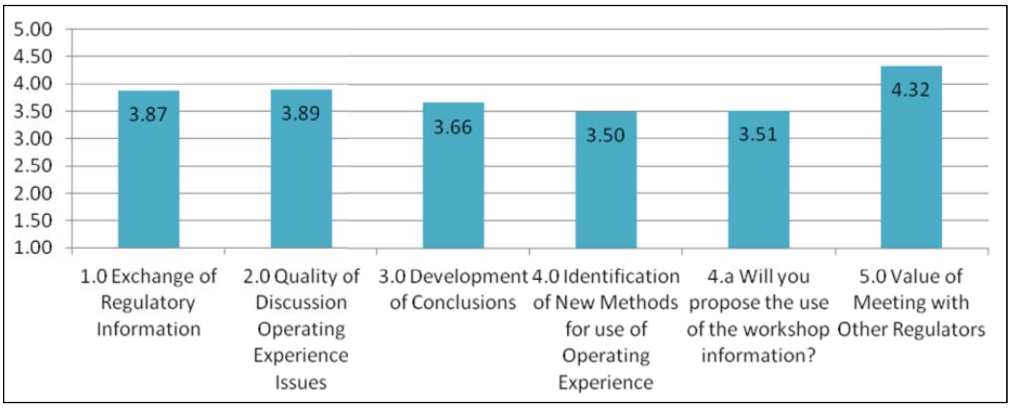
All participants at the workshop were requested to complete an evaluation form. The results of this questionnaire summarised below, are utilised by WGOE in setting up future workshops and to look at key issues in the programme of work over the next few years. Of the 61 total participants, 38 responses were received.

The evaluation form, which was similar to ones issued at previous workshops, asked questions in 4 areas: general - workshop objectives, workshop format, workshop topics and future workshops. Participants were asked to rate the various questions on a scale of 1 to 5 (with 1 being a low (poor) score and 5 being a high (excellent) score. Results are provided in the following charts along with a brief written summary.

### *General*

The chart below depicts the overall conduct of the workshop and the participant's responses on how well the workshop was conducted.

**Helsinki June 2011 WGOE Workshop: General Survey Questions: Q1-5**



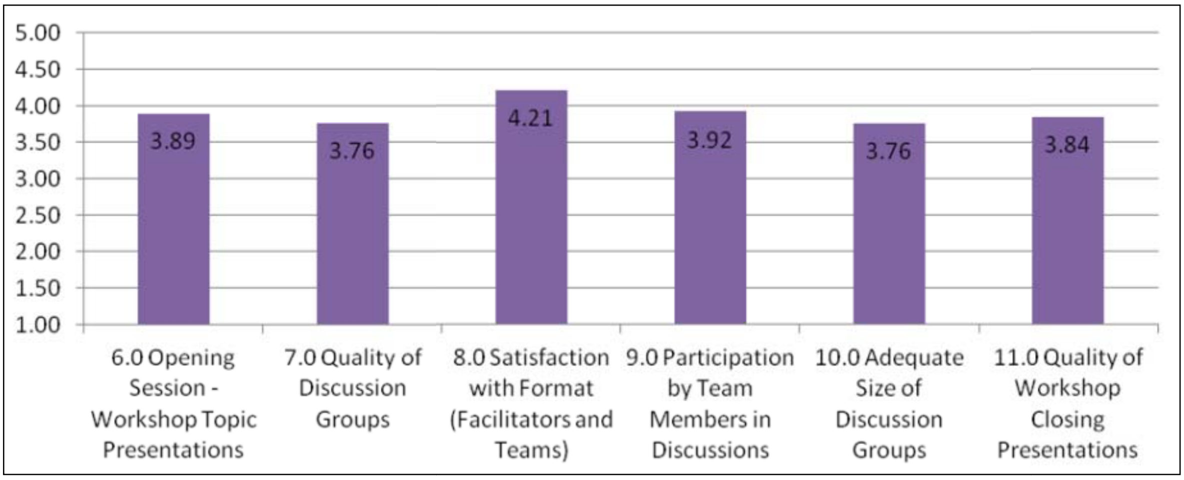

The responses to the general survey questions indicate that overall, there was general satisfaction with the conduct of the workshop. Most of the participants valued meeting with other regulators to discuss their operating experience and inspection programmes (average 4.32, with a range of responses from 3 to 5). The quality of the discussions and the exchange of regulatory information were perceived as good by most of the respondents (average 3.89, with a range of responses from 2 to 5, and an average 3.87, with a range of responses from 2 to 5, respectively). Development of conclusions (average 3.66, with a range of responses from 2 to 5) and identifying new methods for using operating experience (average 3.5 with a range of responses from 2 to 5) show a general satisfaction with these areas as well. The majority of the respondents indicated that they would propose the use of the workshop information in their operating experience and inspection programmes (average 3.51, with a range of responses from 2 to 5).

This was the first WGOE workshop to use this format. However, this format has been used a number of times by WGIP. The results of the general questions for this WGOE workshop are generally consistent with the result from some of the earlier workshops conducted by WGIP. As WGOE gains experience with conducting workshops using this format, it is anticipated that the trend towards higher ratings should be achieved in a manner similar to that experienced by WGIP as it applied this format.

***Workshop Format***

This part of the questionnaire looked at the effectiveness each of the sessions. The main objective of these questions focuses on the way sessions are conducted. The responses provide feedback to WGOE and NEA in its preparation and planning for future workshops.

**Helsinki June 2011 WGOE Workshop: Format Effectiveness: Q6-11**

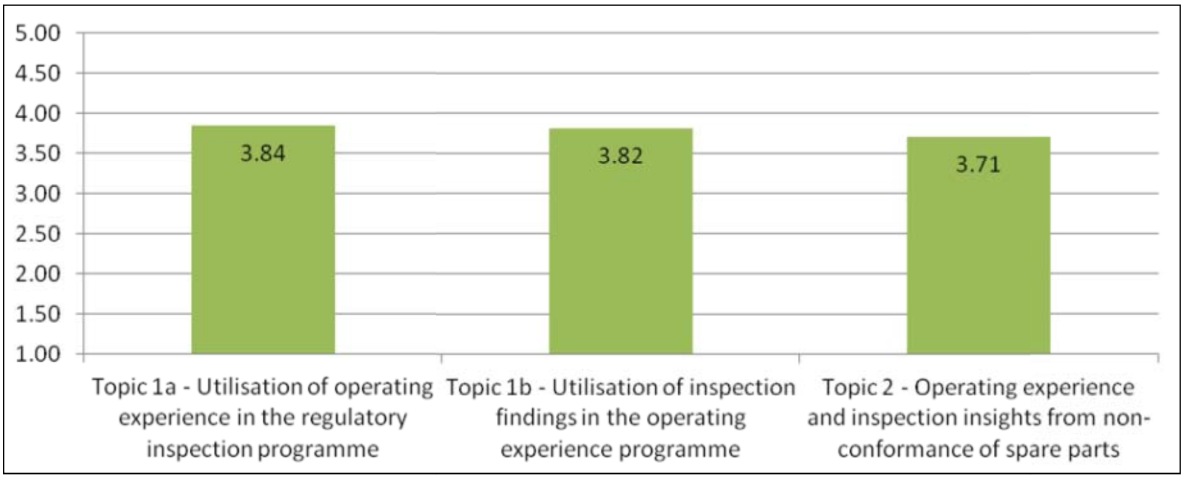



This is the first time that WGOE used this format for a workshop. To assess the results of this survey a comparison to other NEA workshops using this format will provide insights on which areas may warrant attention in planning and conducting future WGOE workshops. Previous results from WGIP workshops were used to assess the results of the survey for this workshop since this workshop included significant participation by members of WGIP. Comparing these WGIP results with those of this workshop finds that these results have a similar range to previous WGIP workshops. The average for the opening sessions (3.89 out of 5 or 77.8%) was lower than the previous WGIP workshops (all at 100%). The average for the quality of the discussion groups (3.76) was within the range of previous WGIP workshops (3.36 to 4.5); satisfaction with the format (4.21) is on par with the typical WGIP workshop (3.98 to 4.44). Feedback on the participation by team members (3.92) was within the range of WGIP workshops (3.14 to 4.4). The size of the discussion groups (3.76) was rated lower than all of the previous WGIP workshops (3.97 to 4.63). This may reflect the large groups in this workshop compared to typical WGIP workshops. They confirm that NEA members are efficient in preparing and running the workshop. The success of each workshop is dependent on good preparation by the WGOE and WGIP and that the co-ordination between the facilitators and recorders for each topic. As noted in previous WGIP proceedings, the informal interaction, outside the discussion sessions, clearly enhances the discussion group sessions.

***Workshop Topics***

In order to assess how well the topics have been addressed, participants are asked to give a rating on whether they perceived the topics were covered adequately.

**Helsinki June 2011 WGOE Workshop: Were topics covered adequately? Q12-14**




Workshop participants were generally satisfied with the selection of topics and how they were addressed.

***Future Workshops***

While the other section looked at the way workshop sessions are conducted, this section provides an overall of the value for future workshops and how they can be improved. For this workshop, 82% of the respondents indicated that another workshop on related topics between operating experience and inspection practices would be of interest. The number of topics that should be covered during future workshops was two, with a range of between one and three (the average of the responses being 2.18). This suggests that more respondents favoured two or three topics be included in future workshops. Based on the responses received, the duration of this workshop was the correct length. Respondents stated that future workshops should be 3 days (the average was 2.91 days, with responses ranging from 2 to 3.5 days). Finally, 78% of the respondents favoured continuing using the workshop format used for this workshop for future workshops.

***Additional Comments Received***

In general the additional comments indicated that overall there was a frank and free exchange of information and discussion on the topics covered and the sessions were good. Participants indicated that they learned some things that will help them do better at home. There was mixed feedback provided on the format of the meeting. Some of the comments indicated that the topics were relevant, the logistics and schedule were good, and there was a good balance between presentations, discussions, and time for networking with other participants. Some thought the format facilitated meaningful and fruitful discussions that may not have been possible in a larger group. However, it was also suggested by several respondents to the survey that it would have been better to reduce the size of the groups. This feedback indicated that sometimes it made the progress of the discussions slow and that smaller groups would have enabled more comprehensive discussions. It was suggested that the maximum group size be between 8 to 10 people, including the discussion leader. In addition, it was suggested that the group discussion time was too short, while the closing session was too long. A comment indicated that it was difficult to understand the timing for the last day – the topic leads working to finish at 2pm and then having a 2.5 hour closing session for the workshop. Similarly, a comment was provided that the time dedicated to prepare report 2 was too short and that the time to close workshop could be avoided.

Additional comments were also received regarding the discussions groups. It was suggested that not much information was obtained on the inclusion of inspection information in OEF in programme. It was suggested that the group discussion should be prepared better and clearer. It was indicated that the common presentation by group leaders was apt and concise, truly reflecting the gist of the deliberations. However, some of the discussions could be better organized keeping the focus at the right issues and the goal clear. It was stated that this was dependent on the discussion leader. Further, the discussions focused too much on CSFI, an issue already being worked by WGOE; some countries dominated the discussion and seem not be to be interested on other countries' practices; and the discussions on "part 21" were overwhelming.

### 7.2 Suggested Future Topics

Participants were asked to provide their input on potential future topics. Forty-five (45) topics were listed in the responses. While no specific analysis was applied to the results, WGOE and the CNRA will evaluate these and use them in proposing topics for future workshops. The respondents provided ranking of their suggested future topics. Below are the topics that were ranked as one (1):

- Future topics – general.
  - Clarification of safety significance.
  - Corrective actions.
  - Control and monitoring during outages.
  - Commissioning.
  - Knowledge Management and Knowledge Transfer.
- Future topics related to OE Programmes.
  - Exchange of OE methodologies.
  - Improving International exchange in OE.
  - Corrective actions following events.
  - Results on the "stress tests".
  - Maximizing the use of OE databases.
- Future topics related to Inspection Programmes.
  - Inspection of competence level of licensee.
  - Inspection of new builds.
  - How to utilise and combine inspection data to make a statement about the licensee organisational issues.
  - Additional OE tools to support inspections.

***Additional feedback***

Feedback from the Discussion Groups is also provided below:

- We should recognize, and document that the licensee is clearly responsible for its operating experience program.
- The IAEA standards for inspector responsibilities in the inspection of Operating Experience Programs is an excellent foundation for an inspection programme.
- Inspectors should (in some countries they do) follow/review the licensee's OEF group and the work the licensees are doing.
- It was very GOOD and encouraged to have the WGIP and WGOE support this workshop jointly. It provided a diversity of ideas and more common understanding of one another's responsibilities for effective use of operating experience and inspection insights.
- Many participants agreed that Topic One deserved more time; and, recognizing that, suggested that a follow-on workshop focused on this topic be organized for a later time. In such a workshop, we could further develop the concepts and practical approaches for strengthening the ties between inspection and NOEF programmes.
- Participants asked: "How does this work and the associated NEA reports feed into or can they be fed into the IAEA standards process? Should we do this through our own individual representatives to IAEA or

can NEA advocate for inclusion of important insights and good practices into the IAEA standards. We could possibly be more active in pursuing this goal individually, but an organisational approach coming from IAEA with input from NEA might be more effective.

- WGIP and WGOE reports and workshop proceedings are available for review on the NEA website in the pages assigned to these working groups and through the NEA public website. Members and participants should take the time to review these reports for related information in their work.
- Finland is getting ready to issue a new regulatory guideline on the use of Operating Experience. An industry member of the discussion group emphasized the need for "balance", that is, the regulator needs to be able to decide (and clearly communicate) what needs to be looked at, and the licensees need a clearer understanding of what it takes to adequately meet regulatory expectations, without having to do everything.

## 8. LIST OF PARTICIPANTS

Argentina

Ms. Silvia Perez — Nuclear Regulatory Authority (ARN)

Belgium – BEL V

Mr. Gerald Degreef

Canada – Canadian Nuclear Safety Commission (CNSC)

Mr. Benoit Poulet
Mr. Burton Valpy

Czech Republic – State Office for Nuclear Safety (SÚJB)

Mr. Karel Matejka

Finland

Radiation and Nuclear Safety Authority (STUK)

Ms. Kirsi Alm-Lytz
Ms. Milka Holopainen
Mr. Yrjo Hytonen
Ms. Erja Kainulainen
Mr. Mika Karjalanen
Ms. Hanna Kuivalainen
Mr. Jukka Kupila
Ms. Kirsi Leva
Mr. Riku Mattila
Mr. Jorma Rantakivi
Mr. Veli Riihiluoma
Ms. Seija Suksi
Ms. Ann-Mari Sunabacka-Starck
Mr. Antti Tynkkynen

Teollisuuden Voinna Oy (TVO)

Ms. Anne Niemi
Ms. Anna Raitanen

Ms. Tarja Nurminen — Posiva Oy
Mr. Jouko Turpeinen — Fortum

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French Nuclear Safety Authority – ASN

Mr. Julien Husse
Mr. Olivier Veyret

Mr. Didier Wattrelos — Institut de Radioprotection et de Sûreté Nucléaire (IRSN)

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Dr. Michael Maqua

Dr. Matthias Schneider — Bundesamt für Strahlenschutz (BFS)

Hungary – Hungarian Atomic Energy Authority (HAEA)

Mr. Gyula Fichtinger
Mr. Laszlo Juhasz

India – Nuclear Power Corporation of India Limited (NCPIL)

Mr. S.A. Bhardwaj
Mr. Devendra Gawande

Korea, Rep. – Korean Institute of Nuclear Safety (KINS)

Mr. Ji-Tae Kim
Mr. Durk Hun Lee

Mexico – National Commission for Nuclear Safety and Safeguards (CNSNS)

Mr. Luis Miguel Gutierrez Ruiz

The Netherlands – Ministry of Housing, Spatial Planning and the Environment

Mr. Kees des Bouvrie
Frederik Willem van Iddekinge

Poland – National Atomic Energy Agency (PAA)

Mr. Andrzej Glowacki

Russian Federation – Scientific and Engineering Centre for Nuclear and Radiation Safety (SECNRS)

Dr. Mikhail Lankin

Slovenia – Slovenian Nuclear Safety Administration (SNSA)

Mr. Ales Janezic
Mr. Leopold Vrankar

Spain – Consejo de Seguridad Nuclear (CSN)

Mr. Julio Crespo
Ms. Elena Verduras Ruiz

Sweden – Swedish Radition Safety Authority (SSM)

Mr. Kenneth Broman
Mr. Linus Norlander

Switzerland – Federal Nuclear Safety Inspectorate ENSI

Mr. Hans-Rudolf Fierz
Mr. Thomas Sigrist

United Arab Emirates – Federal Authority for Nuclear Regulation

Mr. Abdulla Al Blooki
Mr. Helal Al Khafili
Mr. Haitham Al Senaani
Mr. Salem Hafidah

United Kingdom – HSE Nuclear Installation Inspectorate

Mr. Rob Campbell
Mr. Stephen Lewis

USA – US Nuclear Regulatory Commission

Mr. Tim Frye
Mr. Timothy Kobetz
Mr. Daniel Pasquale
Mr. John Thorp

International Organisations

OECD Nuclear Energy Agency
Ms. Diane Jackson
European Commission – Joint Research Centre, The Netherlands
Mr. Stanislovas Ziedelis

## 9. RECENT WGOE AND RELATED-CNRA REPORTS

| | |
|---|---|
| NEA/SEN/NRA/WGOE(2012)1 | WGOE Technical Note: Presentations on the Status of National Actions in Response to the TEPCO Fukushima Dai-ichi Accident – Special Topic Discussion on 17 June 2011 |
| NEA/CNRA/R(2012)1 | Knowledge Transfer and Management of Operating Experience – Extended Special Topic Meeting on 13 April 2010 |
| NEA/CNRA/R(2011)9 | Operating Experience Report: Counterfeit, Suspect and Fraudulent Items – Special Topic Discussion on 28 September 2010 |
| NEA/CNRA/R(2011)8 | Operating Experience Report: Regulatory Response to Forsmark-1 and DIDELSYS report recommendations |
| NEA/CNRA/R(2011)6 | Operating Experience Report: Recent Failures of Large Oil-Filled Transformers – Special Topic Discussion |
| NEA/CNRA/R(2011)5 | Operating Experience Report: Investigating Trending Utilising the International Database |
| NEA/CNRA/R(2011)4 | Regulatory Guidance Booklet: The Regulator's Role in Assessing the Licensee's Oversight of Vendor and Other Contracted Services (also referenced as: NEA No. 6910) |
| NEA/CNRA/R(2009)3 | CNRA Summary Report On Operating Experience Feedback Related To Fire Events And Fire Protection Programmes (Safety Analysis Of Fire Operating Events) |
| NEA/CNRA/R(2009)2 | Current Status Of The National Operating Experience Feedback Programs |
| NEA/CNRA/R(2008)3 | The Use of International Operating Experience Feedback for Improving Nuclear Safety |

These reports, as well, as all CNRA reports are available on-line at:
http://www.oecd-nea.org/nsd/docs/indexcnra.html

# 10. PRESENTATIONS BY HOST COUNTRY REPRESENTATIVES

## 10.1 Overview of Presentations by STUK and licensees

### *National NPP Programme and NOEF Programme*

On the morning of the second day of the workshop there were presentations by STUK on the NPP programme in Finland and NOEF programme. These presentations were followed by presentations by Finnish licensees, Teollisuuden Voima Oy (TVO) and Fortum. The first presentation provided background on the overall regulatory framework for Finland and was presented by STUK's Assistant Director, Mrs. Kirsi Alm-Lytz. Her presentation included information on recent NPP activities in Finland (i.e. Licence renewals and periodic safety reviews) at the existing NPPs; Status of OL3 project; New NPP projects; organisation and resources of STUK's Nuclear Reactor Regulation department; and the development of Finnish nuclear regulations. Mrs. Alm-Lytz also briefly discussed Finland's response to the Fukushima NPP accident.

Next, Mrs. Hanna Kuivalainen made a presentation told about requirements for operational experience feedback and reporting given in the Finnish legislation and in STUK's regulation. According to the requirements, operating experience from nuclear power plants, as well as results of safety research, shall be systematically assessed. For further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology. This is congruent with the principle of continuous safety enhancement, which had been adopted in Finland in the 1970s when nuclear power plant operation was started. Mrs. Kuivalainen described how OEF is currently organised in Finland including the responsibilities and processes of STUK and Licensees as well. She also described the development of oversight guidance and the renewal of STUK's guidance. Finland's OEF process is described in the new guidance and follows IAEA Guide "A System for the Feedback of Experience from Events in Nuclear Installations Safety Guide NS-G-2.11".

The Finnish Licensees made presentations on the OEF processes and the use of internal and external OE at their plants. The most important source of International Operating Experience used by the Finnish utilities is the World Association of Nuclear Operators (WANO), but the Finnish Licensees are increasingly using the IAEA/NEA Incident Reporting System (IRS) as a source of external OE (with the assistance of STUK). Finnish utilities have direct contacts with the utilities who operate similar plants and also with the respective owners' groups. The first presentation by the licensees was by Mrs. Anna Raitanen, an Operating Experience Engineer from the Olkiluoto plant. In her presentation she described the work of TVO's OEF group in dealing with OE related to the operating units (OL1 and 2) and the unit under construction (OL3). For the Olkiluoto plant ERFATOM is the most important activity in OE. TVO also has close co-operation with the Swedish boiling water reactor (BWR) plants and with the Nordic Owners' Group (NOG) and the BWR owners' group.

Two presentations were made by Fortum. First, the Manager of International Programmes, Mr. Jouko Turpeinen from the Loviisa plant made a presentation on OEF and results of safety research that were utilised at Loviisa during the 1970s in the design and construction of the plants. Significant measures to improve the safety of the plants were started on the basis of qualitative judgements soon after the initial start-up of Loviisa 1 in 1977. Since that time, the safety of the Loviisa nuclear power plant has continuously been improved. The Loviisa NPP has direct contacts with the utilities in Russia and in Eastern Europe who operate similar VVER plants and with VVER users and the WANO Moscow Centre. The next Fortum presentation was made by Safety Engineer, Ms. Taija Solja. In her presentation she described the analysis and use of

Fortum's own OE at the Loviisa plant, both low-level and significant events requiring deeper investigation. Both licensees (Fortum and TVO) have specific divisions and systematic procedures and guidance for investigating and assessing events of their own. Root cause analyses (RCA) have been made selectively on events if there are: evidence of procedural deficiencies; Common Cause Failure (CCF) indications; or if the event is recurring; and if they have potential safety significance. Altogether 25 RCAs at Loviisa NPP and 22 at Olkiluoto NPP have been completed in the last 18 years. Ms. Solja stated that they are developing RCA methods at the Loviisa plant to make the process a more user-friendly method for daily use.

A final presentation on STUK's international operating experience feedback process was planned; however, due to time constraints the presentation by Ms. Seija Suksi was not made. The presentation material was made available to the participants at the workshop and is included as part of this report.

***Recent Experience with the Replacement of Spare Parts in Finland***

On the afternoon of the third day of the workshop there were presentations by STUK on the regulatory experience on spare parts management using examples from Finland and by TVO on its recent events and experiences with the replacement of plant components. STUK's presentation was given by Mr. Jukka Kupila and provided an overview of the issues associated with the failure of safety system components due to inadequate qualification of slightly modified replacement parts at Olkiluoto 1 and 2; and on the emergency diesel generator connecting rod bearing failure at Loviisa 1 and 2. The presentation by TVO was given by Mr. Petri Koistinen. During his presentation he discussed insights and experiences related to three events including, the common-cause failure of a main steam line outer isolation valve actuator (IRS 8029) at Olkiluoto 1; the failure of safety system components (specifically, the primary circuit blowdown/overpressure relief valves) due to inadequate qualification of slightly modified replacement parts (IRS 8150) that was discussed in STUK's presentation; and the replacement of start-up and intermediate range monitoring system (SIRM) detectors and their shells which was an internal TVO issue with replacement components. Some of the common features the challenges faced in these events related to communication failures; the competence and cooperation between different technical organisations; oversight of suppliers; and ensuring a safety culture exists within organisations responsible for modifications and the replacement of spare parts.

**10.2 Nuclear Power Plants and Regulatory Oversight in Finland – STUK**

## Presentation outline

- Recent NPP activities in Finland
  - Licence renewals and PSRs at the existing NPPs
  - Status of OL3 project
  - New NPP projects
- Organisation and resources of Nuclear Reactor Regulation
- Development of Finnish nuclear regulations
- Response in Finland to Fukushima NPP accident

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## Nuclear power plants in Finland

**Fennovoima Ltd**

- New utility, no operating reactors, DiP approved for FV1 (2 alternative sites)

**Olkiluoto NPP (TVO)**

- 2 operating units - ABB BWRs
- OL3 (EPR) under construction
- DiP approved for OL4

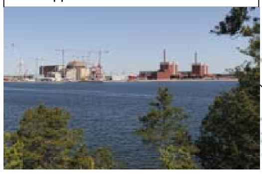

Photo: TVO

**Loviisa NPP (Fortum)**

- 2 operating units - VVERs

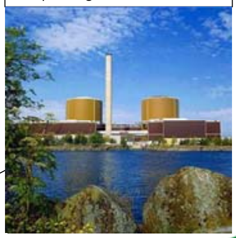

Photo: Fortum

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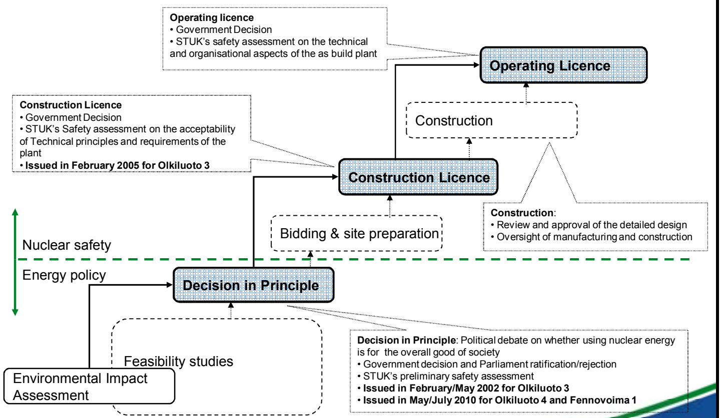
## Licensing steps in Finland

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## Licensing status of the existing Finnish NPPs

NPP operating licence renewals involve a comprehensive safety review taking into account the IAEA PSR guidelines (NS-G-2.10)

| Loviisa NPP Terms of licences | | Olkiluoto NPP Terms of licences | |
|---|---|---|---|
| LO1 | LO 2 | OL1 | OL2 |
| 1977 - 1983 | 1980 - 1983 | 1978 - 1983 | 1982 - 1983 |
| 1984 - 1989 | 1984 - 1988 | 1984 - 1988 | 1984 - 1988 |
| 1989 - 1998 | 1989 - 1998 | 1989 - 1998 | 1989 - 1998 |
| 1999 - 2007 | 1999 - 2007 | 1999 - 2018 | 1999 - 2018 |
| 2007 - 2027 | 2007 - 2030 | PSR in 2008 | PSR in 2008 |
| PSR in 2015 and 2023 | PSR in 2015 and 2023 | | |

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## Relicensing of Loviisa 1 and 2 in 2007

- Loviisa 1 and 2 operating licence renewal
  - new licences valid up to 2027 and 2030, respectively
  - Periodic Safety Reviews in 2015 and 2023
  - The lifetime of both units will be 50 years; e.g. safety and strength analysis were updated to correspond the continued operation
- Key issues in future:
  - maintaining competence and high level of safety culture,
  - effective lifetime management,
  - follow-up of RPV material embrittlement
  - renewal of I&C systems,
  - operating experience feedback, and
  - use of risk-informed methods to further develop the plant safety.

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## Periodic Safety Review of Olkiluoto 1 and 2

- Current operating licences of Olkiluoto 1/2 are valid until end of 2018 (PSR performed in 2008)
- Updated Finnish nuclear safety legislation in end of 2008 - changes:
  - Changes in classification of accidents (including DEC cases) and public dose limits
  - Emergency control room
  - Security requirements updated
- Assessment/modifications based on Nuclear Energy Act 7a § (continuous improvement), e.g.:
  - diversification of safety functions (e.g. Residual Heat removal, RPV level measurement), assessment of the plant diversity as a whole by end of 2010.

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## OL3 Project - General

Photos: TVO

- Project is progressing but is about four years behind the original schedule
  - Start of commercial operation in 2013
  - Fuel load by the end of 2012
  - Operating licence application in 2011.
- Status of the project
  - Design ongoing - open design issues on I&C
  - Final civil construction activities ongoing
  - Manufacturing slowing down but still ongoing
  - Installation activities in progress at site
  - Commissioning activities to start

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## OL3 project - Constant issues

- Competence and training of subcontractors
- Interaction with, guidance and oversight of subcontractors
- Compliance with QA programme
- Adequacy of oversight resources at site (vendor, licensee)
- Safety culture of organisations, personnel.

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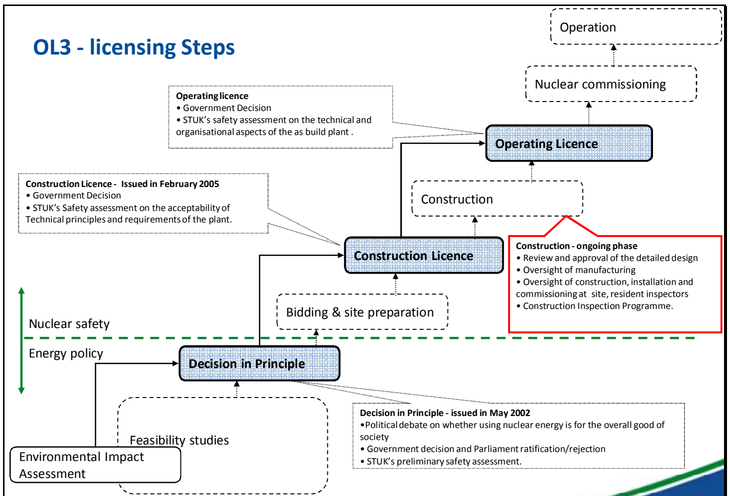
## OL3 - licensing Steps

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## New NPP Projects - Teollisuuden Voima Ltd – OL4

- Environmental Impact Assessment procedure for OL4 (1000-1800 MWe) has been completed by the statement of the Ministry of Employment and the Economy (TEM) in June 2008
- Application for Decision in Principle (DiP) was submitted to the Ministry (TEM) in April 2008
- Feasibility studies with potential vendors ongoing
  - ABWR, Toshiba Westinghouse
  - APWR, Mitsubishi Heavy Industry
  - AP1400, KHNP
  - EPR, Areva
  - ESBWR, GE Hitachi
- STUK's preliminary safety assessment was issued in May 2009

Olkiluoto, photo TVO

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## New NPP Projects - Fennovoima Ltd - FV1

- Fennovoima is a new utility that was established in 2007 to construct a nuclear power plant with one or two 1000–1800 MW units in Finland.
- Feasibility studies with potential vendors are ongoing:
  - ABWR, Toshiba Westinghouse
  - EPR, Areva
  - SWR-1000, Kerena ("German BWR"), Areva
- Environmental Impact Assessment procedure for FV1 (1000-1800 MWe) has been completed by the statement of the Ministry of Employment and the Economy (TEM) in February 2009
- Application for Decision in Principle submitted in January 2009
- STUK's preliminary safety assessment was issued in October 2009

Simo, Karsikko

Pyhäjoki, Hanhikivi

Photo: Fennovoima

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## Future steps in STUK with possible new NPP's

- The Government has granted two DiP's to TVO and Fennovoima (for single reactor). Fortum's application was rejected.
  - The Parliament ratified both granted applications 1.7.2010.
- STUK has continued discussions with licence applicants on construction licence application requirements, some principal design issues under review
  - Geological and seismic conditions
  - Possibility to apply American standards and products in civil engineering
  - Composite construction technology of massive concrete structures for modular construction
- The applicants shall send nuclear safety related bid requirements to STUK for information
  - That is the first step for STUK to prepare regulatory project for construction licence review.

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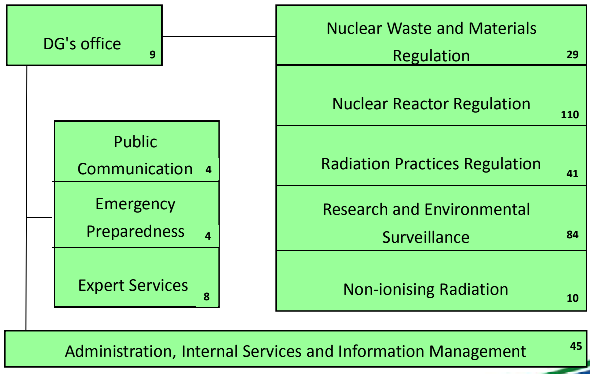
## Organisation of STUK

Figures indicate staff number (344) at the end of 2010.

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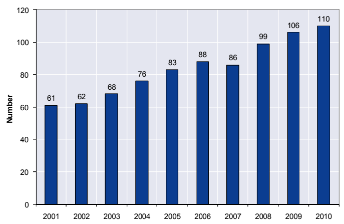
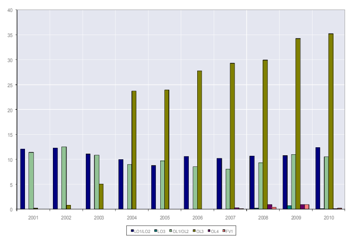
## Resources of Nuclear Reactor Regulation (NRR)

Full time equivalents on oversight (man-years/NPP)



Number of staff is currently ~ 110

2010 statistics:

Reviews: 41 man-years

Inspections (site/manufacturers): 22 man-years
*Resident 29,9 %*
*HQ 70,1 %*

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## Development of Finnish nuclear regulations

- Modification of the Nuclear Energy Act and Decree and the Decisions of the Government
  - fundamental safety requirements were transferred to the Act (2007) in order to reflect the spirit of revised Constitution (2001)
  - Decisions of the Government were replaced with Government Decrees (2008)
  - no major changes in the licensing process
  - a few additional safety requirements (consideration of development of science and technology as well as operating experience).
- Regulatory guide system restructuring
  - improved consistent structure and terminology
  - improved clarity and user-friendliness
  - early licensee involvement in working groups during preparation
  - updated national legislation, IAEA and WENRA guidance considered
  - lessons learned from OL3 construction project taken into account
  - project continues until 2011.

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### Structure of the new YVL guides

| A Safety management of a nuclear facility | B Plant and system design | C Radiation safety of a nuclear facility and environment | D Nuclear materials and waste | E Structures and equipment of a nuclear facility |
|---|---|---|---|---|
| A.1 Regulatory control of the safe use of nuclear energy<br>A.2 Siting of a nuclear facility<br>A.3 Management systems of a nuclear facility<br>A.4 Organisation and personnel of a nuclear facility<br>A.5 Construction of a NPP<br>A.6 Operation and accident management of a NPP<br>A.7 Risk management of a NPP<br>A.8 Ageing management of a nuclear facility<br>A.9 Reporting on the operation of a nuclear facility<br>A.10 Operating experience feedback of a nuclear facility<br>A.11 Security arrangements of a nuclear facility | B.1 Design of the safety systems of a nuclear facility<br>B.2 Classification of systems, structures and equipment of a nuclear facility<br>B.3 Safety assessment a NPP<br>B.4 Nuclear fuel and reactor<br>B.5 Reactor coolant circuit of a NPP<br>B.6 Containment of a NPP<br>B.7 Preparing for the internal and external threats to a nuclear facility<br>B.8 Fire protection of a nuclear facility | C.1 Structural radiation safety and radiation monitoring of a nuclear facility<br>C.2 Radiation protection and dose control of the personnel of a nuclear facility<br>C.3 Control and measuring of radioactive releases to the environmental of a nuclear facility<br>C.4 Radiological control of the environment of a nuclear facility<br>C.5 Emergency preparedness arrangements of a NPP | D.1 Regulatory control of nuclear non-proliferation<br>D.2 Transport of nuclear materials and waste<br>D.3 Handling and storage of nuclear fuel<br>D.4 Handling of low- and intermediate-level waste and decommissioning of a nuclear facility<br>D.5 Final disposal of nuclear waste<br>D.6 Uranium and thorium production | E.1 Manufacture and use of nuclear fuel<br>E.2 Construction plan of the mechanical components and structures of a nuclear facility<br>E.3 Manufacture, installing and commissioning of the mechanical components and structures of a nuclear facility<br>E.4 Verification of strength of pressure equipment of a nuclear facility<br>E.5 In-service inspections of the mechanical components and structures of a nuclear facility<br>E.6 Buildings and structures of a nuclear facility<br>E.7 Electrical and I&C equipment of a nuclear facility |

Collected definitions of YVL-guides: a part of the regulations, but a separate document.

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## Fukushima NPP accident – Response in Finland

- STUK followed event progress 24/7 for the first two weeks, and continues to monitor
  - Status of plant units, possible accident progress scenarios
  - Radiation measurements and release estimates
- Information to media and Finnish citizens
  - Press releases
  - Media requests
  - Questions and Answers
- Co-operation with
  - Foreign Ministry (travel recommendations, evacuation, iodine)
  - Customs (measurement of travellers, gargo)
  - Finnish industry (recommendations to workers, import/export from Japan)
  - Airline company (safety of workers, contamination of airplanes)
  - others

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## Measures taken in Finland in the aftermath of Fukushima NPP accident

- Request from the Ministry to STUK to evaluate safety of Finnish NPPs (operating, under construction and planned) by mid May 2011
- STUK asked utilities in Finland to assess safety of their NPPs by mid April 2011 – Areas to be covered in the assessment
  - Re-evaluation of external threats - emphasis in threats to AC power supply, coincident events / threats, damage to external infrastructure (roads, information transfer).
  - On-site AC power supply and contingency measures
  - Available heat sinks: designed systems and contingencies
  - Decay heat removal possibilities - reactor core, spent fuel pools, containment
  - Availability of qualified people to handle accident in long-term.
- STUK's preliminary statement 15.5.2011:
  - Immediate actions not necessary
  - More detailed evaluation will be done by end of June; some safety improvements will be requested to be further studied
- STUK sent also a letter to the utilities concerning the European Stress Test on 1.6.2011

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# Thank you!

**www.stuk.fi**

**e.g. regulatory guides, assessment reports**

**Regulatory guide renewal:**
**https://ohjeisto.stuk.fi/YVL/?en=on**

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## 10.3 Developing Operational Experience Procedures – STUK

**Developing Operational Experience Procedures**

Hanna Kuivalainen
15th of June, 2011

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**Regulatory requirements for Operational Events and for Operational Experience Feedback**

- General requirements for operational experience feedback and reporting are given in the Finnish legislation i.e. in Government Decree (733/2008) on nuclear safety, physical protection and emergency preparedness.
- According to Section 8 55 § of the Nuclear Energy Act (990/1987, amendment 342/2008), the Radiation and Nuclear Safety Authority (STUK) shall specify detailed safety requirements concerning the implementation of safety level in accordance with this Act
- STUK issues detailed regulations (YVL Guides) that apply to the safe use of nuclear energy and physical protection as well as emergency preparedness and safeguards.
- YVL Guides are available on STUK's website:
  http://www.stuk.fi/julkaisut_maaraykset/viranomaisohjeet/en_GB/yvl/
  http://www.stuk.fi/julkaisut_maaraykset/viranomaisohjeet/sv_FI/yvl/

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## Operational Experience Procedures in Finland

- Operating experience shall be systematically followed and assessed according to requirements
- Actions shall be taken considering operating experience, results of safety research and the advancement of science and technology.
- In Finland, the regulations provide adequate guidance for implementing systematic OEF, and the organizations have established necessary structures for it.
- Each licensee has established its own OEF process, being thus in compliance with the regulatory requirements.

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## STUK's OEF processes

- STUK reviews the function and results of each OEF process through its supervision processes of nuclear safety and as part of its periodical inspection programmes for operating NPP's as well as for a unit under construction.
- STUK evaluates the safety significance of operational events and the needs for technical improvements and changes concerning the operation or plant.
- STUK assigns its own investigation team to look into operational events deemed to be of special importance.
- STUK evaluates the need for communication and informing operational events outside of STUK.
- STUK has also its own independent OEF processes for screening, review and assessment of operating experience information reported by Finnish NPPs or received through international channels.

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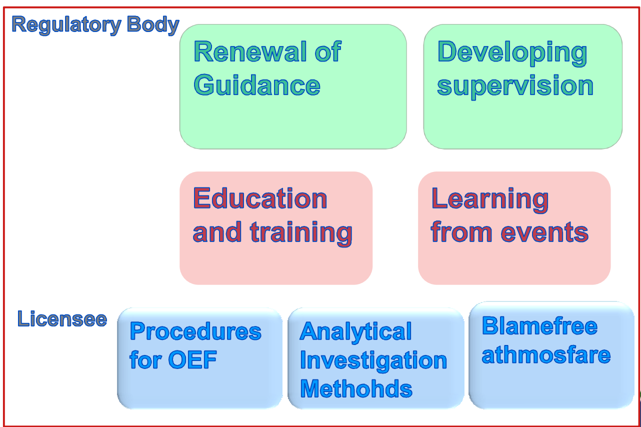
## Developing OE practices in Finland

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## Developing Supervision

- A review and investigation of operational event at nuclear facilities is a part of the regulatory oversight of operational safety
- STUK monitor the operation of NPPs and operational events by resident inspectors and by licensees' daily and event reports
- The preliminary investigation of operational events right after incidents are performed in order to inform other STUK's inspectors and public if necessary
- It is licensee's responsibility to ensure proper investigation
- Based on the characteristics of the event the report will be inspected by STUK's experts with required competence
- The proper investigation of reports needs quite a lot resources
- STUK has a good access to plant information and operational event data
- STUK is still developing own event database for more practical direction

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## Renewal of Guidance

- The previous Guide has been publised in1994. In the new version it has been taking account the recommendations by IAEA and research work.
- OEF prosess follows IAEA Guide: A System for the Feedback of Experience from Events in Nuclear Installations Safety Guide NS-G-2.11.
- The Guide sets forth the criteria and requirements for nuclear power plant the feedback of operational experience, covering: screening of events, investigation and analysis, corrective actions, trending and review, utilization and dissemination of information, reviewing of effectiveness
- The guide includes both external and internal operational experience.

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## Renewal of Guidance

- The licensee shall establish and conduct a programme to collect, screen, analyse, and document operating experience and events in a systematic way
- The licensee shall designate staff for carrying out these programmes
- The new guidance point out the importance of highly experienced OEF group and wide need of organization expertise, also knowledge of matters concerning human performance and behavior
- The level of the investigation carried out should be commensurate with the consequences of an event and the frequency of recurring events

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## The levels of the Evaluation or Investigation

- High priority: requires immediate attention. Safety or plant reliability are affected. Require root cause investigation to be completed by a team.
- Moderate priority of lower significance than above, but needs resolution in short time. Often requires apparent cause evaluation (less stringent than root cause analysis);
- Routine priority: a condition that has minimal effect on the safe and reliable operation of the plant or personnel. The condition is sufficiently minor that apparent or root cause analysis is not required;
- Low priority - No further action required, saved for trend evaluation.
- However the events witch have learning opportunity to offer should be investigated more deeply

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## Reporting to the regulatory body

- The Guide presents what notifications and reports of the events of nuclear facilities are required and how they shall be delivered to STUK.
- Reporting base on the list of different kind of events
- Corrective actions should be tracked and prioritized.

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## Types of Event Report and Content

- The early notification report by telephone
- The preliminary report
  - Electronically or facsimile
  - Short description
  - The level of safety of the plant
  - The need to correct factual errors
  - Estimation of the safety significance of events
  - INES -rating
- A main report
  - Basic information;
  - Narrative description;
  - Safety assessment (consequences and implications);
  - Causes and corrective actions (taken and/or planned);
  - Lessons learned;
  - Graphic information for a better understanding of the event (if necessary);
- Follow up report

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## Competence, Education and Training

- The lead event investigator should be competent in investigation skills as well as having techincal competence
- More education of inspections methods should be provided in Finland
- Training (both initial and refresher) should be provided for the staff who take part in an investigation
- The number of investigators and their areas of expertixe should be based on the type of plant and characterstics of the event

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## Organizational learning from events

- The line organisation should successfully mobilised to contribute to the event investigation
- Learning from events is the key question of event investigation
- Everybody should understand hazards related to the activities, one's work connect to plant safety and the systemic nature of safety
- Best way to learn is ones own contribution to evaluation and investigation of events
- The independency of investigation group could be challenging to remain

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## Licensees' procedures for OEF

- Finnish licensees have systematic procedures and guidance for management of any kind of observations and events of their own plants and abroad.
- OEF group of the plant has an important role in the process
- Licensees' procedures for OEF cover:
  - collecting, evaluating and classification of deviations and observations
  - screening of events on the bases of safety significance
  - reporting of events at plants
  - investigation of events of their own
  - in-depth analyses of safety significant events
  - defining and approval of recommended corrective actions
  - implementation and follow-up of corrective actions
  - dissemination and exchange of information
  - storage, retrieval and documentation systems for deviations and events

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## Analytical Inspection Methods

- Investigation of events base on the graded approach. High priority event shall be analyzed by analytical techniques. STUK does not require a specific type of method, but requires that the method:
  - Provide useful frameworks for demonstrating and documenting the cause- consequence relationship
  - To organize the information on events once the evidence has been collected;
  - To help in describing the causation of events and developing hypotheses for future examination by experts;
  - To help with the assessment of proposed corrective actions.



## Analytical Inspection Methods for Events

- Operational practices of event investigation should be improved
- The framework or method helps isolate the prevalent individual or organizational factors that contributed to the event.
- The method supports the fair and consistent application of performance coaching, or discipline if appropriate, across all departments and work groups.
- Systematic framework speed up the investigation and support handling organizational and human factors



## Blamefree athmosphere

- Managers of NPPs should continually reinforce expectations for open communication, encouraging staff to look for ways to learn from low level events and near missings reporting. Staff must also recognize that the process includes an element of personal responsibility and accountability.
- The objective of an event investigation is not to apportion blame or to determine fault
- Studies show that almost all industrial events are rooted in latent organizational weaknesses rather than human error.
- A blamefree investigation atmosphere contributes to the quality of inspection results
- People do not intend to make errors, and most people want a “Blame Free” or “Just” environment that treats people fairly, honestly, and with respect.

**References**

**A System for the Feedback of Experience from Events in Nuclear Installations**
Safety Guide IAEA Safety Standards Series No. NS-G-2.11,
Vienna, 2006

**Improving the International System for Operating Experience Feedback**
INSAG-23 A Report By The International Nuclear Safety Group
Vienna, 2006

**WENRA Reactor Safety**
Reference Levels
J: System for Investigation of Events and Operational Experience Feedback
January 2007

**Ydinvoima-alan organisatioiden käyttökokemustoiminta organisaation oppimisen näkökulmasta**
Tutkimusraportti VTT-R-01303-10
Espoo, 2010

**Best practices in the development, implementation and operation of a Low Level Events and Near Misses Process at Nuclear Power Plants**
Safety Reports Series XX Draft 30.7.2010,
IAEA, Vienna

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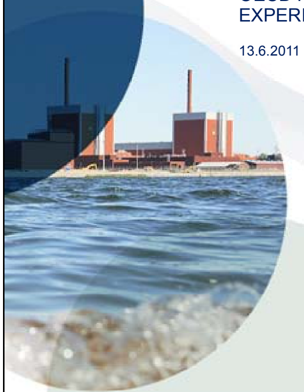
## 10.4 TVO Operating Experience Group – TVO

TVO



**OPERATING EXPERIENCE**
OECD NEA INTERNATIONAL OPERATING EXPERIENCE FEEDBACK WORKSHOP

13.6.2011

Raitanen Anna
Operating Experience Engineer



**OPERATING EXPERIENCE**

**Operating Experience Group (KÄKRY)**
**ERFATOM Operating Experience Group for Nordic Plants**
**Operating Experience for Maintenance**
**International databases**
**Other communication**
**Internal Reporting**

TVO  2

## KÄKRY- OPERATING EXPERIENCE GROUP

**Members**

- Chair: Head of Operation Supervision
- Secretary: Operating Experience Engineer
- Members from Nuclear Safety, Operation Supervision, Operation, Maintenance, Quality, Human Performance Specialist, Engineering

**Supervised by Safety Group**

**Operating Experience**

- Handling and evaluation for relevance
- Follow up

**Information for component, equipment and system responsibles**

**Operating Experience database OPEX**

- Input and classification

**Broader Operating Experience Group KÄKRY**

**Co-operation with Loviisa NPPs**

TVO



3

## KÄKRY – OPERATING EXPERIENCE GROUP

**Input**

- External events every two weeks
  - ERFATOM 14 days report, mostly Swedish events
  - WANO, IRS, NRC
- Separate meetings for own events
  - Reported events
  - Important Technical Specification limitations from OPEX

**Output**

- Send for information
- Request for comments
- Recommendations
- Training

**Follow up of actions**

- OPEX
- KELPO – Corrective actions database

TVO



4

## OPEX – OPERATING EXPERIENCE DATABASE

**Events handled by KÄKRY**
**Smaller internal events handled by Operation Supervision**
**Content**

- Data recording
- Classification
- Follow up of actions

**Everybody can read events in the database**

TVO



5

## KELPO- CORRECTIVE ACTIONS DATABASE

**Operating Experience group uses to follow corrective actions**
**CAP uses to follow actions and safety observations**
**Content**

- Corrective actions
- Responsibles
- Deadlines
- Handling
- Closing

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## BROADER OPERATING EXPERIENCE GROUP

**Chair: Senior Vice President, Operation**
**Handles signifigant operating experience reports**

- WANO Signifigant Operating Experience Reports (SOER)
- WANO Signifigant Event reports (SER)

**Twice a year or when needed**

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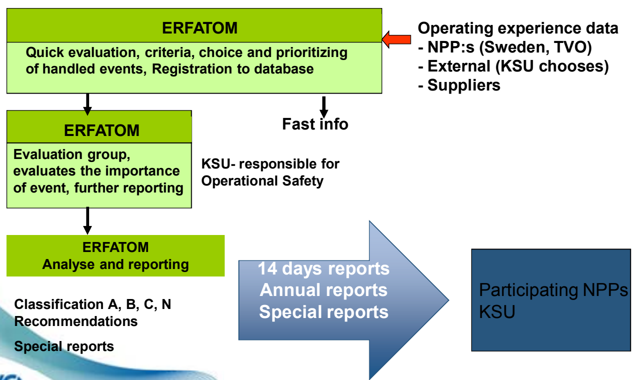
## ERFATOM- OPERATING EXPERIENCE GROUP

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## OPERATING EXPERIENCE IN MAINTENANCE

**Annual equipment responsible reports**

- Fault reports
- Preventive maintenance programs
- Periodic testing
- Ageing

**System responsible analysis**

**TUD-database**

- PSA reliability data
- Fault statistics

TVO



9

## OECD/NEA DATABASES

**Separate responsibles**

**Interesting events presented for KÄKRY and handled as other events**

TVO



10

## OTHER MEETINGS WITH SWEDISH PLANTS

**NOG (Nordic owner's group)**

**BWR owner's group**

**Meetings with Swedish plants**

- 200-möte
- Reaktor-möte
- Turbin-möte
- Kemi-möte

Direct contacts with plants and suppliers

TVO



11

## INTERNAL REPORTING

**Event reports**

- Description
- Causes
- Corrective and preventive actions
- Safety analysis (optional)
- Significant event reports sent to authority for information

**Special reports**

- As event reports but analyzed more deeper and sent to authority for approval within a month

**Root cause analysis**

- If deeper investigation is needed

TVO



12

## INTERNAL REPORTING

**Safety observations**

- Minor events
- Near misses
- Industrial safety
- Followed in KELPO
- Followed by CAP to observe trends and to evaluate need for further analysis

TVO



13

## INTERNAL REPORTING

**Reporting WANO**

- Special reports
- Scram reports
- Event reports with important lessons learned

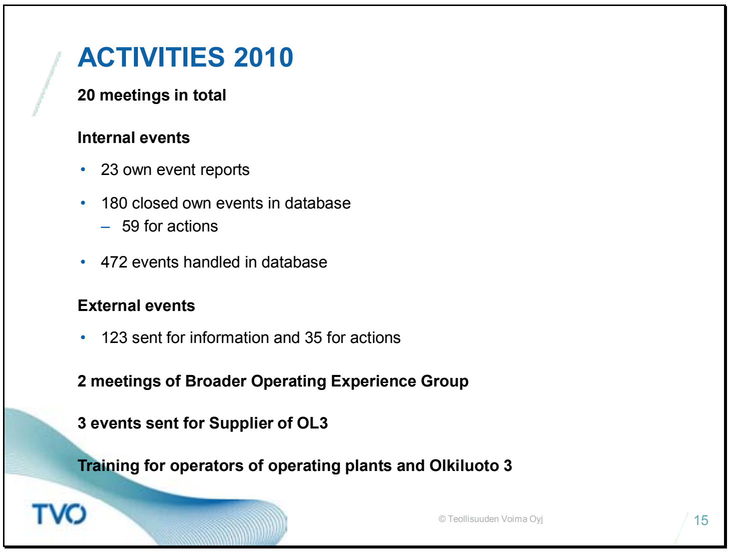
**Reporting ERFATOM**

- All event reports
- Fast info

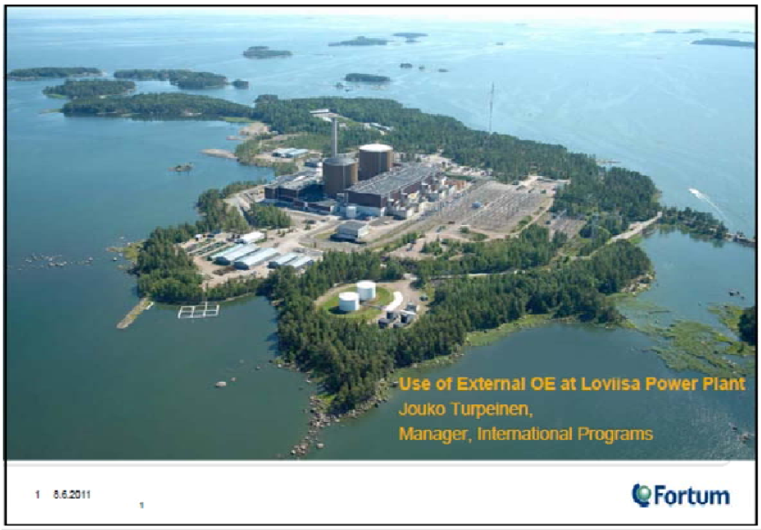
TVO

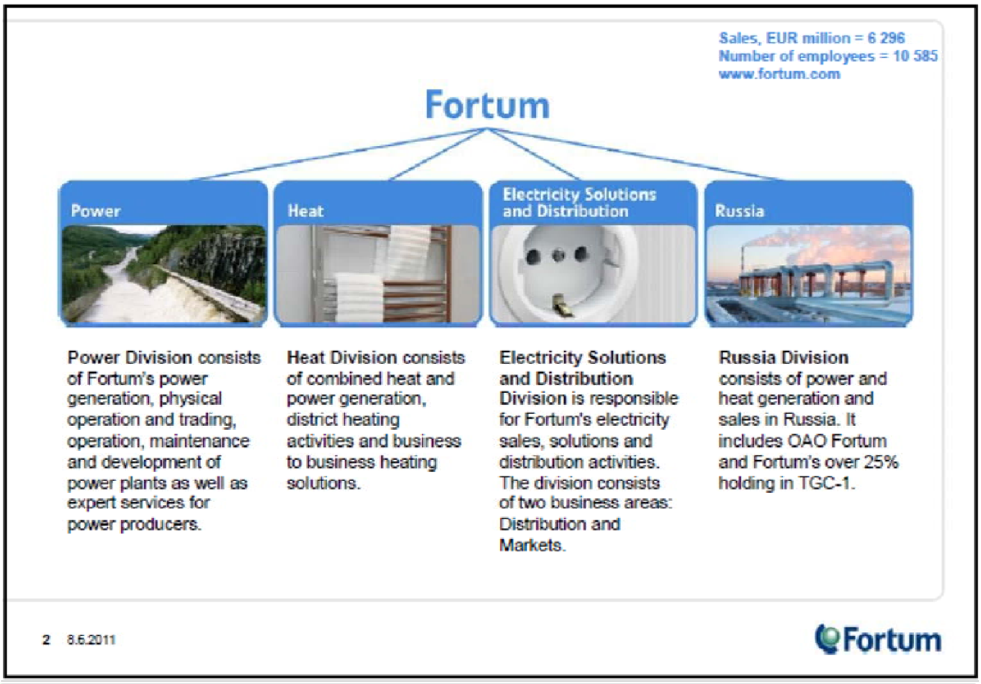


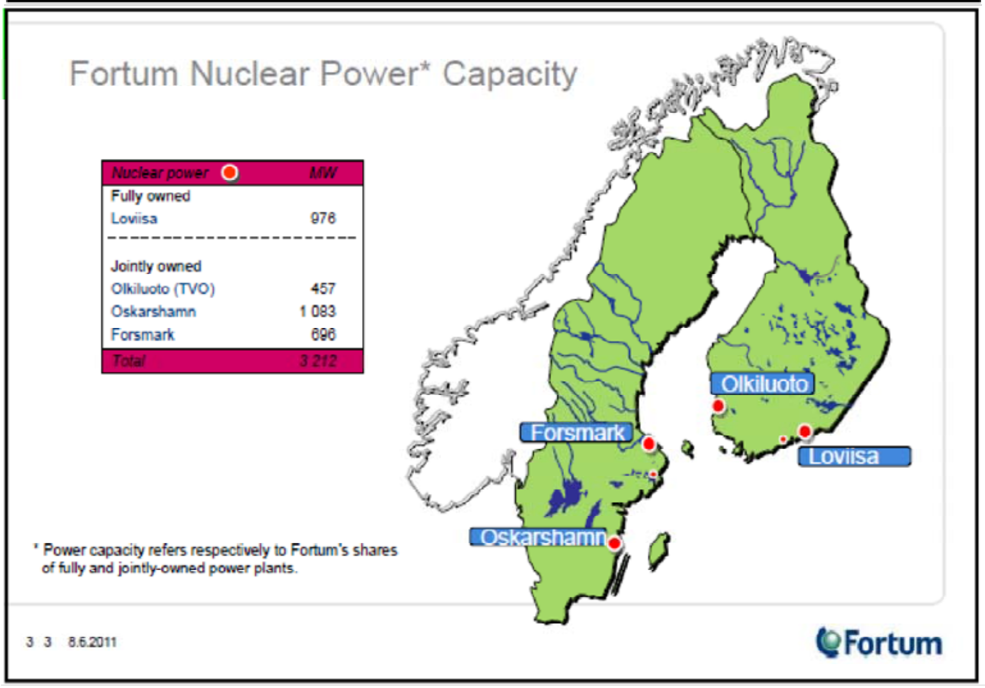
14




## 10.5 Use of External OE at Loviisa Power Plant – Fortum






| Nuclear power | MW |
|---|---|
| Fully owned | |
| Loviisa | 976 |
| Jointly owned | |
| Olkiluoto (TVO) | 457 |
| Oskarshamn | 1 083 |
| Forsmark | 696 |
| Total | 3 212 |

## Loviisa Power Plant

- Fortum Power and Heat Oy (former IVO)
- Lo1 / 1977 & Lo2 / 1980
- Reactor + 2 turbines / unit
- PWR/VVER-440
- Thermal output 1500 MW
- Electrical output, gross/net 510/488 MW
- Annual generation 8 TWh (9 %)
- Cooling water flow (2 x 25 m³/s, dt 10 °C)
- Transmission lines (400 kV, 110 kV)
- Main components: USSR / AEE
- Project: 1/3 Russian+1/3 domestic+1/3 western
- Western automation & safety features
- Personnel: 500

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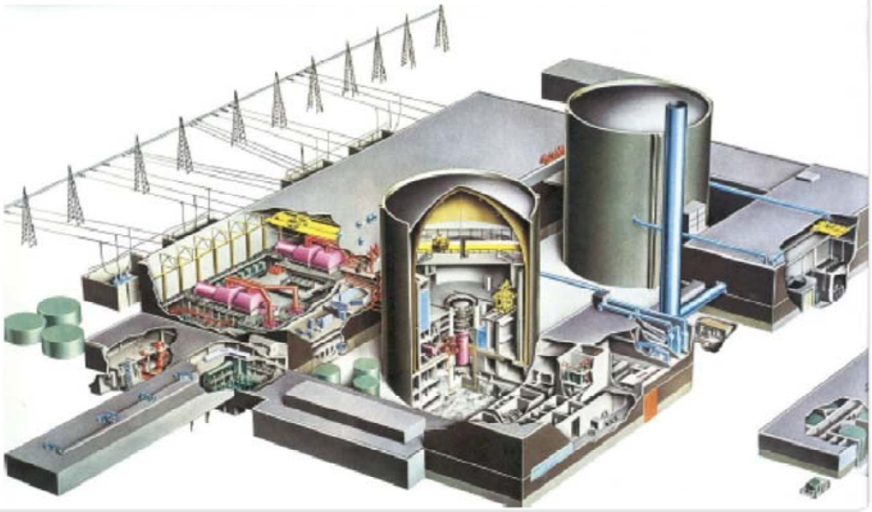
## Loviisa 1 and 2



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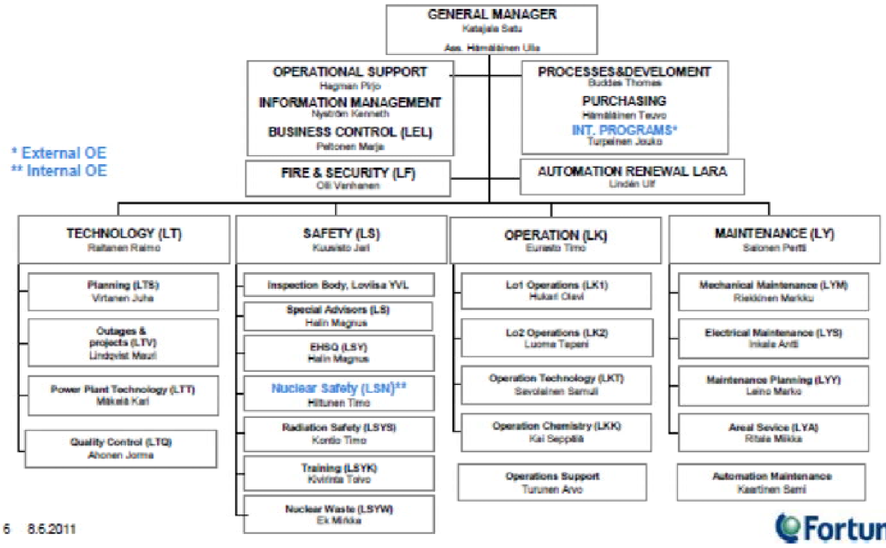
## Loviisa Power Plant Organisation




6 8.6.2011

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## National OE Guideline - YVL 1.11

• Sets forth the criteria and requirements for nuclear power plant operational experience feedback (in-house and industry OE).

• Operational event reports from other nuclear facilities received from various sources shall be systematically monitored and assessed (= part of advanced safety culture). Such reports include i.a. IRS reports by the IAEA and NEA.

• The plant personnel shall be given sufficient information about operating events, their causes and the actions necessary to avoid recurrence. The results of analyses are to be utilised in personnel training.

• Licensee => proper resources (experience, authority, modern information techniques), written updated procedures, documentation, reporting, assessment

• Annual control by STUK- inspections

• New guideline A10?

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External (Industry) OE Activitites
at Loviisa Power Plant
• Participation in IAEA-, WANO-, OECD- Programmes:
– NEA/IRS- & WANO- OE Programme (OE- Review Team = KKR)
– OSART Missions and WANO Peer Reviews
– WANO Technical Support & Exchange Programme
– WANO & IAEA: Workshops, Seminars etc.
– OECD: CNRA / WGOE- membership
• Direct co-operation between NPPs:
– Technical inquiries & emails (WANOMC, NUMEX)
– Plant visits, annual seminars etc. (PAKS, Kola, Tianwan…)
• Annual Self Assessment
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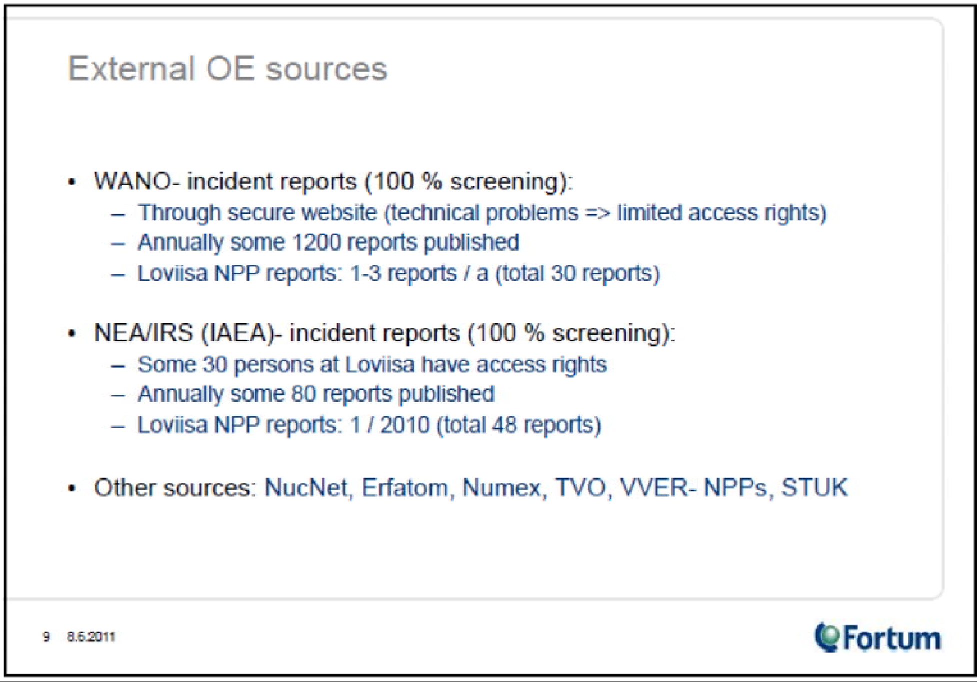
External OE sources
• WANO- incident reports (100 % screening):
– Through secure website (technical problems => limited access rights)
– Annually some 1200 reports published
– Loviisa NPP reports: 1-3 reports / a (total 30 reports)
• NEA/IRS (IAEA)- incident reports (100 % screening):
– Some 30 persons at Loviisa have access rights
– Annually some 80 reports published
– Loviisa NPP reports: 1 / 2010 (total 48 reports)
• Other sources: NucNet, Erfatom, Numex, TVO, VVER- NPPs, STUK
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## WANO Background, Mission & Organization

- Established 1989 (Chernobyl!)
  - *To maximise the safety and reliability of the operation of nuclear power plants worldwide by working together to assess, benchmark and improve performance through mutual support, exchange of information and emulation of best practices.*
- WANO 2010:
  - 97 members = 441 operating / 5 shutdown / 66 under construction reactors = 520
  - Nuclear Industry's own organization => **Confidentiality!**
- Regional Centres + London Office
  - AC Atlanta = 131 reactors
  - MC Moscow = 87 reactors (e.g. Fortum P&H)
  - PC Paris = 175 reactors (e.g. TVO)
  - TC Tokyo = 127 reactors
- Secure WANO Web Site + Public Web Site: www.wano.info

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## WANO Programs

1. Operating Experience Programme
   - External OE- review team (KKR)
2. Peer Review Programme
   - Loviisa Peer Reviews
3. Technical Support and Exchange Programme
   - Technical support Missions
   - Performance indicators
   - Guidelines
   - Twinnings
4. Professional and Technical Development Programme
   - Workshops, tecnical meetings etc.

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## WANO Programmes
## 1. Operating Experience

- Members post their event reports on the secure web site (confidentiality):
  - Database includes more than xxxx reports since 1988
  - 1161 reports in 2010 = 117 Event Analysis (EAR) + 1044 Misc. Event (MER) reports
  - WANO goal: 2 reports/reactor/year (Loviisa total = 31 reports)
- WANO does also in-depth and trend analysis of significant events resulting in Significant Operating Experience (SOER) and Significat Event Reports (SER):
  - These reports include recommendations for members to implement
  - 14 SOER- and 33 SER- reports published so far (available in Loviisa intranet)
- Selected incident reports are reviewed for possible corrective actions by Fortum OE- review team "Käyttötapahtumien Käsittelyryhmä KKR":
  - All WANO SOER/SER- reports reviewed
  - Other reports (WANO, IRS, TVO etc.) / safety significance, VVER- linkage etc.)
- Selected reports: published in Intranet, sent to experts & PRA, possible training
- Just-In-Time (JIT) check-lists for more than 200 different jobs
  - To be used e.g. in risk assessments and pre-job briefings (available in Intranet)

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## WANO OE- Programme /
## KKR- External OE Review Team

- KKR- lineup:
  - Fortum Power TS (3 persons): KKR- Chair, KKR- Secretary, PRA
  - Loviisa NPP (8 persons): Maintenance, QA, Nuclear Safety/OE, OE/Training, Maintenance, Electrical ES, Planning, Radiation Protection
- 5-6 Meetings annually: 49 reviewed event reports in 2010 (= some 5 %)
- Recommendations for corrective actions => Loviisa QAS- meeting:
  - Update of procedures and training / Rigging & Lifting - 2009
  - Operability checking of the fire dampers - 2009
  - Installation of "Vortex"- plates to ECCS water storage tank - 2009
- Follow-up of corrective actions status (SELMA)
- Annual reporting to:
  - National regulatory body, STUK
  - Fortum Power & Loviisa power plant top management

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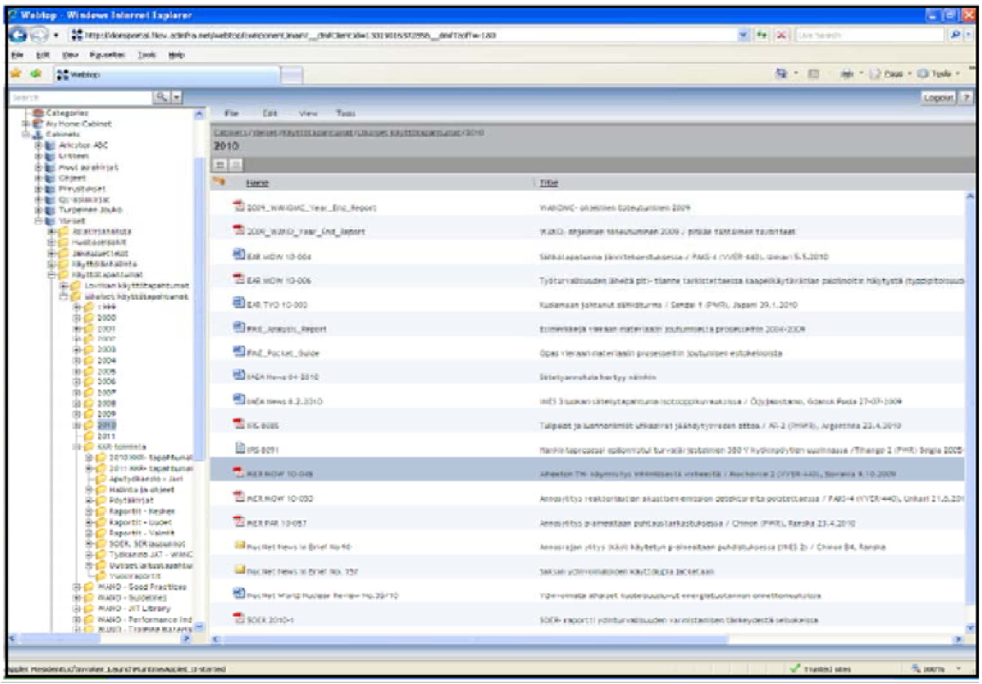

## WANO Programmes
## 2. Peer Reviews (vs. IAEA OSARTs)

- Team of international nuclear experts (peers) review the power plant operations through:
  - Observation of work activities, interviews, review of documentation etc.
  - Best international practices are used as review criteria
- Review Areas: Organization/Administration, Operations, Maintenance, Engineering Support, Radiation Protection, Operating Experience, Training, Chemistry, Fire protection, (Emergency Preparedness)
- Team notes and lists possible good practices (Strengths) for others to learn and Areas for Improvement (= AFI) for corrective actions
- Final report (confidential) => Power plant response => Peer Review Follow-Up + report
- WANO Goal = Peer Review / 6 years (+ "balance" with IAEA OSART- reviews)
  - History 1992-2010: 457 PRs (2010/36)
  - 2010: All plants have been reviewed at least once and 70 % ≥ twice
  - Loviisa PR- history: PR 2001/Fup 2004, PR 2010/Fup 2012 (vs. OSART 2007 / Fup 2008)
- Fortum experts as peers 2010-11: S-Ukraina/RP & Kalinin/OE 2010, Paluel/MA & Forsmark/TQ 2011 +?

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## WANO Programmes
## 3. Technical Support & Exchange

- **Technical Support Missions**
  - Requested by the member utility
  - Team of experts try to identify solutions to known problems e.g. found during Peer Review
  - 2010: WANO organized 193 TSMs
  - Loviisa TSMs: Clogging of the Sump Strainers 2009, Task Observation 2009, Stream analysis & RCA for Peer Review AFIs 2010
- **Performance Indicators (PI)**
  - Regular reporting (quarterly) of the power plant data for the calculation of PIs
  - 11 different indicators (e.g. capability factor, radiation doses, safety system unavailability, fuel reliability, industrial safety accident rate) since 1990...
  - Used for monitoring and trending of plant performance (vs. rest of the industry)
- **Guidelines and Good Practices:** Available in Doris
- **Operator Exchanges ("Twinnings")**
  - Direct co-operation between power plants through operator exchanges, peer visits etc.
  - Similar to Loviisa–PAKS co-operation

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## WANO Performance Indicators (PI)

- For use by nuclear operating organisations to monitor:
  - performance and progress
  - set challenging goals for improvement
- Not to use:
  - for ranking plants
  - to encourage personnel to take nonconservative actions
- *WANO Performance Indicator information is confidential when plant names are associated !*

- Unit Capability Factor (see next slides)
- Unplanned Capability Loss Factor
- Forced Loss Rate
- Grid-Related Loss Factor (2006...)
- Unplanned Automatic Scrams per 7000 Hours Critical
- Safety System Performance (HPSI, AFW, AC)
- Fuel Reliability
- Chemistry Index
- Collective Radiation Exposure
- Industrial Safety Accident Rate
- Contractor Industrial Safety Accident Rate (2006...)

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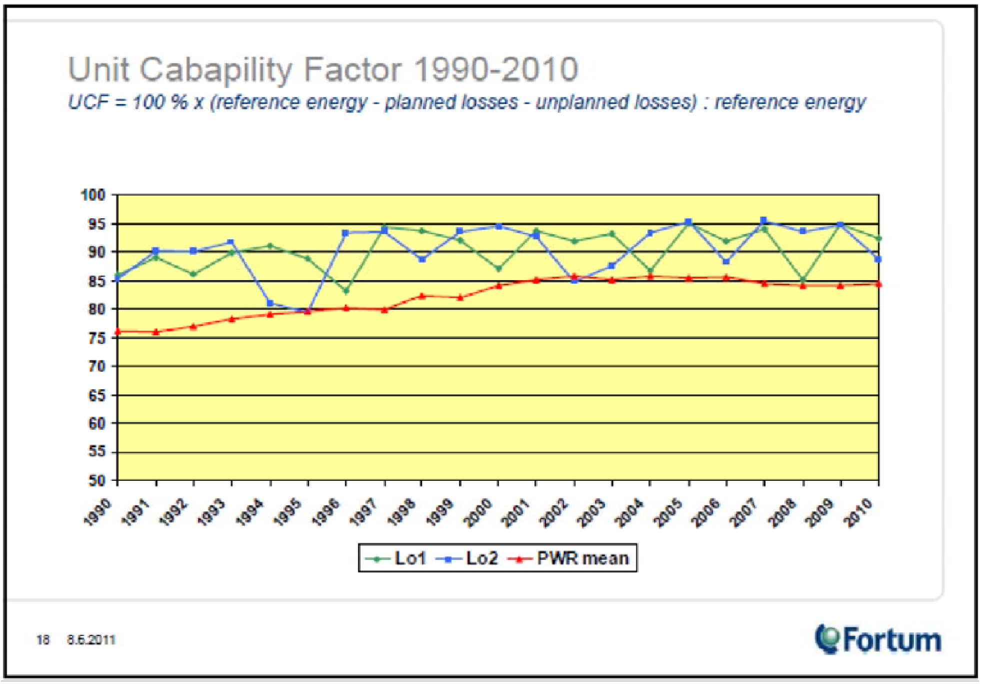
Unit Cabapility Factor 1990-2010
UCF = 100 % x (reference energy - planned losses - unplanned losses) : reference energy
100
95
90
85
80
75
70
65
60
55
50
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Lo1
Lo2
PWR mean
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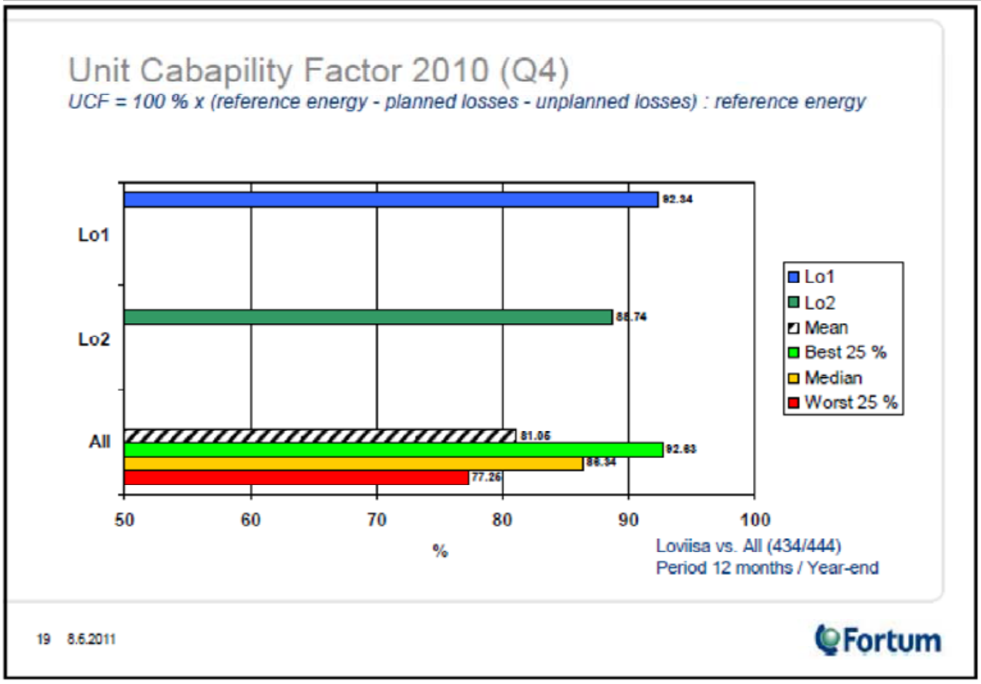
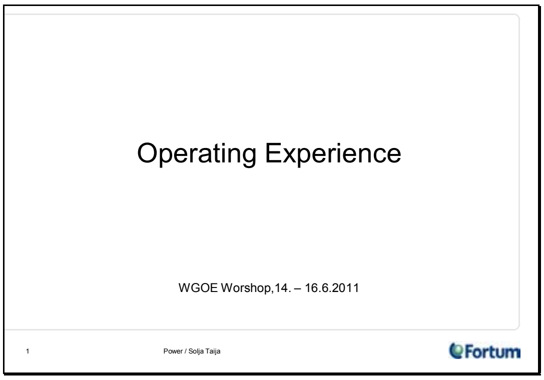
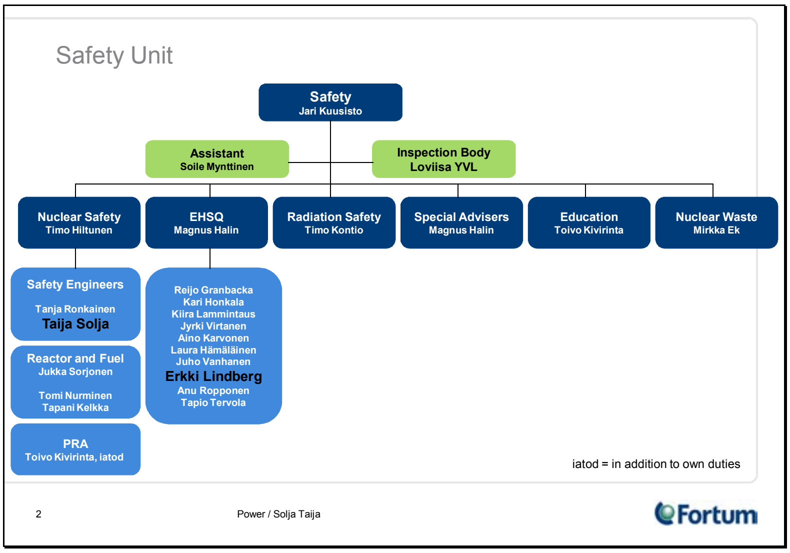

Unit Cabapility Factor 2010 (Q4)
UCF = 100 % x (reference energy - planned losses - unplanned losses) : reference energy
Lo1
Lo2
All
92.34
81.06
92.63
77.26
50
60
70
80
90
100
%
Lo1
Lo2
Mean
Best 25 %
Median
Worst 25 %
Loviisa vs. All (434/444)
Period 12 months / Year-end
19 8.6.2011
Fortum


## 10.6 Operating Experience – Fortum



## STUK's YVL Guide 1.11

- It is stated in, YVL Guide 1.11 *Nuclear power plant operating experience feedback*, according to the section 27 of the decision 395/91 of the Council of State

"*Operating experience from nuclear power plants as well as results of safety research shall be systematically followed and assessed. For further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the advancement of science and technology*".

3 Power / Solja Taija Fortum

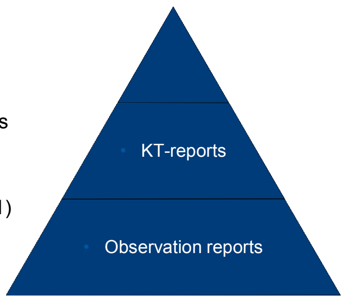
## GUIDELINES

- MO-06-00006 "The criteria for reporting the events to the authority"
- MO-12-00001 "Processing and utilization of operating events"
- MO-12-00002 "Root Cauce Analysis"
- MO-12-00003 "Human Errors"

4 Power / Solja Taija Fortum

## Statistical data

- 2005 - 2010 / 39 - 74 KT-reports
  - 2009 64 reports
  - 2010 61 reports
  - 2011 18 reports (9.6.2011)
- 2005 -2008 / 161...403 observations
  - 2009 317 observations
  - 2010 431 observations
  - 2011 95 observations (1.6.2011)




5 Power / Solja Taija Fortum

## Observation report, overview

- Process was developed in 2001
- It helps the personnel to report any kind of observation, defects and near-misses.
- Everyone can file a report
- As easy as possible to file a report:
  - paper sheet
  - electronic sheet
- No restrictions about the subject, some topics on the sheet to choose:
  - Industrial safety near-by event
  - Fire hazard
  - Operational event
  - Environmental issue
  - Loose parts and impurities
  - Other


Fortum Poikkeamailmoitus



## Observation report, handling

- Reports to coordinator
- Coordinator
  - Keeps records published in intranet
  - Distributes report to safety department, industrial safety department, fire department and environment department
  - Corrects small deviations with responsible persons
- Significant deviations are handled by above mentioned departments; can lead for example internal OE analyzing
- All reports tried to handle as quick as possible, feedback to reporter under 10 days
- Recurrence is always checked



## Low Level Events (=KT-reports)

- Low-level events have been processed from the beginning of the plant operation
- A systematic approach (KT-reports) was first started during outages 1993 and 1994
- During 1995 a method for processing events during both power operation as well as in outages was developed. This method is still in use, though it has been developed further along the years
- The safety engineer responsible of the OE practically coordinates the investigation of events and after getting the information mainly personally writes the internal KT-report

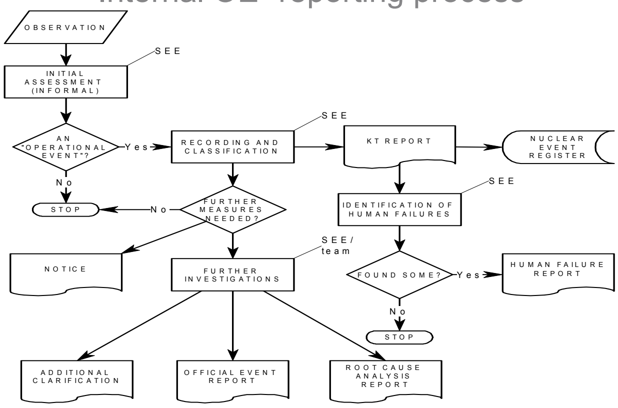
## KT-reports

The most important features of the method

- use the best expertise of the event
  - so called contact persons, who have either somehow participated in the event or otherwise know it thoroughly
- transparency of reporting
  - both the drafts and the final versions of the reports are published in the intranet and summaries of the final reports as well as information about new reports are presented in weekly plant news
- Lightness of reporting
  - max. 2 pages and light inspection and approval process
- No defined analyzing tool



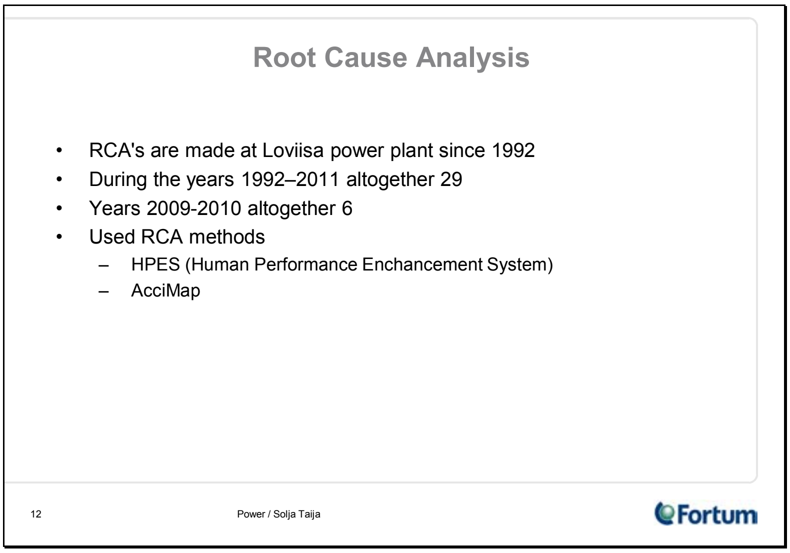
## Internal OE- reporting process

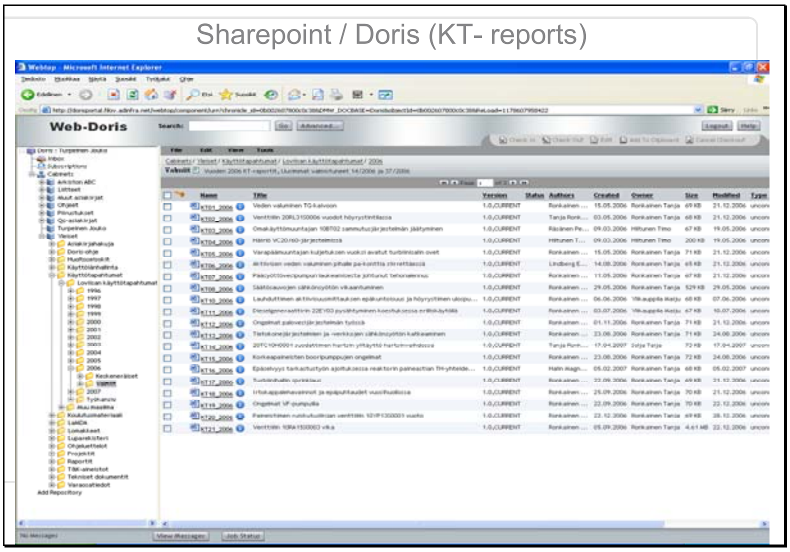





## Use of Internal OE

- Feedback for general & simulator training
- Feedback for PRA- studies (Human Failure Data)
- Annual summary to plant management
- Published in "Loviisa Intranet" (Doris)




## 10.7 International Operating Experience Feedback Process – STUK

## International Operating Experience provides insights for enhancing nuclear safety

- The principle of continuous safety enhancement was adopted in Finland already in the 1970's when the nuclear power plant operation was started.
- As part of its regulatory oversight and enforcement policy, STUK requires that the licensees utilize the reported foreign operating experience for
  - improving staff competences and management of operations,
  - modernizing and back-fitting of operating plants, and
  - addressing the lessons learned in improved design of new facilities
- STUK also uses foreign operating experience for planning its inspection programs and safety assessment.



## International OEF process at STUK

- STUK is the national co-ordinator of IRS reports
  - STUK has requested a direct access to the IAEA/NEA's web-based IRS system to more than 100 experts representing different organizations (Licensees, Research Center, Ministry) in Finland
- STUK also gathers information directly from its cooperation with other regulators, especially with the regulators and plants of Sweden and Russia having similar operating plants (BWRs, VVERs) as Finland
- Cooperation started with the French regulator ASN related to the exchange of information and experiences on the OL3- EPR under construction.



## Sources of International OEF by STUK

Other sources of IOE by STUK

- meetings of regulator groups: OECD/NEA/WG's, WENRA, NERS, VVER-forum, MDEP, EU-projects
- IAEA/NEWS, WGPCNEWS etc. passing early information
- Multinational database systems: OECD/NEA Topical Databases
  - ICDE, OPDE (CODAP), FIRE, COMPSIS, SCAP, IAGE, ISOE (co-sponsored by IAEA)
- Peer review missions organized by the IAEA
  - IRRS, OSART, PROSPER, TM, etc.

## European Clearinghouse on NPP OEF (1)

- STUK participates in the operating experience co-operation (established in 2008) at the Institute of Energy, Joint Research Centre of European Commission in Petten, the Netherlands.
- The goal of Centralized Clearinghouse is:
  - the enhancement of the efficient sharing and implementing of OE as well as preventive and corrective actions to improve NPPs safety
- Provision of EC-JRC resources is based on permanent staff from JRC-IE complemented with Detached National Experts on a voluntary basis (STUK/Finland, VATESI/Lithuania) and temporary experts
- Access to the IRS system granted by IAEA&NEA.

SÄTEILYTURVAKESKUS • STRÅLSÄKERHETSCENTRALEN
RADIATION AND NUCLEAR SAFETY AUTHORITY 10.3.2010 JL 5 STUK

## European Clearinghouse on NPP OEF (2)

**Participating organizations**:

- Regulatory Bodies from Finland, Hungary, Lithuania, Netherlands, Romania, Slovenia, Switzerland; and Spain, Czech Republic, France, Bulgaria, Germany, Slovakia, Belgium, Sweden, United Kingdom as observers
- European Technical Support Organization Network (ETSON): GRS, IRSN, Bel-V are observers and participate actively.

**European Clearinghouse programme**:

- Quality assurance of IRS reports
- Support comprehensive reporting of European OEF to IRS
- Operational Event Assessments – Technical Reports on selected significant events or safety issues. Expected 4 reports/year.
- OEF quarterly report ("Newsletter" )

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RADIATION AND NUCLEAR SAFETY AUTHORITY 10.3.2010 JL 6 STUK

## Use of International OEF by STUK (1)

- STUK has a dedicated group that works on international OEF:
  - Co-ordinator of international OEF processes
  - Deputy director and Assistant Director of NRR department
  - ten participating experts in different technical disciplines: reactor and safety systems, thermo hydraulics, fuel, materials, manufacturing, systems and components, electrical and automation systems, civil engineering, radiation protection, operation and safety management
- The group meets monthly
- STUK's own IOEF processes are described in STUK's Quality Manual.

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## International OEF process at STUK (2)

STUK’s IOEF group is tasked to

- make screening of
  - IRS-reports disseminated through the IAEA
  - other information or reports received directly from other sources
- assign the received foreign information to categories with respect to actions to be taken
- maintain a database on the received information
- make within the limits of its competence or propose other staff to make a detailed review and assessment of experience found of special interest and suggest actions if needed
- oversee the utilization of international OE by licensees
- prepare the IRS-reports on events at NPP’s in Finland.

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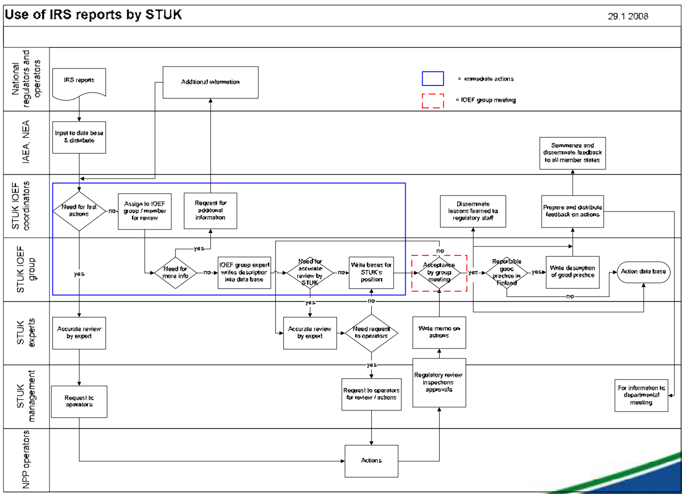
**Use of IRS reports by STUK** 29.1 2008

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## Review and assessment of IRS reports

- STUK has its own Access-based IRS database, where every IRS report received through IAEA WBIRS is recorded
- IOEF group expert writes a short event description (in Finnish) into database sheet and makes the categorisation of the IRS report:
  - **0. No further actions**
  - **1. Applicability on information / Particular issues need clarification**
  - **2. Lessons learned need to be taken into account in certain activities**
  - **3. Actions required in Finland**
  - **4. Good practice in Finland**
- At this stage expert may start discussions with the utilities to check the situation at their plants and to strengthen his/her judgment
- Justification for STUK’s position need to be recorded for each report
- Summary of actions needed or already performed at Finnish operating NPPs or at the unit under construction is written (in Finnish and in English) for each report categorized to class 1 or higher.

SÄTEILYTURVAKESKUS • STRÅLSÄKERHETSCENTRALEN
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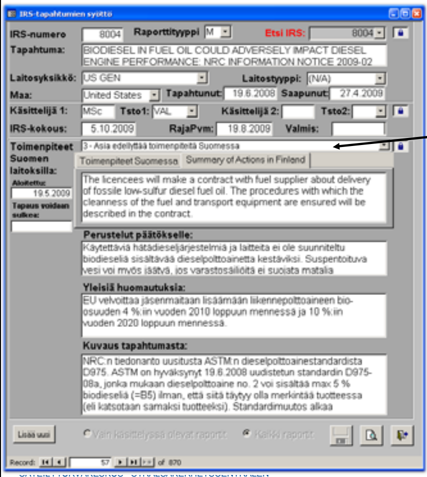
## User's interface to STUK's database of IRS reports




**Actions at Finnish plants**
0. No further actions
1. Particular issues need clarification
2. Lessons learned need to be taken account in certain activities
3. Actions required
4. Good practice in Finland

⇐ **Summary of actions in Finland**

⇐ **Justification**

⇐ **General remarks**

⇐ **Event description**



## IRS report preparation at STUK

Events are selected according to the general principles and main reporting categories applying IAEA/NEA IRS Reporting guidelines.

- General criteria for reporting is that **experience having led to corrective measures with potential generic importance** is shared.
- Case by case appointed STUK expert drafts an IRS report based on information from fact finding mission by STUK and on the Licensee's event report.
- The draft report is prepared as soon as possible, and not later than within 2 weeks.
- After internal comments the IRS coordinator submits the draft IRS report to the utility in question for review and comments.
- Comments and suggestions for improvements of draft IRS reports are also requested from IE-JRC Petten Clearinghouse staff.



## Analysis conducted by licensees, external OE

Both licensees have a group for coordinating external OEF

- groups have around 12 experts representing different areas of nuclear technology
- regular meetings every other month (Loviisa) or biweekly (Olkiluoto)
- tasks of external OEF groups
  - collection, screening, and analysis of OE
  - recommendations to make more in-depth expert review or to consider need for actions
  - data bases on events taken into OE process
  - annual summary report on utilization of OE to STUK
- OEF group of Olkiluoto NPP has an essential role also in assessment and screening of OE of their own.

## Oversight of licensees' OEF processes

- STUK reviews and assess the functioning and results of licensees' OEF arrangements and activities through its regulatory oversight processes of nuclear safety and as part of its periodic inspection program for operating NPP's:
  - review of **event reports** and **periodic reports** on operation and OEF
  - inspection of **OEF process for plant's own events**
    - part of the inspection "**Operating activities**"
  - inspection of **utilisation of OEF from other plants**
    - inspection "**International Operating Experience Feedback**" conducted once a year
  - inspection of **efficiency and effectiveness of OEF processes**
    - inspection **"Safety management**" conducted every second year.

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## Safety enhancing measures based on IOEF (1)

Most of the measures at operating Finnish NPP's, based on inputs through the international reporting systems **(IRS, WANO),** have been "soft" measures:

- additional safety assessment and analysis
- improvements in
  - management systems and operating practices
  - procedures and instructions
  - inspections and testing of equipment
  - staff training, including simulator training.

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## Safety enhancing measures based on IOEF (2)

Most plant modifications and smaller improvements in systems, structures, and components that are based on foreign experience,

- originate from **similar plants as those being operated in Finland**: VVER-440 and BWR plants designed by Asea Atom

In addition, a few widely reported foreign events have led to plant modifications

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## Examples on Utilisation of IOE

- Foreign events that have **recently initiated a process leading to plant modifications** at Finnish NPP's:
  - ECC recirculation filter blockage (Barsebäck 1992)
  - Disturbance in electrical power system (Forsmark 2006), IRS 7788
- Recent **actions based on lessons of IRS reports**
  - ECCS Gas Accumulation (NRC Information Notices 2008, 2006), IRS 7950, IRS 7815
  - Biodiesel in Fuel Oil of Safety Related Engines (NRC Information Notices 2009, 2006), IRS 8004
  - Welding Defects in Replacement Steam Generators, IRS 8078

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## Response to NPP events through NEWS

STUK has a process for the prompt response on NEWS and other urgent information:

- Immediate actions by STUK's duty system
- Detailed review by STUK's IOEF processes (IRS group)

**Recent NPP events through NEWS**

- Worker overexposure, 23.4.2010, Chinon 4, France
- Exposure of a worker in excess of statutory annual dose limits, 31.8.2010, Leibstadt, Switzwerland
- Emergency Diesel Generator Connecting Rod Bearing failures
  - Tricasting 2011: IRS 8164, NEWS notification 18.2.2011
  - Brunsbûttel 2009: IRS 8147
  - Reference was made to other similar events from 2008 and 2009 in France and China
  - Ascó Unit II in October 2009 (informed by Spanish NC of IRS on October 15, 2009)

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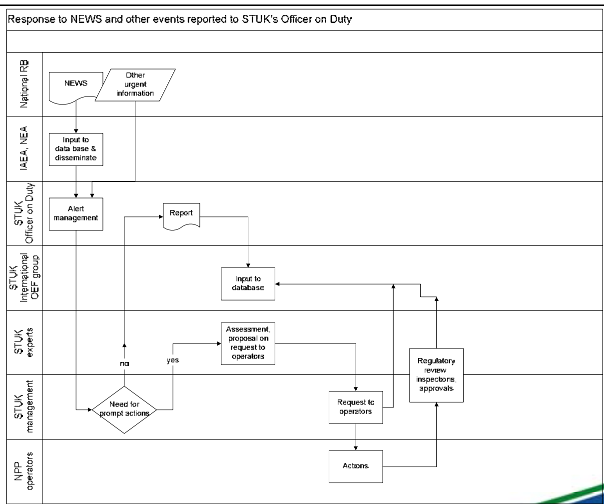


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## Response to worker exposure events through NEWS

- Duty officer alerted STUK's management, director of NRR, and prepared a report to STUK's duty system (data base)
- No immediate response or actions were required on these events
- NEWS reports were appointed to the radiation protection experts of STUK's IOEF group for closer review
- Based on the expert's review the procedures to manage the occurrence and handling of radioactive foreign materials at the NPPs was taken as one topic in the upcoming radiation protection inspection of STUK's periodic inspection programme.

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## Response to EDG Connecting Rod Bearing failures

- NEWS report was appointed to STUK's expert for closer review together with other similar recent events; Brunsbüttel NPP (2009) in Germany (IRS 8147) and in China (2009)
- Finnish licensees were asked by email if they had similar type of EDGs at their plants
- Loviisa NPP informed that in January 2011 their staff had identified at subcontractor's (Patria, Linnavuori) premises in Finland under maintenance a similar type of EDG as they had at Loviisa plant

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## Loviisa 1 and 2 EDG Connecting Rod Bearing failure

- In January 2011 licensee's maintenance staff was informed at subcontractor's premises in Finland on Connecting Rod Bearing failures of French EDGs.
- EDG under maintenance at the subcontractor was similar type as they had at the Loviisa plant
- Also similar bearing type was in use at one of the eight EDGs at the Loviisa plant
  - Licensee inspected the EDG and discovered 3 damaged bearings
  - Failures were not similar as those of EdF's EDGs' bearings
  - All 8 bearings were changed
  - Causes of bearing failures are studied at VTT.
  - Licensee will decide on further measures after getting the results.
  - Licensee informed other plants through WANO.

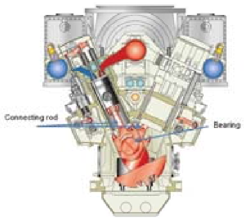


Photo: Fortum

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## Response to EDG Connecting Rod Bearing failures

- No immediate actions were required from the Finnish licensees on the EDG Connecting Rod Bearing failure events because Loviisa NPP had already taken the actions and the EDGs at Olkiluoto plant are different type.
- Because of several similar recent events related to Wärtsilä France (previously SACM) Emergency Diesel Generator (type SACMV16UD45S5D) Connecting Rod Bearing failures STUK asked EU Clearinghouse actions on international level to clarify:
  - root cause(s) of these events
  - the efficiency of International OEF arrangements (operators, regulators, subcontractors) for informing about these problems, utilizing International OE, and needs for improvement.

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## Improvements in OL3-EPR design

- Design of OL3 has been improved with consideration given to
  - **experience from existing reactors**
  - **insights gained from deterministic and probabilistic assessments for operating plants**
  - state of the methodologies and techniques
  - results of safety research
- International experience, especially from the German and French PWRs, has been used in the design of EPR layout and systems.
- The experience from the Finnish NPPs has also been taken into consideration; especially regarding protection against harsh weather conditions and other site specific issues.
- In review and assessment of IRS reports their applicability on OL3-EPR is also considered.

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## Lessons learnt from Olkiluoto 3 project

### Development of regulation and oversight

- Reform of STUK-YVL guides
  - also other than technical specific guides need to be up-to-date e.g. guides for safety management issues
- Planning of regulatory oversight of new plant projects
- Regulatory oversight and inspections
  - focus on organisation, resources and management
  - processes
  - products
- Procedures for oversight and inspections
  - well-documented written instructions to guarantee consistency of inspections
- Resource planning
- Competencies and training of personnel
- Tools for collecting experiences and utilisation of lessons learned.

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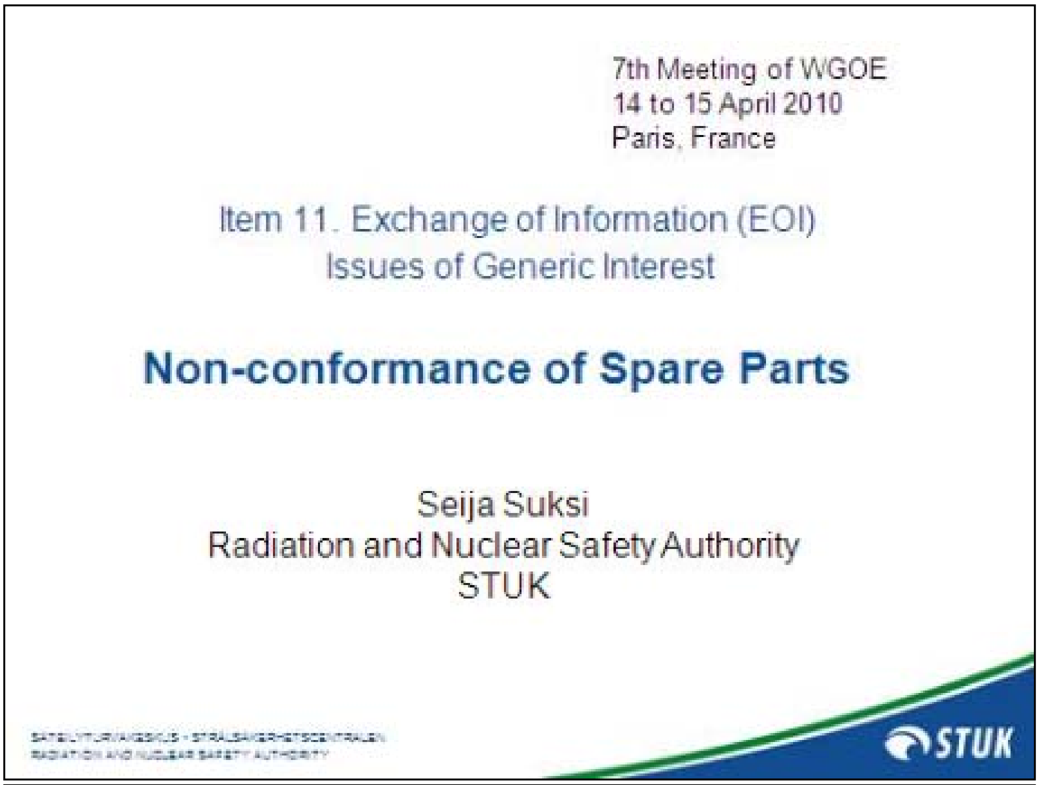
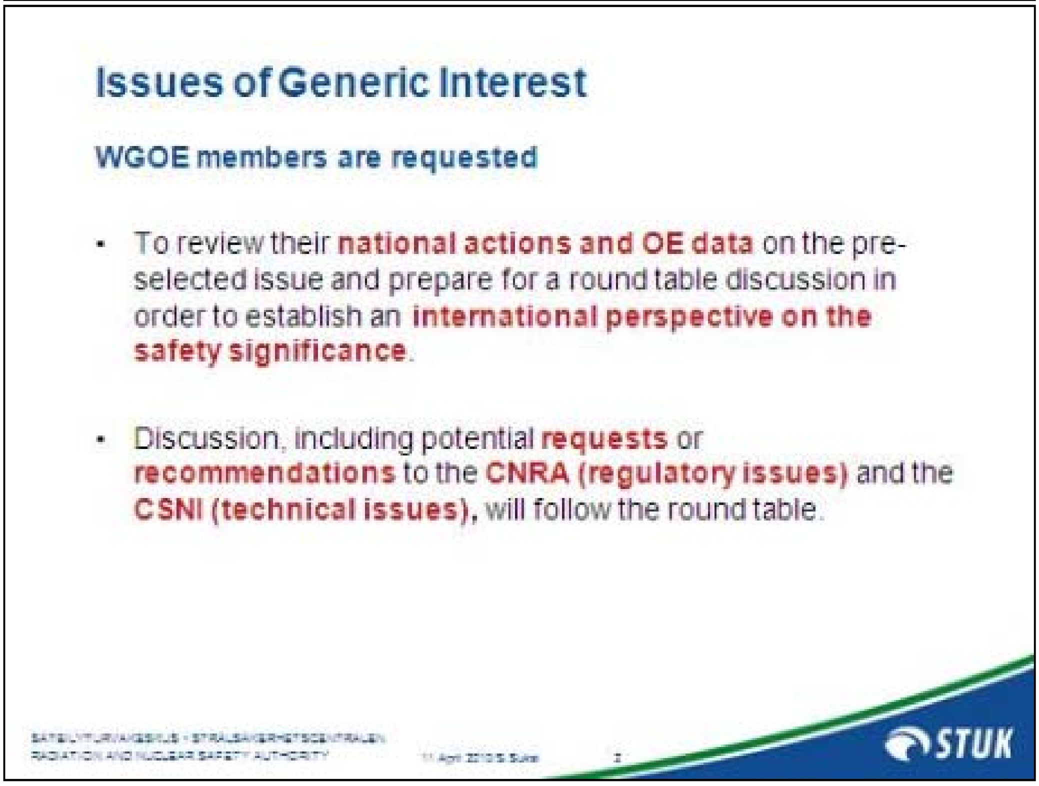
**10.8 WGOE Meeting Presentation on Non-Conformance of Spare Parts – STUK**



## What is meant by the Non-conformance of Spare Parts?

- The "non-conformance of spare parts" refers to problems raised from **replacement parts not conforming to original design standards**.
- Non-conformance may be a result of several issues, such as,
  - the inability to acquisition of original type of spare parts
  - fabrication might be closed down
  - changes in type or standards; change in materials; etc.
  - chemicals and supportive materials used in components and equipments (safety classified products - deficiencies in their quality or grading bases)
- These safety-related spare parts are **nuclear quality** - not warehoused.

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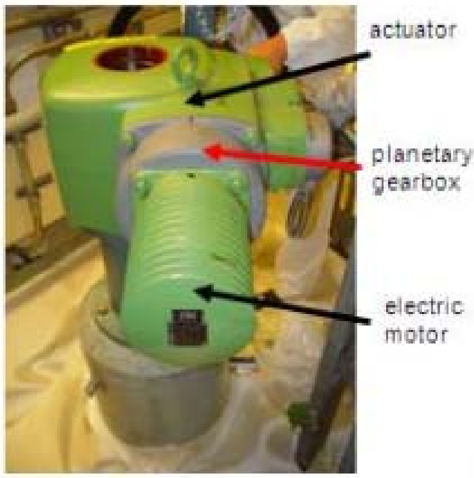
## Common-cause failure in main steam line outer isolation valve actuator (1/5)

- The issue "*Non-conformance in spare parts*" came forward in Olkiluoto nuclear power plant in connection of IRS-reported event "Common-cause failure in main steam line outer isolation valve actuator (2009-05-12)" (**IRS 8029**)
- A planetary reduction gearbox of an outer main steam line isolation valve (311V6) actuator at Olkiluoto 1 unit **failed in periodic test** during plant start-up after the annual outage on May 12, 2009.
- The failed valve actuator (type AUMA SA30.1-B16) was sent to the manufacturer for inspections in order to find the cause of the malfunction.

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## Common-cause failure in main steam line outer isolation valve actuator (2/5)

- Based on the **preliminary inspection** by the licensee, it was concluded that the **cause was grease** that had leaked from the actuator gearbox, and prevented switch-over from manual operation to the electric motor.
- The actuator was replaced on May 16, and the **plant start-up was continued**.



## Common-cause failure in main steam line outer isolation valve actuator (3/5)

- It was later found out (2nd June 2009) another planetary gear of the same design - the one that had been taken from the storage in order to replace the failed one - had **failed when being tested in a bench** on12th May prior to installation in order to replace 311V6.
  - **this information was not forwarded by the maintenance personnel because it happened at the maintenance workshop.**
- On June 2, 2009, the results of the manufacturer's inspection revealed that the actual reason was a **mechanical failure** of the planetary-type reduction gear
- Later analyses and investigations showed that **material and dimensioning** of the planetary reduction gear which **differed from the original** and **lack of tempering** were actual reasons for the failures.

Indications in one planetary gear

## Common-cause failure in main steam line outer isolation valve actuator (4/5)

On June 4 2009, after the failure mechanism became known

- **STUK ordered the plant operator to ascertain the operability of all eight planetary reduction gearboxes of the two plant units by June 30.**
- **Several of the gearboxes showed early indications of fatigue**

### Actions of the licensee

- **All planetary reduction gearboxes** of the outer main steam isolation valve were **replaced** with new ones at Olkiluoto units 1 and 2
- The **dimensioning basis and material specifications** of the reduction gears were **re-evaluated**
- Instructions regarding **informing about faults** found by maintenance personnel in safety-critical equipment were improved in the plant's job order system.

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## Common-cause failure in main steam line outer isolation valve actuator (5/5)

### Lessons learned

- **Lack of communication** between maintenance and safety personnel at the utility
  - **misinterpretation of the failure** => both plant units were restarted after the annual outage before discovering the actual failure and initiating the corrective actions
- The planetary gearbox between the electric motor and the valve actuator are administratively treated as part of the electric motor rather than of the actuator.
  - **planning of mechanical modifications and maintenance of the reduction gear may not be properly done due to unclear responsibilities**

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## Problems in scram valves (1/2)

Nitrogen leakages from scram system valves have been detected at Olkiluoto units during several years (2005, 2006, 2007, 2009)

- STUK came aware about the leakages within its normal oversight activities: resident inspectors, inspections of operation and maintenance
- In 2007 **STUK required a further report** on nitrogen leakages and **requested the utility to assess the criteria and schedule for corrective actions**
- TVO inspected all fourteen scram valves at both units during the outage in May 2008
  - Inadequate locking of the ring seal of the pilot valves was observed, which was supposed to be a reason for the leakage.
- **All scram valves were changed** in 2008 annual maintenance and **new method for the ring seal fixation** was used.

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## Problems in scram valves (2/2)

- In connection of Olkiluoto unit 2 start-up after 2009 annual maintenance outage nitrogen leakages from scram system valves were detected again
- Scram valves were taken to be tested in in a bench by nitrogen over pressure: all seven valves were leaking between the housing and upper flange plate
  - As opening two of scram valves the hardening and deformation of rubber ring seal were detected
  - The valves had been maintained and tested in 2007 and installed in 2008
  - The leaking scram valves were replaced by other valves.
- Characteristics of rubber seals have been analysed at VTT (Research Centre of Finland) and found out that they are ageing early (in 4 years) even in storage conditions and the elasticity of rubber seals is lost as being first time in contact with nitrogen
- **All scam valves will be replaced** in 2010 maintenance outages by scam valves of a new delivery lot (**seal material has been changed**).

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## Examples on Non-Conformance of Spare Parts

**Inability to acquisition of original type of spare parts**

- has resulted to modification or modernization of original systems
  - the off-gas radiation monitoring systems were replaced at Olkiluoto units in 2007 because of recurrent component and equipment failures and there were not any more spare parts available.

## Inability to acquisition of original type of lubricant (1/3)

- Periodic tests of low pressure turbine valves of Olkiluoto unit 2, which took place every two months during 2001-02, indicated gradual degradation in valves' performance with time.
- Licensee ordered assessments and analysis concerning the effects of valve failures from the turbine plant supplier to get evidence for supporting of its own decision making to continue production.
- The management of the plant did not prioritize protection of the main equipment, the failure of which might lead to a complicated transient situation and thus cause elevated risk of severe accident.
- The Licensee implemented a temporary modification in the turbine protection system due to worsening valve problems.

## Inability to acquisition of original type of lubricant (2/3)

- The plant was shutdown after a serious discussion between STUK management and Olkiluoto plant manager.
- Degraded valves were placed by spare valves and the temporary modification was removed in a hot shutdown.
- The removed valves were disassembled and inspected:
  - The bearings of the valves were jammed due to a decomposition of a lubrication crease.
  - The new lubricating grease was not "nuclear quality". The original grease was not any more available. Other characteristics of a new grease fulfilled the approval criteria. Persistence of high temperatures was regarded as the most important criteria in addition to a low concentration of impurities and its influence on material integrity.

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## Inability to acquisition of original type of lubricant (3/3)

- STUK launched its own investigation team to address:
  - the course of events
  - utility procedures, decision making and actions
  - a temporary turbine protection system modification made at full power
- The investigation was mainly targeted on:
  - safety culture of the utility including decision making
  - relations and communications between different parts of organisation
- The event and investigations performed by STUK and by the Licensee had several consequences at the plant and at STUK:
  - organisational changes at the plant
  - more specific procedures in changing a type of approved chemicals and supporting materials: the **purpose of use of chemical materials and substances was added for one approval criteria**
  - the recommendations on STUK's own operation focused e.g. on the **analyses and registration of safety significant faults**.

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## Why Discuss Non-Conformance of Spare Parts?

- Non-conformances of replacement (spare) parts of safety-related equipment or systems and supportive materials (lubricants/greases) used in safety-classified systems may lead to **unavailability of safety system / inoperability of safety function and elevated risk of severe accident**
- Non-conformances of replacement (spare) parts of safety-related equipment or systems and supportive materials can result to **common cause failure**
- Non-conformances or failures of safety-critical replacement (spare) parts if observed at the storage or at the maintenance workshop are **not notified or recorded** as those observed at the plants and **don't always receive the same kind of safety assessment**.
- Clarification of an actual root cause of a failure or malfunction resulted from non-conformances of spare parts or supporting material may not be prioritized leading to **misinterpretation of failure** and to **unfavorable decision making** e.g. to continue/start-up of production.
- Conformance of spare parts or supportive materials **cannot be observed or verified in the acceptance inspection** and utility has to trust on manufacture's quality certificate.

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## Recent Examples on Non Conformance of Spare Parts

Recent experiences on non-conformance of spare parts or supportive materials point to continued weakness in the same areas discussed extensively in industry operating experience:

- Lack of communication between maintenance and safety personnel at the utility
- Delay in decision making
- Misinterpretation of failures
- Unclear responsibilities in planning modifications and maintenance
- Poor design of components: effects of changes in type, standards, dimensioning and materials not analyzed enough
- Inadequate spare (replacement) parts monitoring
- etc.

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## Questions to be focus in table around

1. **Your RB's requirements for licensees to report on the non-conformance for spare (replacement) parts?**

- STUK has not set specific regulatory requirements for reporting failures e.g. non-conformance of spare (replacement) parts or degrading performance of components in periodic tests.
- Non-conformance of component or equipment has to be reported to STUK if caused malfunction or event meeting the criteria set in the Regulatory Guide YVL 1.5
- STUK can required licensee to report on non-conformances or failures observed in connection of its oversight activities and to assess criteria and schedule for corrective actions.

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## Questions to be focus in table around

2. **Your country's operating experience on events or regulatory issues related to the non-conformance for spare (replacement) parts?**

- Common-cause failure in main steam line outer isolation valve actuator (IRS 8029)
- Problems in scram valves at Olkiluoto NPPs
- Replacement of the off-gas radiation monitoring system at Olkiluoto NPPs
- Degradation of turbine valves at Olkiluoto unit 2 in 2002

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## Questions to be focus in table around

3. **If your RB has dealt with this issue previously, any regulatory activities or programme changes that have taken place or are the process of being taking related to the issue?**

- As response on recommendations given in STUK's own investigation team in 2002 STUK intensified follow-up and assessment of safety-significant faults by establishing at the department of Nuclear Reactor Regulation a new practice; supervisory meeting, later OPERA-meeting, where specialists and management of NRR are participating
- STUK has required further reporting of non-conformances or failures and corrective measures
- STUK has intensified and focused its oversight and inspections of Periodic Inspection Programme on spare parts acquisition and once launched its own investigation team

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## Questions to be focus in table around

4. **What type of routine inspection or oversight activities, if any, does your RB conduct of the licensee's programme?**

- Resident inspectors follow at site operation and maintenance activities and failure records of the plants and report their findings weekly.
- In biweekly department level OPERA-meetings it's assessed at department level if any further inspections or licensee reporting are needed.
- Several inspections of STUK's Periodic Inspection Programme can be focused on licensee's programme and arrangements on acquisition and monitoring of spare parts (supportive materials) when necessary.

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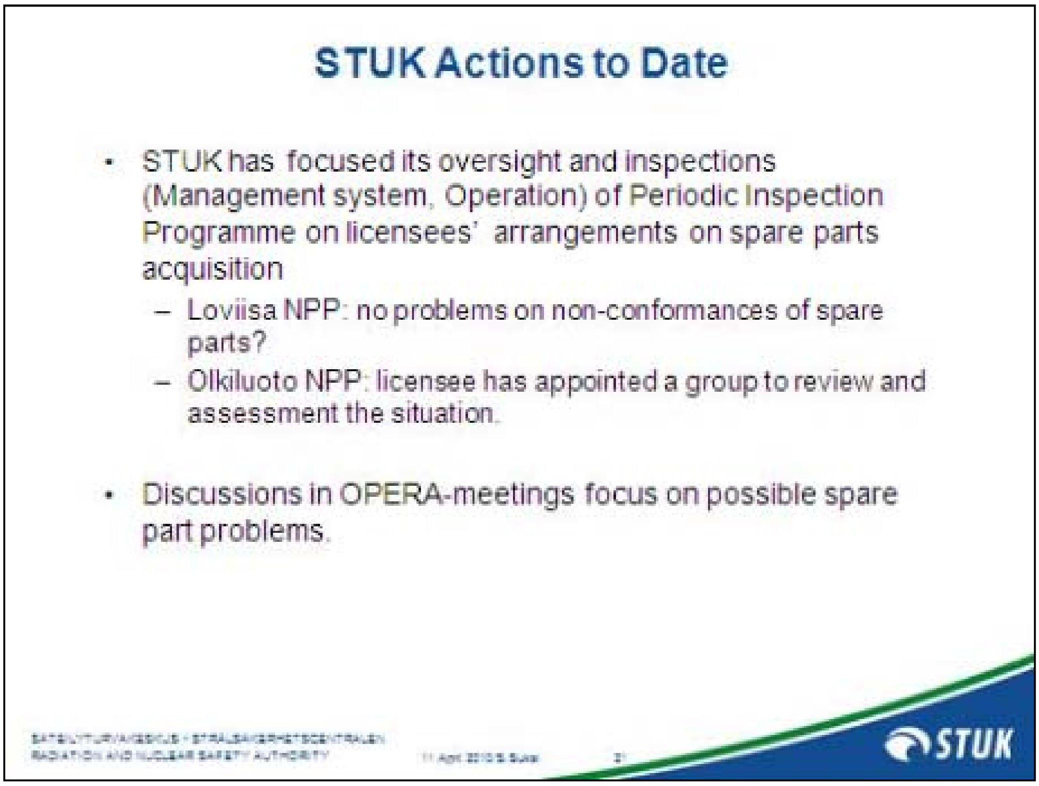
STUK Actions to Date
• STUK has focused its oversight and inspections (Management system, Operation) of Periodic Inspection Programme on licensees' arrangements on spare parts acquisition
– Loviisa NPP: no problems on non-conformances of spare parts?
– Olkiluoto NPP: licensee has appointed a group to review and assessment the situation.
• Discussions in OPERA-meetings focus on possible spare part problems.
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# INTERNATIONAL INCIDENT REPORTING SYSTEM (IRS)

| | | | |
|---|---|---|---|
| **IRS Number:** | **8160** | **Date of Receipt:** | 2010-12-22 |
| **Report Type:** | **Main** | | |
| **Title:** | **FAILURE OF SAFETY SYSTEM COMPONENTS (PRIMARY CIRCUIT BLOWDOWN / OVERPRESSURE VALVES) DUE TO INADEQUATE QUALIFICATION OF SLIGHTLY MODIFIED REPLACEMENT PARTS** | | |
| **Country:** | Finland | **Date of Incident:** | 2010-05-16 |

| Plant Name | Plant Code | Reactor Type | Power | Designer | Start of Operation |
|---|---|---|---|---|---|
| OLKILUOTO-1 | FI-3 | BWR | 880 | ASEASTAL | 1979-10-10 |


## Abstract

In a periodic test carried out at Olkiluoto 1 BWR unit (OL1) prior to the annual refuelling/maintenance outage on May 16, 2010, two electrically operated pilot valves in the primary circuit blowdown/overpressure protection system (system 314) failed to close due to jamming of their electrically operated pilot valves. In addition, a third valve was found to be stuck in the closed position.

The jammed valves were of a new type, which had been introduced at OL1 in the previous refuelling/maintenance outage. On closer inspection, it turned out that the new valves had had a slightly prolonged opening time already in the previous periodic test, carried out in the middle of the operating cycle. However, since the acceptance criteria for the periodic test had been fulfilled, this early indication had not been noted at that time.

The new pilot valve type (see Figure 2) had a guide bushing made of a new material (martensitic steel) with chromium coating. The prolonged exposure in the operating internal environment conditions (temperatures around 250 ºC, saturated steam/water environment) resulted in local surface corrosion of the guide bush coating, which caused the jamming of the valve piston in its place.

Since only 5 of the 14 electrically operated pilot valves (10 of which were to be re-placed with the new type, the remaining 4 being of a different design) had been replaced at OL1 in the previous outage, the other half of the valves had been unaffected by the fault. In addition, since each blowdown valve is equipped with a spring governed pilot valve (operating pneumatically with the pressure of the steam lines) in parallel to the electrically operated one, the overpressure protection had not been jeop-ardised.

After the incident, all electrically operated pilot valves of the new type were replaced with ones of the old type, with the exception of two valves of a modified new type, which were installed at OL2 in order to get operating experience to better facilitate shift from the old valve type.

As a result of the incident, plant procedures concerning design modifications were improved to provide for better follow-up of long-term behaviour of new components in their actual operating conditions.

On the International Nuclear Event Scale, the incident was classified as INES 1.

IRS Number: **8160** Report Type: **Main**

## Coded Watch List of Guide Words

| | |
|---|---|
| **Reporting categories** | |
| 1.2.2.2 | Degradation of main steam or feedwater lines |
| 1.2.5 | Degradation of systems required to assure primary coolant inventory and core cooling |
| 1.3.1 | Deficiencies in design |
| 1.3.2 | Deficiencies in construction (including manufacturing), installation and commissioning |
| 1.3.4 | Deficiencies in safety management / quality assurance system |
| **Plant status prior to the event** | |
| 2.1.2 | Reduced power (including zero power) |
| 2.5 | Testing or maintenance being performed |
| **Failed/affected systems** | |
| 3.BK | Nuclear boiler overpressure protection (BWR) |
| **Failed/affected components** | |
| 4.2.3 | Valves (including safety/relief/check/solenoid valves) , valve operators, controllers, dampers and fire breakers, seals and packing |
| **Cause of the event** | |
| 5.1.1.1 | Corrosion, erosion, fouling |
| 5.1.1.8 | Blockage, restriction, obstruction, binding, foreign material |
| 5.3.5 | Control of contractor/sub-contractor |
| 5.4.13 | Construction, installation and commissioning (of new equipment system, or complete plant) |
| 5.7.1.2 | Materials selection |
| 5.7.1.3 | Modifications engineering quality |
| 5.7.1.4 | Modifications engineering review process |
| 5.7.4 | Equipment environmental qualification |
| **Effects on operation** | |
| 6.2 | Controlled shutdown |
| 6.5.1 | Challenge to safety or relief valve in the primary circuit |
| **Characteristics of the event/issue** | |
| 7.0 | Other characteristics |
| **Nature of failure or error** | |
| 8.3 | Common cause failure (including potential for CCF) |
| **Recovery actions** | |
| 9.0 | Not relevant |

**NARRATIVE DESCRIPTION**

On May 16, 2010, Olkiluoto 1 was preparing for the annual refueling/maintenance out-age. Prior to shutdown, a periodic test of the 14 blowdown valves is scheduled to check their proper functioning: a steam relief from the main steam lines to the condensation pool inside the containment in case of containment isolation and/or reactor overpressure. Each of the main blowdown valves (valves 314V2-13) is equipped with a pneumatically operated pilot valve and a parallel electrically operated pilot valve, each capable of opening the main valve (Fig. 1). The remaining two main blowdown valves (314 V19-20) are located in the blowdown lines used for pressure regulation and have a different pilot valve configuration. The test is carried out by opening the electrically operated pilot, taking note of the opening time of the main valve, and closing the pilot.

The opening times of the main blowdown valves 314V13 and 314V7 exceeded the acceptable opening time required in the test specifications. In addition, the valve 314V13 failed to close on a signal from the control room. The design considers these circumstances, and there is a "Forced closing" valve in series with the pilot valves (Fig. 1), and the main blowdown valve 314V13 was subsequently closed according to plant procedures in order to stop loss of steam from the reactor, and the test was carried on. Later during the test, the main blowdown valve 314V3 failed to close in a similar manner. According to the plant technical specifications no more than two blowdown lines are allowed to be "Forced closed", it was therefore not possible to carry on with the periodic test and plant shutdown was continued to cold state.

Both jammed main blowdown valves 314V13 and V3 had electrically operated pilot valves of a modified type that had been installed in the previous outage. The new design had a different type of guide bushing (Fig. 2) that was not fastened by soldering as in the old design, but could be removed by dismantling the valve body. The reason for the design modification was an aspiration to perform the periodic replacement of the guide bushing on plant site, as the old design required shipping of the valve to the manufacturer (CCI AG) for such maintenance operations. The new valves had been designed and procured according to TVO procurement procedures and had passed their factory acceptance tests at TVO operating temperature and pressure. The new valve type had already been installed at Gösgen PWR plant, in Switzerland, and operating experiences there had been good. In order to get operating experience from actual operating conditions at TVO, 5 of the 10 electrically operated pilot valves (four blowdown valves — 314V4-5 and 314V19-20 — have different pilot valves and were excluded from the modification project: thus the total number 10 instead of 14) had been replaced at OL1 in 2009, and used for one operating cycle, prior to replacing the remaining 5 electrically operated pilot valves at OL1 and all 10 at OL2 during the 2010 outage. The outage at OL2 was completed on May 13, 2010, shortly prior to discovery of the failures at OL1 on May 16.

In order to identify what actually caused the valves' inoperability, the valves were disassembled. In addition to the two valves that had failed to close in the periodic test, one valve that had not been tested (since the test was terminated after the second failure) was found to be stuck in the closed position. After disassembly, it was found out that the gap between the valve piston and bushing (Figure 2) was filled with a substance, probably a corrosion product that caused the valve to jam. Similar corrosion product was found in all pilot valves of the new type, but not in those of the old type. A laboratory analysis determined that the substance was rich in chromium, and its probable source was judged to be a chromium coating of the guide bushing, used as lubrication between the piston and bushing made from the same steel material (martensitic stainless steel, X46Cr13). However, no mentioning of such coating was found in the design specifications or construction plan. Another finding was that the part of the guide bushing not in contact with the piston (marked "a" in Fig. 2) was clean and bright. Based on these findings, a preliminary assessment was made that the cause of the corrosion product would possibly be corrosion in the narrow gap between the piston and guide bushing.

Since at the time the pilot valve problem was identified, OL2 was already operating at full power with 10 electrical pilot valves replaced with the new type, a decision was needed concerning the continued operation and/or replacing the valves. Since first signals of unexpected behaviour of the pilot valves at OL1 had been detectable (though not detected) at the December 2009 periodic test - after about 6 months of operation - it was proposed by the operator and accepted by the authority to continue operation with the new valves using a reduced periodic testing interval of two months until the valves can be replaced with overhauled valves of the old type. (Normally, all blowdown valves are tested at the beginning and end of the 12 month operating cycle, and in addition, half of the valves are tested once in the middle the cycle). Furthermore, an application by the plant to install two pilot valves of a yet another modified type - a design that was in all respects identical to that used in Gösgen and also already had some operating experience from Swedish utilities (BWR:s of the same design as OL1/2) - to two selected blowdown lines was accepted in order to get additional operating experience. In this design, the chromium coating of the guide bushing is replaced with a plasma nitriding treatment, and the clearance between the bushing and piston is increased from 0.025-0.085 mm (the original design value of the OL1/2 old pilot valves) to 0.105-0.169 mm (the value used at the reference plant). OL2 was shut down and the pilot valves were replaced on June 25, 2010.

A sample from the guide bushing of one jammed valve was sent to the Technical Research Centre of Finland (VTT) for closer examinations. The results have confirmed the initial assessment of the failure and specified the corrosion mechanism in detail. After first installation of the valves with chromium coated guide bushing, hard chrome surface had started slowly to dissolve in BWR water /steam by general corrosion mechanism. Dissolved corrosion products then precipitated locally forming a firm layer to the valve piston 0,025 - 0,085 mm clearance. This layer filled up the clearance and prevented piston free movement.

OL2 is currently operating with 8 valves of the old type and two of the modified new type; OL1 with all 10 valves of the old type.

**SAFETY ASSESSMENT**

The incident did not directly endanger cooling of the fuel: according to safety analyses made as part of the plant safety analysis report (SAR), the reactor core would remain sufficiently cooled even if 10 blowdown valves would spuriously open and get stuck in the open position. According to PRA analyses, the conditional increase in the core damage frequency due to the actual incident concerning two stuck valves is 7,5e-5 per reactor year.

At OL1/2, each main blowdown valve of system 314 (with the exception of the two valves in the pressure regulation lines) is equipped with two pilot valves: one spring governed valve operated by steam line pressure and the other operated electrically. The faults were found in the electrically operated pilot valves, which are needed to open the main blowdown steam valves in two situations:

- directing the steam from the reactor to the condensation pool, when its normal route to the turbine plant is lost (anticipated operating occurrence)

- reducing the reactor pressure in order to enable low-pressure safety injection and/or to prevent high-pressure melt-through of the reactor pressure vessel in preparation for severe accidents

Regarding overpressure protection, operability of the spring governed valves is suffi-cient to ensure that the plant stays within the acceptance criteria for postulated accidents, and the overpressure protection capability was thus not affected. In addition, since only 5 of the electrically operated pilot valves had been changed to the new type, the remaining 9 would still have been operable and capability to direct steam to the condensation pool would have existed - although with slightly reduced capacity - even though all 5 valves of the new type would have been inoperable.

Due to the conditional increase in core damage frequency, and a common cause failure in a safety-critical component, the event was rated as level 1 on the INES scale.

**CAUSES ANALYSIS**

The direct cause for the incident is inadequate qualification of a design modification, where the bushing material was changed to martensitic steel requiring a coating between the bushing and piston. The guide bushing martensitic stainless steel was surface treated by hard chromium, but this information was not presented in the design documentation. In the reference plant at Gösgen, the component was surface treated with plasma nitriding.

The size of the gap between the piston and guide bushing was unchanged in the modifi-cation at TVO, whereas in the reference plant the gap was larger than at OL1/2. In addition, the corroding properties of the water at the location of the valves in OL1/2 (BWR plant, close to the reactor) may differ significantly from the reference PWR plant. These differences to the reference case were probably of a smaller significance than the change in surface treatment, but may however have contributed to the growth rate of the failure.

Generally, it can be said that the operating experience from Gösgen, which played an important role in justification of the design change proposed by the manufacturer, was not directly applicable to OL1/2 due to differences in the design and operating conditions of the valve. The importance of these differences was not sufficiently recognized in either the plant's procurement process or during the review of the design change by the safety authority. The requirement by TVO to perform factory test of the valves in order to demonstrate that the modified valve has sufficient capacity in the operating conditions at TVO was aimed at verifying that the new design performs acceptably in the plant conditions, but this test did not reveal the inacceptable long-term effects due to the corrosion.

The decision to install 5 valves in 2009 and get operating experience from one operating cycle prior to changing the rest of the valves was a conservative one. However, it was partially invalidated by not taking note of the prolonged operation times of the valves in the periodic test made during the operating cycle (since only the opening time of the main valve is specified as an acceptance criterion for the periodic test, and no in-structions had been given to the operating personnel to take special note of the pilot valve opening times). In addition, the modifications had already been made at OL2 before making the final periodic test of the first operating cycle at OL1.

**LESSONS LEARNED AND CORRECTIVE ACTIONS**

- Lessons learned from the incident

The incident revealed a deficiency of the procedures needed to guarantee long-term operability of a modified component in the safety classified system: although the components passed all factory acceptance tests and had operational experience from another NPP (Gösgen), long-term exposure to the actual operating conditions at TVO led to the valve failure. The operational experience from Gösgen concerning the coating of the guide bushing turned out not to be directly applicable due to differences in design and possibly also operating conditions. The fact that only half of the valves were replaced in 2009 limited the potential consequences of the failure and is a good practise to be con-tinued.

A lesson to be learned is that even a slight design modification of a safety related component may result in an unexpected long-term degradation of that component in actual operating conditions. The qualification testing programme should be able to find the possible deviations from expected behaviour before the performance of the components is degraded. Therefore, careful attention should be paid to the periodic testing, particularly to the first one after modification, and thorough evaluation of the test results, no matter where modified components have been installed. If the longer-than-usual opening times of the new pilot valves in the December 2009 periodic tests would have been noted, deterioration of the plant's blowdown capacity could have been prevented. The improved follow-up programs are aimed at improving this aspect in future plant modifications.

- Actions taken after the Incident and Regulatory Actions

As an immediate corrective action, the new electrically operated pilot valves at both units were replaced with those of the old design (with the exception of the two valves installed at OL2 in order to collect operational experience). The new modified valves are identical with those used at the Gösgen reference plant - also with respect to surface coating and clearances - and have also operating experience from Swedish BWR utilities at the same operating conditions as at TVO. These valves are installed in blowdown lines not used in the safety function "forced blowdown" (=reducing the reactor pressure in order to enable low-pressure safety injection and/or to prevent high-pressure melt-through of the reactor pressure vessel in preparation for severe accidents), and their operability is monitored in the periodic test taking place in the middle of the operating cycle.

Information of the new type of valves and the need for additional attention on following their behaviour had not reached the operating personnel conducting the periodic testing of the blowdown system in December 2009. Therefore, the early indication about prolonged operating times of the new valves went unnoticed, since the acceptance criteria for the test were fulfilled at that time. In order to improve monitoring concerning plant modifications in safety-critical systems, a specific follow-up program will be added in future testing procedures applied in plant modifications in order to ensure the suitability of the new components at the actual plant conditions.

The point of explicitly requiring information regarding possible changes in surface treatment of valve components as part of the pre-inspection documentation was added to the procurement procedures.

IRS Number: 8160 Report Type: Main

## List of attachments/illustrations

| Name | Type | Length |
|---|---|---|
| Attachment 2 | application/pdf | 129 |
| Attachment 1 | application/pdf | 283 |

## Related Reports

None

Finland, Olkiluoto 1 IRS-report Attachment 1

"FAILURE OF SAFETY SYSTEM COMPONENTS DUE TO INADEQUATE QUALIFICATION OF SLIGHTLY MODIFIED REPLACEMENT PARTS", 2010/05/16

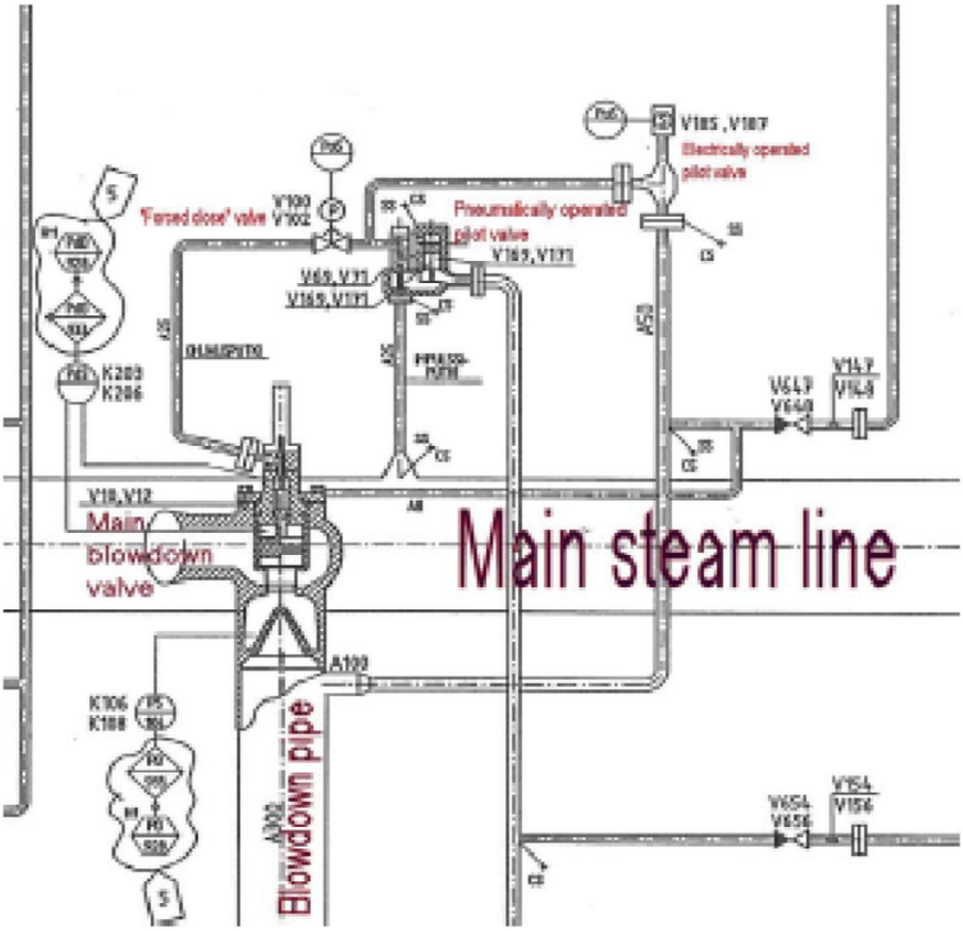



Figure 1: Main and pilot valve arrangements in OL1/2 blowdown system

Finland, Olkiluoto 1 IRS-report Attachment 2

"FAILURE OF SAFETY SYSTEM COMPONENTS DUE TO INADEQUATE QUALIFICATION OF SLIGHTLY MODIFIED REPLACEMENT PARTS", 2010/05/16

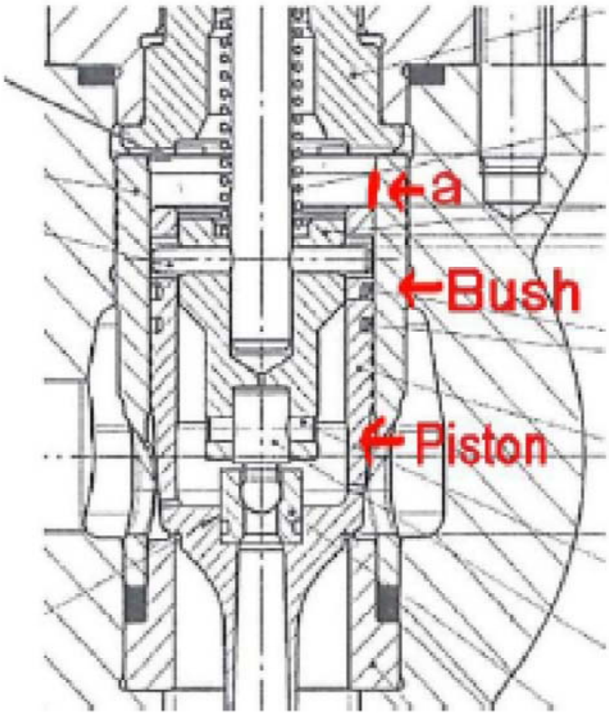
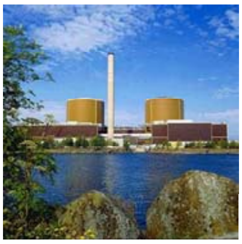



Figure 2: Valve piston and bush of electrically operated pilot valve (new design)

## 10.9 Regulatory Experience on Spare Parts Management - Examples from Finland – STUK

## Content



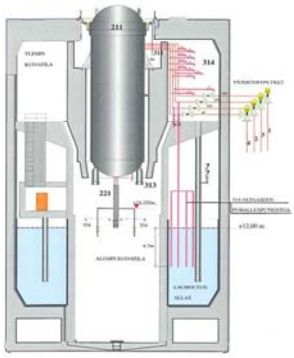
Photos: TVO and Fortum

- Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts
- Loviisa 1 and 2 Emergency Diesel Generator Connecting Rod Bearing failure

SÄTEILYTURVAKESKUS • STRÅLSÄKERHETSCENTRALEN
RADIATION AND NUCLEAR SAFETY AUTHORITY
STUK

## Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Description of the event
  - Periodic test of blowdown / overpressure protection system (314) prior OL1 outage in May 2010
  - Two main valves failed to close due to jamming of their electrically operated pilot valves – main valves were forced to close
  - In addition, a third valve was found to be stuck in the closed position
  - Event was rated to INES 1 due to CCF possibility



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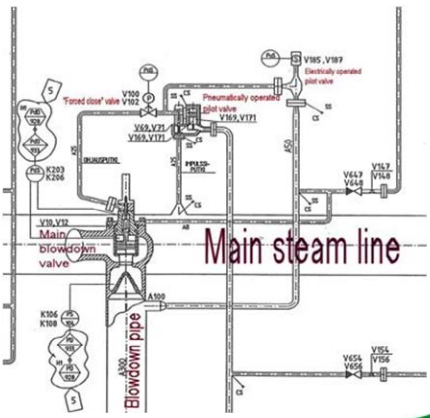
STUK

## Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

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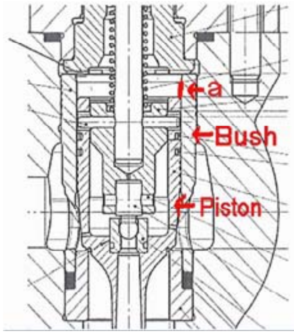
RADIATION AND NUCLEAR SAFETY AUTHORITY
STUK

## Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Background
  - In May 2009 outage new electrical pilot valves (5 out of 10) were changed at OL1
  - New valves had a changed guide bushing design to enable replacement of the bushings at site
  - In Nov 2009 periodic tests were done, but slightly longer opening times of the modified pilot valves went unnoticed
  - 10 out of 10 pilot valves were replaced at OL2 in May 2010 prior OL1 outage
  - Jammed valves were detected in OL1 outage in May 2010

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STUK

## Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Cause for jamming
  - New valve had a guide bushing made of a new material (martensitic steel) with chromium coating for lubrication - change was made by the manufacturer but not specified in the manufacturing documentation
  - At the operating conditions (different to reference plant), chrome surface had started slowly to dissolve and dissolved corrosion products precipitated locally forming a firm layer to the valve piston
  - Gap between the valve piston and bushing was filled with a corrosion product jamming the valve

Photo: TVO

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STUK

## Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Actions taken
  - After discovery in May 2010, all modified pilot valves were replaced with old valves at OL1
  - Discussions between Licensee and STUK on the continued operation of OL2 with modified valves
  - Licensee decided to shut down OL2 to replace modified valves in June 2010
  - However, OL2 has now 2 re-designed valves (and 8 old valves) to gain operating experience with a new coating material (similar to reference design)

Modification made at OL1 in May 2009
↓
Periodic tests done at OL1 in Nov 2009
↓
Modification made at OL2 in May 2010
↓
Malfunction discovered at OL1 prior to outage in May 2010
↓
OL2 shut down to replace modified valves in June 2010

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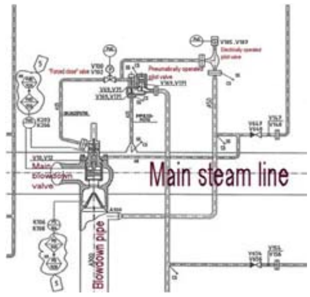
## Olkiluoto 1 & 2 Failure of Safety System Components due to inadequate qualification of slightly modified replacement parts

- Lessons Learned
  - Diversity in design provides safety – main valve has both electrical and spring loaded pilot valves
  - It is a good practice not to introduce modifications simultaneously in all safety trains
  - Importance of management and oversight of manufacturers
  - Importance of Qualification programme - especially long term exposure in real operating conditions
  - Careful attention to periodic testing and programme results after modifications
  - For more information see IRS 8150

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## Loviisa 1 and 2 Emergency Diesel Generator Connecting Rod Bearing failure

- Description of event
  - In January 2011 licensee's staff identified a similar type of EDG under maintenance at subcontractor's premises in Finland
  - It was found out that the EDG had had a connecting rod bearing failure
  - Similar bearing type were in use at one of the eight EDGs in Loviisa plant
  - Licensee inspected the EDG and discovered damaged bearings
  - Bearings were changed during the next week
  - Reason for bearing failure is being studied

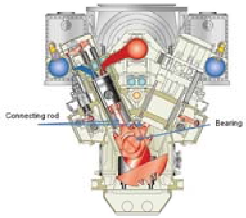


Photo: Fortum

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STUK

## Loviisa 1 and 2 Emergency Diesel Generator Connecting Rod Bearing failure

- Recent similar events elsewhere
  - NEWS notification from France on the 18th of February 2011 – INES 2 event at Tricastin
  - IRS report 8147 from Germany on the 24th of February 2011 – Brunsbuettel NPP in 2009
  - Reference was made to other similar events from 2008 and 2009
  - Similarities with events in Finland and Germany
    - Same Diesel manufacturer Wärtsilä France (Previously SACM) - Diesel type SACMV16UD45S5D
    - Same bearing type

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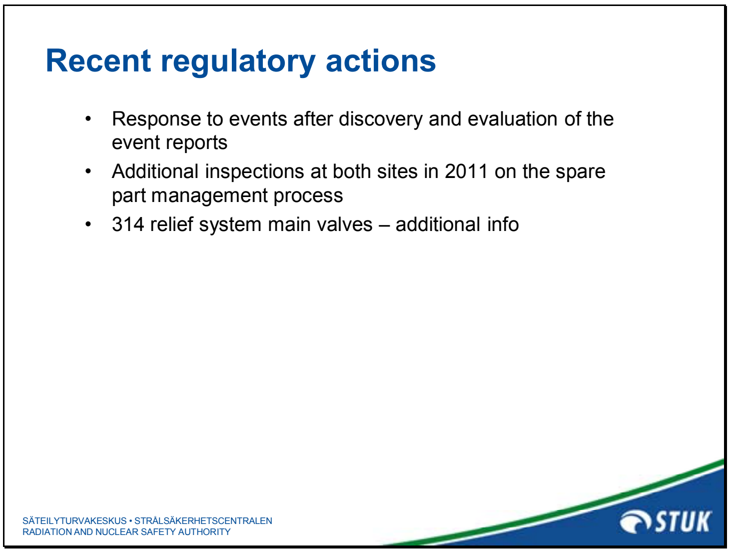
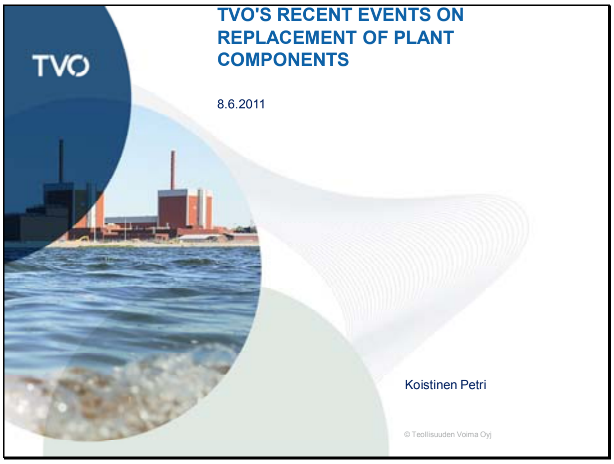
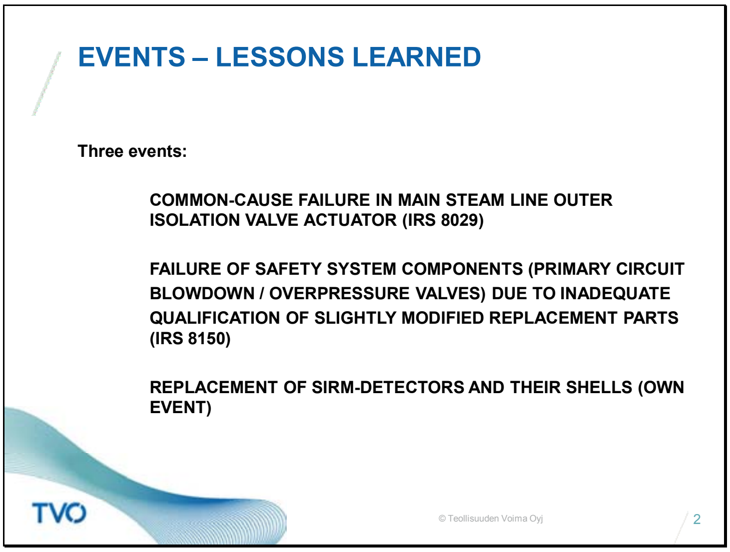



## 10.10 TVO's Recent Events on Replacement of Plant Components – TVO



## EVENT 1, IRS 8029

A planetary reduction gearbox of an outer main steam line isolation valve actuator (311V6) at Olkiluoto 1 NPP (OL1) failed in a periodic test during plant start-up after the annual outage on May 12, 2009. The failure mechanism was initially misinterpreted, and the plant was started after replacing the actuator

On June 2, the reason for the failure was eventually found to be a fractured reduction gear between the actuator and its electric motor

Furthermore, at that time it was found out that another planetary gear of the same design had failed on May 12, when it was being tested in a bench prior to installation in order to replace 311V6. The immediate reason for the fractures is fatigue

TVO



3

## EVENT 1, CAUSES

The actual reason for the fatigue is not yet known

The planetary gearbox is situated between the electric motor and the valve actuator, and it is administratively treated as part of the electric motor rather than of the actuator

Lack of communication within TVO (maintenance, tech. support, operations) and between TVO and STUK during the incident

Lack of supplier oversight, there was a different construction than expected (modified). Also communication issue – Nuclear is unique

TVO



4

## EVENT 2

In a periodic test carried out at Olkiluoto 1 BWR unit (OL1) prior to the annual refuelling/maintenance outage on May 16, 2010, two electrically operated pilot valves in the primary circuit blowdown/overpressure protection system (system 314) failed to close due to jamming of their electrically operated pilot valves. In addition, a third valve was found to be stuck in the closed position

The jammed valves were of a new type, which had been introduced at OL1 in the previous refueling/maintenance outage. On closer inspection, it turned out that the new valves had had a slightly prolonged opening time already in the previous periodic test, carried out in the middle of the operating cycle. However, since the acceptance criteria for the periodic test had been fulfilled, this early indication had not been noted at that time.

See Jukka Kupila's presentation

TVO



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## EVENT 2, CAUSES

The direct cause for the incident is inadequate qualification of a design modification, where the bushing material was changed to martensitic steel requiring a coating between the bushing and piston

The size of the gap between the piston and guide bushing was unchanged in the modification at TVO, whereas in the reference plant the gap was larger than at OL1/2

This was handled as a spare part project, not as a modification. Replacements were done at TVO maintenance facilities and this contributed in the event

Later there was a lack of communication between maintenance, tech. support and operations (modification not known in the periodical testing)
All in all: did the replacement get the attention required by its safety significance?

TVO





## EVENT 3, INTERNAL

Replacement of SIRM (Start- up and Intermediate Range Monitoring System), done in annual outage 2008

Detectors had to be replaced due to detected problems (vibrations) in 2008

Finally detectors were put into the reactor without proper documentation, however the detectors as such were correct

TVO





## EVENT 3

Investment decisioin was made September 2007
…..
January 2008, remarks in protocols about schedule problems

Detector shells arrive in Olkiluoto 7.4.2008. Challenging components (15 meters long), so put to 'unsusual storage'

Detectors arrive in Olkiluoto 28.4.2008. They were marked as 'STOP QC' and stored close to the shells

The shells and detectors were put together 29.4.2008 and moved to the reactor hall (due to outage of the other unit – logistics) 2.5.2008

Assembly in May and 23.5 it was noted by the QC – so done without the correct documents

TVO

## EVENT3, CAUSES

Was done as a spare part project, not purely as a modification project

Project was late in start and was delayed along the way

Lack of communication between QC, tech. support (project person) and QA

Non-routine actions (storage, logistics inside the plant) – flexibilty…

Two different technical branches (mechanical (shells) and I&C (detectors). There are different qualification procedures in these fields. Project manager was I&C specialist.

TVO



9

## EVENTS – COMMON FEATURES

Communication failures
- How do we ensure information flow by procedures – meetings, documents…

Different technical branches
- How do we ensure competence
- How do we ensure cooperation

Oversight of suppliers
- Schedule
- Do we know what we get – communicating nuclear demands

Ensuring safety culture
- How do we ensure that modifications and spare part replacement get the attention they require (based on their safety significance)

TVO



10