

Operating Experience **P**rogramme Effectiveness **M**easures

Workshop Proceedings
Garching, Germany
September 8–10, 2014

Unclassified

NEA/CNRA/R(2015)7

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

English text only

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

**International Operating Experience Workshop Proceedings on
Operating Experience Programme Effectiveness Measures**

**Garching, Germany
September 8-10, 2014
Workshop hosted by Gesellschaft für Anlagen- und Reaktorsicherheit (GRS)**

Complete document available on OLIS in its original format
This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.



NEA/CNRA/R(2015)7
Unclassified

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, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, 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

OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 31 countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, Russia, 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;
- 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 programme 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.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Corrigenda to OECD publications may be found online at: www.oecd.org/publishing/corrigenda.

© OECD 2015

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of the OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to rights@oecd.org. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at info@copyright.com or the Centre français d'exploitation du droit de copie (CFC) contact@cfcopies.com.

COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES

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

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

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

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

ABSTRACT

The NEA Committee on Nuclear Regulatory Activities (CNRA) believes the national operating experience feedback programmes and the sharing operating experience between countries and organisations are major elements in the regulatory bodies and industry 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 Operating Experience, while maintaining the same acronym. In 2006, the WGOE was moved to be under the umbrella of the CNRA in NEA.

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.

The CNRA, Working Group on Operating Experience (WGOE) organised the International Workshop on Operating Experience (OPEX) Programme Effectiveness Measures. The workshop was hosted by the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) and was held in Garching, Germany, from 8-10 September 2014.

Evaluation of safety significant events including the Fukushima Daiichi nuclear power plant (NPP) accident indicated that lessons to be learnt from OPEX could provide an important prevention tool if implemented in a timely manner. The main objectives of the workshop were aimed at providing a forum for the exchange of information on the licensees' and regulators' OPEX programmes and on the approaches to assess or even measure the effectiveness of these programmes.

Participants had the opportunity to meet with their counterparts from other countries and organisations and discussed current and future issues on the selected topic. They developed conclusions and commendable practices and identified methods to improve their own OPEX feedback and assessment methodologies.

Regulatory bodies and potentially commercial organisations could benefit from a generally accepted methodology of assessing the effectiveness of their OPEX programmes. Effective application of OPEX is consistently recognised as a fundamental pillar of nuclear safety. An organization's ability to effectively consider OPEX information and determine the appropriate application of the lessons learnt and best practices identified through consideration of that information should be measurable to foster continuous improvement to OPEX processes and programmes.

A set of effectiveness measures and performance assessment tools – heretofore referred to as measures and tools – applicable to OPEX processes and programmes would provide useful information for the

management of these processes and programmes. Ideally, these measures and tools would be structured such that they would be applicable to all entities responsible for nuclear safety (e.g. reactor, materials, radiation protection) across the international community.

The goal of the workshop was thus to identify effectiveness measures and performance assessment tools applicable to OPEX programmes. These measures and tools would be focused on improving the adoption of OPEX-derived safety improvements and overall OPEX programme effectiveness. Three discussion groups were established to discuss the different aspects of the topic in separate working group sessions. The members of the groups were selected such that a diversity of views for each of the topics was created. Discussions groups met for separate sessions to review their individual topics. The exchange of ideas and opinions between participants was active and the groups formulated conclusions based on the discussions.

The three different topics for the discussion groups were related to measures and tools in the following areas:

- identifying/gathering OPEX;
- processing OPEX information;
- assessing outcomes of OPEX programmes.

Initial results to consider are as follows:

- Potential tools and criteria were identified for effectiveness analysis of the various steps of OPEX programmes.
- Only a few tools or verification instruments were identified as potentially missing.
- Specific criteria have been developed to measure effectiveness of OPEX programmes.

The group concluded that major parts of existing OPEX programs can be assessed with respect to their effectiveness with existing measures and tools.

The group discussions resulted in the following generic recommendations that are applicable to OPEX programmes:

- to develop the missing measures and tools to assess the OPEX effectiveness;
- to address the effectiveness of OPEX in OPEX programme reviews like self-assessments, peer reviews, and international missions;
- to intensify the collaboration with non-nuclear industry.

The evaluation of the workshop results was based on the questionnaire responses received from the participants at the conclusion of the workshop. The results of the evaluation show that the approach used during the workshop was effective in encouraging the active exchange of information between the participants and resulted in meaningful conclusions that could be applied to the participants' OPEX programmes.

FOREWORD

Evaluation of safety significant events including the Fukushima Daiichi NPP accident indicate that lessons to be learnt from OPEX could provide an important prevention tool if implemented in a timely manner. The main objectives of the workshop were to provide a forum for the exchange of information on the licensees' and regulators' OPEX programmes and recommended approaches to assess or even measure the effectiveness of these programmes.

Participants were provided with the opportunity to meet with their counterparts from other countries and organisations to discuss current and future issues on the selected topic. They were tasked with developing conclusions and commendable practices regarding the issues and identify methods to help improve their own OPEX feedback and assessment methodologies.

Regulatory bodies, and potentially commercial organisations, could benefit from a generally accepted assessment methodology to measure the effectiveness of their OPEX programmes. Effective application of OPEX is consistently recognized as a fundamental pillar of nuclear safety.

An organisation's ability to effectively consider OPEX information and determine the appropriate application of the lessons learned and best practices identified through consideration of that information should be measurable to foster continuous improvement to OPEX processes and programmes.

A set of effectiveness measures and performance assessment tools—heretofore referred to as “measures and tools” —applicable to OPEX processes and programmes would provide useful information for the management of these processes and programmes. Ideally, these measures and tools would be structured such that they would be applicable to all entities responsible for nuclear safety (e.g. reactor, materials, radiation protection, etc.) across the international community.

ACKNOWLEDGEMENTS

The Members of the Organising Committee wish to acknowledge the excellent planning and arrangements made by the staff of the hosting organisation, the GRS, TSO to the German Federal Ministry. Special appreciation is given to Prof. Frank-Peter Weiss and Michael Maqua (Germany) of the host organisation; Benoit Poulet (Canada), Chairman of WGOE and Workshop Chairman; Nancy Salgado, NEA Technical Secretariat for WGOE. Additional thanks to Elisabeth Mauny and Abir Maalouf, NEA assistants, in the preparation of the proceedings.

Special acknowledgement is given to the members of WGOE who worked as facilitators and recorders for each of the topics, including, Harold Chernoff (US), Henk van der Veen (the Netherlands), Laszlo Juhasz (Hungary), David Garmon (US), and Yves Van den Berghe (Belgium), and Peter Corcoran (Canada).



TABLE OF CONTENTS

1. Executive summary	13
2. Organisation/overview of workshop	15
2.1 Planning	15
2.2 Topic introductions	15
2.3 Announcement and pre-workshop activities	17
3. Opening session.....	21
3.1 Results of breakout group discussions	21
3.2 TOPIC 1: Identifying/gathering OPEX.....	22
3.3 TOPIC 2: Processing OPEX information	24
3.4 TOPIC 3: Assessing outcomes of OPEX programmes	26
4. Closing plenary session	31
4.1 Workshop closing remarks	31
5. General workshop conclusions	33
6. Workshop evaluation form results.....	35
6.1 Evaluation form	35
6.2 General.....	35
6.3 Workshop format	36
6.4 Workshop topics	36
6.5 Future workshops.....	37
6.6 Suggested future topics	37
6.7 Additional comments received.....	37
7. List of participants	39
8. Recent WGOE and related-CNRA reports.....	41
Appendix A: workshop programme	43
Appendix B: Presentations	45

1. EXECUTIVE SUMMARY

The main objectives of the workshop were aimed at providing a forum for the exchange of information on the licensees' and regulators' operating experience feedback (OPEX) programmes and on the approaches to assess or even measure the effectiveness of these programmes. Participants had the opportunity to meet with their counterparts from other countries and organisations and discuss current and future issues on the selected topic. They developed conclusions and commendable practices and identified methods to improve their own OPEX feedback and assessment methodologies.

Approximately 43 participants from 14 different countries and four international organisations took part in the workshop. Participating countries included: Belgium, Canada, Czech Republic, Finland, France, Germany, Hungary, Japan, the Netherlands, Russian Federation, Slovenia, Sweden, United Arab Emirates, and the United States. The international organisations included the IAEA, WANO, EU-Joint Research Centre, and the OECD/NEA.

The evaluation of safety significant events including the Fukushima Daiichi NPP accident indicated that lessons to be learnt from OPEX could provide an important prevention tool if implemented in a timely manner.

Regulatory bodies and potentially commercial organisations could benefit from a generally accepted methodology of assessing the effectiveness of their OPEX programmes. Effective application of OPEX is consistently recognised as a fundamental pillar of nuclear safety. An organisation's ability to effectively consider OPEX information and determine the appropriate application of the lessons learnt and best practices identified through consideration of that information should be measurable to foster continuous improvement to OPEX processes and programmes. A set of effectiveness measures and performance assessment tools – heretofore referred to as measures and tools – applicable to OPEX processes and programmes would provide useful information for the management of these processes and programmes. Ideally, these measures and tools would be structured such that they would be applicable to all entities responsible for nuclear safety (e.g. reactor, materials, radiation protection) across the international community.

The goal of the workshop was thus to identify effectiveness measures and performance assessment tools applicable to OPEX programmes. These measures and tools will be focused on improving the adoption of OPEX-derived safety improvements and overall OPEX programme effectiveness. Three discussion groups were established to discuss the different aspects of the topic in separate working group sessions. The members of the groups were selected such that a diversity of views for each of the topics was created. Discussion groups met for separate sessions to review their individual topics. The exchange of ideas and opinions between participants was active and the groups formulated conclusions based on the discussions. The three different topics for the discussions groups were related to measures and tools in the following areas:

- identifying/gathering OPEX;
- processing OPEX information;
- assessing outcomes of OPEX programmes.

Initial results to consider are as follows:

- Potential tools and criteria were identified for effectiveness analysis of the various steps of OPEX programmes.
- Only a few tools or verification instruments were identified as potentially missing.
- Specific criteria have been developed to measure effectiveness of OPEX programmes.

The groups concluded that major parts of existing OPEX programmes can be assessed with respect to their effectiveness with existing tools and criteria.

The group discussions resulted in the following generic recommendations that are applicable to OPEX programmes:

- to develop the missing measures and tools to assess the OPEX effectiveness;
- to conduct OPEX programme reviews like self-assessments, peer reviews and international missions to confirm the effectiveness and allow for benchmarking of OPEX Programmes;
- to develop and/or improve the collaboration and sharing of OPEX information with non-nuclear industry.

The evaluation of the workshop results was based on the questionnaire responses received from the participants at the conclusion of the workshop. The results of the evaluation show that the approach used during the workshop was effective in encouraging the active exchange of information between the participants and resulted in meaningful conclusions that could be applied to the participants' OPEX programmes.

2. ORGANISATION/OVERVIEW OF WORKSHOP

2.1 Planning

Preliminary planning for this workshop began following the 2012 Meeting of WGOE and was finally approved by the CNRA in December 2013. The topics discussed revealed that the effectiveness of programmes on operating experience feedback could attract the interest of both, regulators and licensees. The WGOE determined that the workshop should have only few lectures in order to maximise time for working sessions on three different aspects of the topic. Germany was selected as the host country for the workshop. The final location was at the offices of GRS Garching (close to Munich). The workshop was organised by GRS staff led by Michael Maqua (Germany), the WGOE Vice-Chair.

2.2 Topic introductions

The evaluation of OPEX and particularly safety significant events including the Fukushima Daiichi NPP accident demonstrate that lessons to be learnt from OPEX provide an important prevention tool. It is important to note that lessons learnt from OPEX can result in nuclear safety-related improvements measures which should be adequately implemented in a timely manner.

The ongoing process of collecting operating experience information, evaluation, definition and dissemination of lessons learned, development and implementation of appropriate improvement measures could be generally described as the OPEX process itself. As all processes it should be assessed with respect to its effectiveness.

It has been shown that several important NPP events could have been prevented had the lessons learned from previous NPP events through OPEX been implemented in an effective and timely manner. The best known example is the 1979 core melt accident at TMI-2 where a precursor event occurred only about one year earlier. Had the lessons learned from this precursor event been implemented at TMI or had the operators been trained on that precursor, the core melt at TMI-2 could have been avoided.

Thus, the main objectives of the workshop were to provide a forum for the exchange of information on both the licensees' and regulators' OPEX programmes and on approaches to assess or even measure the effectiveness of these programmes. Workshop participants had the opportunity to meet with their counterparts from other countries and organisations to discuss current and future issues on the selected topic. It was intended that they should develop conclusions and commendable practices regarding the issues and identify methods to help improve their own OPEX feedback and assessment methodologies.

Both, regulatory bodies, and commercial organisations, could benefit from a generally accepted methodology of assessing the effectiveness of their OPEX programmes. Effective application of OPEX is consistently recognised as a fundamental pillar of nuclear safety. An organisation's ability to effectively consider OPEX information and determine the appropriate application of the lessons learned through consideration of that information should be measurable to foster continuous improvement to OPEX processes and programmes. A set of effectiveness measures and performance assessment tools—here referred to as “measures and tools” —applicable to OPEX processes and programmes provide useful information for the management of these processes and programmes. Ideally, these measures and tools

should be structured such that they are applicable to all entities responsible for nuclear safety (e.g. reactor, materials, radiation protection, etc.) across the international community.

The goal of the workshop was to identify effectiveness measures and performance assessment tools applicable to OPEX programmes. These measures and tools are focused on improving the adoption of OPEX-derived safety improvements and overall OPEX programme effectiveness.

The workshop lasted two and a half days and included panel presentations and breakout sessions. In the breakout sessions diverse groups of nuclear safety experts collaborated on the development of measures and tools applicable to general OPEX programme areas. The presentations were intended to provide specific information on the workshop topic from different points of view used to set the foundation for the breakout session discussions.

The breakout group discussions have been the primary focus of this workshop. Important final workshop deliverables, specifically, measures and tools for assessing the effectiveness of OPEX programmes and commendable practices in this area originated from these groups.

There have been three breakout groups responsible for developing measures and tools in the following areas:

- identifying/gathering OPEX;
- processing OPEX information;
- assessing outcomes of OPEX programmes.

The objectives of each group are described in Table 1 were used as a guide for the development of measures and tools applicable to each area. However, the final product was developed by each breakout group. The breakout groups did not significantly deviate from the original objectives described in Table 1.

Table 1 – Breakout Group Objectives	
Group	Objectives
Group 1 – Identifying/gathering OPEX	<p>This group should focus on developing measures and tools that apply to the area of identifying/collecting OPEX. The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.</p> <p>The following is provided solely to stimulate conversation on what attributes could be measured to ensure:</p> <p>Timeliness</p> <ul style="list-style-type: none"> • That OPEX is considered within an appropriate amount of time. <p>Value</p> <ul style="list-style-type: none"> • That the threshold for information that is considered in the OPEX programme is adequate. • That the sources being considered within an OPEX programme are adequate. • That OPEX is being stored appropriately. <p>Quality</p> <ul style="list-style-type: none"> • That the appropriate amount of information is being provided in an OPEX report.

<p>Group 2 – Processing OPEX information</p>	<p>This group should focus on developing measures and tools that apply to the processing of OPEX information once it has been collected. The processing of OPEX information includes the storing and evaluation of OPEX information. The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.</p> <p>The following is provided solely to stimulate conversation on what attributes could be measured to ensure:</p> <p>Timeliness</p> <ul style="list-style-type: none"> · That OPEX is being evaluated in a timely manner. <p>Value</p> <ul style="list-style-type: none"> · That the criteria for screening an item for further evaluation are appropriate. <p>Quality</p> <ul style="list-style-type: none"> · That OPEX is stored in a retrievable manner. · That effective evaluation of an OPEX issue has taken place. · That an effective outcome/application from the evaluation of an OPEX issue has been proposed.
<p>Group 3 – Assessing outcomes of OPEX programmes</p>	<p>This group should focus on developing measures and tools that assess an organisation's effectiveness in implementing OPEX initiated activities. Within this area, the measures and tools should specifically review the effectiveness of:</p> <ol style="list-style-type: none"> 1. The communication of OPEX. 2. The effectiveness of OPEX on regulatory oversight and requirements. 3. The effectiveness of OPEX on NPP design. The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality. <p>The following is provided solely to stimulate conversation on what attributes could be measured to ensure:</p> <p>Timeliness</p> <ul style="list-style-type: none"> · That the outcomes from OPEX initiatives are assessed in a timely manner. <p>Value</p> <ul style="list-style-type: none"> · That the value added from OPEX initiatives is worth the cost. <p>Quality</p> <ul style="list-style-type: none"> · That the OPEX initiatives accomplish their purpose.

2.3 Announcement and pre-workshop activities

Workshop announcement

The workshop announcement was transmitted to the NEA member and WGOE associated countries to maximise the results of the workshop by engaging world-wide expertise. This approach was meant to ensure that the results of the workshop could improve the efficiency and effectiveness of the regulatory body and industry the OPEX programmes. The announcement was initially sent out in May 2014 to solicit participation of interested organisations and individuals.

Facilitator training

Prior to the start of the workshop, facilitators and recorders attended a pre-workshop meeting. Each discussion group was led by at least one experienced member of WGOE. During the facilitator training, the

general objectives of the workshop were discussed in more detail to enable the facilitators to guide the discussions in their breakout groups. For each group a set of expectations were given to ensure the outcomes of the different breakout groups would be compatible and to avoid an overlapping of the discussion topics. In addition a reminder was given on the role of a good facilitator, on the importance of the leader's role in guiding the group, and on the various methods required to manage an effective group discussion.

2.4 Overview of workshop

The format of the workshop used a modification of the process that was first applied at the 1992 WGIP workshop that was held in Chattanooga, USA. This format, which has evolved over time through the conduct of subsequent NEA workshops, was also used in the joint WGIP/WGOE workshop that was held in Helsinki, Finland in 2011.

The participants in each of the three discussion groups were decided on in advance to provide a diverse group of backgrounds, opinions, and regions. A facilitator and recorder worked with each group to stimulate and encourage discussions. The discussion groups are identified below:

Identifying/Gathering OPEX							
Breakout session - Group 1							
	First Name	Last Name	Country		First Name	Last Name	Country
	Henk	Van Der Veen	Netherlands		Mandy	Richter	Germany
	Harold	Chernoff	USA		Ryuichi	Ichiki	Japan
	Antonio	Ballesteros Avila	Netherlands		Rachel	Vaucher	France
	Leopold	Vrankar	Slovenia		Lena	Bilde	France
	Mark	Kearney	UAE		Salem	Mohammed	UAE
Processing OPEX information							
Breakout session - Group 2							
	Laszlo	Juhasz	Hungary		Vincent	Crutel	France
	David	Garmon	USA		Oleg	Zakharov	Russia
	Fuming	Jiang	IAEA		Georges	Paci	Belgium
	Yoichi	Ishii	Japan		Mats	Severin	Sweden
	Kenneth	Broman	Sweden		Rami	Laaksonen	Finland
	Miguel	Peinador Veira	Netherlands		Nils-Erik	Setterstal	Sweden
Assessing outcomes of OPEX							
Breakout sessions - Group 3							
	Peter	Corcoran	Canada		Vivek	Piplani	IAEA
	Yves	Van den Berghe	Belgium		Igor	Dymovsky	Czech Rep.
	Didier	Wattrelos	France		Miroslav	Jakes	Czech Rep.
	Benoit	Zerger	Netherlands		Adolf	Khazanov	Russia

	Anita	Gudmundsson	Sweden		Ludwig	Drees	Germany
	Mika	Kaijanen	Finland		Manuela	Gottschall	Germany
	Angelica	Öhrn	Sweden		Lukas	Höhndorf	Germany
	Charles-Henri	Tavel	France		Riccardo	Chiarelli	WANO
Not assigned to any Particular breakout session							
	Ben	Poulet	Canada		Nancy	Salgado	NEA
	Michael	Maqua	Germany				

***Bold are the session facilitators/recorders**

3. OPENING SESSION

The workshop was opened by the WGOE Chair, Benoit Poulet (Canada), who welcomed all of the participants and emphasised the important role of each participant to the success of the workshop.

Prof. Frank-Peter Weiss, Director of GRS also 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.

Nancy Salgado, NEA technical secretariat, also 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.

Riccardo Chiarelli, WANO, highlighted the interest to the topic from the operator's point of view. He discussed shortly the activities of WANO regarding the assessment and sharing of the lessons learned from OPEX. The effectiveness of these activities can be measured by peer reviews of the various NPPs. The results of the peer reviews are fed back to improve the WANO procedures and tools.

In the following days two further presentations were delivered, Ludwig Drees and Lukas Höhndorf presented their work at the Institute of flight system dynamics from the Technical University of Munich titled "Predictive Analysis applied to Flight Operations". The presentation discussed the approach used by the airline industry to improve safety. The scientific methodology uses similar steps than the analysis of nuclear reactor operational safety. This presentation was an interesting preparation to the visit of the institute on Tuesday afternoon.

On Wednesday Wolfgang Preischl reported on the GRS approach to human factors in operating experience feedback titled "Generic Human and Organisational Performance Feedback from Reportable Events in German Plants". In a majority of instances a combination of technical, human and organisational factors (HOF) root causes are contributing to significant events. In order to supplement that activity and to obtain a broader view on HOF root causes over a longer period of time GRS developed a specific methodology evaluating all reported events with such contributions. The presentation briefly described the methodology and provided an overview of the first results.

3.1 Results of breakout group discussions

In accordance with the procedures established by the WGOE, three breakout groups were formed to discuss the different aspects of the workshop topic on OPEX programme effectiveness measures in separate working groups. The members of the groups were selected such that a diversity of views for each of the topics was created. Discussions groups met for separate sessions to review their individual topics. The exchange of ideas and opinions between participants was active and the groups formulated conclusions based on the discussions. The three different topics for the discussions groups were related to measures and tools in the following areas:

- identifying/gathering OPEX;
- processing OPEX information;

- assessing outcomes of OPEX programmes.

3.2 TOPIC 1: Identifying/gathering OPEX

The objectives of the Group were to develop measures and tools for identifying and collecting Operating Experience Feedback information. The proposed measures and tools should be effective in measuring aspects that affect *timeliness*¹, *value*² and *quality*³.

The group consisted of ten experts from seven countries and a representative of the European Clearinghouse. The background of the participants was diverse and included experts from various Regulatory Bodies, from a Technical Support Organisation and a Research Institute.

The group had four meeting sessions in an informal setting. All participants contributed by providing information about the specific situation in their respective countries and by participation in discussions.

The scope of discussions was mainly focused on OPEX programmes of Regulatory Bodies but there was a strong link with OPEX activities from licensees, TSOs, vendors, owner groups and relevant (mostly international) nuclear organisations like WANO, IAEA and NEA.

The following measures were identified to safeguard the adequate identification and gathering of relevant OPEX info:

- Assure the availability of sufficient resources to perform OPEX activities.
- Assure the smooth transfer of OPEX information within the Regulatory Body and with the identified external stakeholders.
- Assure adequate access to relevant OPEX information
 - Nationally
 - § From the NPP's
 - § From TSO's
 - § From others (vendors, owner groups etc.)
 - Internationally
 - § From IAEA
 - § From WANO
 - § From INPO
 - § From JRC Clearinghouse
 - § From vendors, owner groups etc.
 - § Bilateral agreements between countries
- Assure active participation in international OPEX activities (WGOE, IRS, INES, other)

An important issue is the time when reported events are evaluated at the different bodies.

Timeliness

- Timely after reporting of the event;

1. Timeliness: OPEX is considered within an appropriate amount of time.

2. Value: Threshold for information in OPEX programmes is adequate. Sources of information in OPEX programmes are adequate. OPEX is stored appropriately.

3. Quality: Amount of information in OPEX reports is appropriate.

- Timely processing (screening, distribution and evaluation);
- OPEX will follow near term actions to remediate the event.

Value

Threshold of information in OPEX programmes

- Information in OPEX programmes should be prioritised according to its relevance to nuclear safety. The main focus should be on significant events but in appropriate attention should be paid to the lower level of OPEX (e.g. near misses, events involving non-safety systems etc.).

A set of criteria should be in place to categorise the relative importance of events.

- Analysis and reporting of events should result in high quality reports.
- Special attention has to be paid to recurring events and events of a generic nature.

Sources of information within OPEX-programmes⁴

- From the sites:
 - Incident reports from licensees (O)
 - Regular contacts between RB and licensee (telephone, email etc.) (O)
 - Inspections by RB (R)
 - Other reports from licensee
 - § Status reports on plant performance (R)
 - § Reports on OPEX activities (low level events, trending) (Y)
 - § Periodic Safety Reviews (LF)
 - § Conformity Checks (LF)
 - § Outage deviation reports (Y or LF)
 - Other sources (inspection bodies) (R)
- From other sources:
 - IAEA
 - § IRS (O)
 - § INES (R)
 - OECD/NEA
 - § Reports (R)
 - WANO
 - § Events database (O)
 - § Reports (SOER, SER, other) (R)
 - INPO
 - § Events database (O)
 - Clearinghouse

4. Frequency of information: Often (O), Regular (R), Yearly (Y), Less frequent (LF)

- § Newsletters (R)
- § Topical Operating Experience Reports (R)
- Other countries
 - USNRC
 - Information Notices (R)
 - Generic Letters (R)
- § GRS
 - Weiterleitungsnachrichten (German Information Notices) (R)
- Owners groups (reports, studies) (R)
- Vendor reports (service levels, Part 21-defects, maintenance notes) (R)
- Research institutes (reports) (R)
- Media (mostly of low quality, but often very timely) (O)

3.3 TOPIC 2: Processing OPEX information

The objectives of the Group were to develop measures and tools to assess whether Operating Experience Feedback information is processed effectively after it is received. The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The group consisted of 12 experts from eight countries and a representative from each of the IAEA and JRC. The background of the participants was quite diverse and included experts from various Regulatory Bodies, from licensees and from international institutions.

The group had four meeting sessions in an informal setting. All participants contributed by providing information about the specific situation in their respective countries and by participation in discussions.

The initial discussions set a frame to set priorities for the review and analysis of incoming OPEX information which should be screened according to the following attributes:

- Significance
- Applicability
- Difficulty of an Evaluation
- Time for initial screening
- Time for detailed analysis.

The evaluation of the significance of OPEX information should take into account the following:

- Impact on analysed accident sequences
- Real/Potential safety consequences
- Affected Equipment/Procedures
- Affected safety functions/Barriers.

The group highlighted as a good practice the assessment of OPEX regarding its relevance to probabilistic safety analyses and precursor analyses.

Following the screening the next step in the OPEX information process is the determination of the causes (i.e. root causes and contributing causes). These cause analyses should be performed using generally accepted methods. The analysts should have been adequately trained in the applied method(s).

The cause analyses are also relevant for the investigation of pre-event activities (e. g. human factors, operations and maintenance).

One of the most important challenges to the processing is the lack of information on the specific event. The investigators should develop a process to cope with this generic difficulty to get the best benefits from their analyses. It is considered as a good practice, if the evaluation also covers near misses and similar events in other NPPs.

An event analysis should have a high priority when all of the important attributes mentioned above (i.e. significance, applicability, difficulty of evaluation) are present. When some of these attributes seem not to be fully met, the event analysis should have a medium priority. In cases where some of the attributes are missing (or are very weak) the analysis should be attributed a low priority.

Further general attributes of good OPEX processing comprise adequate resources, high qualification of involved OPEX personnel, and the involvement of the NPP management.

The screening process starts with the initial review of the event information. This needs competent (dedicated, diverse backgrounds) reviewers, following established screening criteria for significance [i.e. INES (International Nuclear and radiological Event Scale), PRA (Probabilistic Risk Assessment)/PSA (Probabilistic Safety Assessment) ...]. The screening process finishes with setting the priorities for the further investigations.

The analysis step in OPEX processing is primarily based on the event description that should include the initial condition of the plant, the chronology of the event and a clear description of the related safety concerns.

The following step in the process is the evaluation of the safety significance. This includes the impact on analysed accident sequences, the determination of real/potential safety consequences, investigation on the affected equipment and/or procedures, the evaluation of the affected safety functions or barriers. The group considers it as a good practice when probabilistic assessments are included in the evaluation of safety significance (e.g. PSA and precursor analyses).

The evaluation of the event causes, root causes and contributing factors completes the analysis. It is recommended to use generally accepted analysis methods and to take into account relevant pre-event activities related to e.g. human factors, operations and maintenance.

The major challenge is to complete an adequate analysis despite a potential lack of information. It is usual for the analysis to have to be conducted before all of the event information is available. This often affects the more safety significant cases. A further step in the processing of OPEX information is represented by the response to the results of the analyses (e.g. organisational learning, corrective actions, etc.). The corrective actions should be Specific, Measurable, Achievable, Realistic, and Timely (SMART). Implementation plans should include a prioritisation of recommended actions and these plans should account for risks associated with the implementation of recommended actions. It is necessary to direct the corrective actions toward the appropriate audience.

The generic lessons learned are important for all NPPs and regulators which are not directly affected by the event. These have to be drawn from the analyses and should include the specific messages to be sent to the key stakeholders.

The storage of OPEX information is considered as the final step of the analysis process. Most regulators and licensees prefer a centralized storage for OPEX information. Within the design of such a database the following should be considered:

- Track items as necessary
- Storage and ability to attach and reference related files
- Systematic code word to facilitate information organisation and retrieval

- Capability of trend analysis
- Search functions
- Stakeholders access
- Information directed to appropriate stakeholder
- Storage scheme support timeliness goal
- User-friendly structure
- Training for use
- Clear ownership of the overall process

Some of the items listed will not have the same solutions. As examples, a regulator might allow access to their event database to the public or vendors. In these cases, a filtered version of the database should be established to ensure only information that is intended to be released to a certain population is accessible by that population.

The final results of the working group discussions focus in recommendations developed regarding the timeliness of initial screening and the detailed analysis, the balance between resources and outcomes, and the quality of the analysis.

3.4 TOPIC 3: Assessing outcomes of OPEX programmes

The overarching goal of Group 3 was to verify whether an OPEX programmes is effective in implementing OPEX initiated activities. The group consisted of 16 representatives from national regulators, technical support organisations, licensee operators, and international organisations (IAEA, WANO, and EU JRC). The main objectives should cover the development and proposal, respectively, of measures and tools to assess the outcomes of OPEX programmes.

The Group defined “outcomes” as followed:

Outcome(s): An effective OPEX Programme in terms of communications, impacts on facility design and NPP operational safety and regulatory oversight effectiveness.

Major attributes are characteristics and qualities that constitute an effective OPEX programme. These attributes are achieved by “measures” that means actions and/or activities to be taken by organisations (national regulators and licensees). The term tool was defined by group 3 as methods or metrics by which one might measure or assess effectiveness of OPEX programmes.

Having arrived at the definitions above, the group undertook to establish, in logical order, the attributes of an effective OPEX programme, the measures to achieve these attributes, and the tools that could be used to verify these measures are being effective. Due to the mixed composition of the group, the attributes identified relate well to the Regulatory Body, TSO and licensee OPEX programmes.

Having settled upon the approach, the Group considered each of the items above in logical order, beginning with brainstorming to produce attributes, then refining these in small groups and validating them in a plenary session of the Group.

Once the attributes were agreed, the Group worked as a team to propose measures and suggest ways that we might try to demonstrate that these measures were in place and/or gauge their effectiveness.

Some attributes gave rise to several measures and some measures gave rise to more than one metric. Rather than debate the value of any of these, and in consideration of the limited time at the workshop, all were included for consideration by the readers as options for measuring success.

Recognising that all attributes might not have measures and all measures might not have metrics, the facilitators nevertheless felt that these might still be desirable for reasons the group might not have

identified. Therefore the group decided to keep these so others might consider them and might even find measures and metrics for them.

The summary of those discussions on suggested/proposed measures and metrics/tools resulted in the table (see below) as well as the slides for Group 3 as presented at the workshop. The group presented them as a table to the full plenary of the Workshop in hopes that the participants and future readers would have concrete suggestions for consideration in their specific cases.

Some further issues can be found at the end of the table.

OPEX programme managers should look, in a systematic way, at those outcomes that define an effective OPEX programme and seek to develop

- i. attributes,
- ii. measures and
- iii. metrics or tools, which can be used to gauge progress on the attainment of these outcomes.

OPEX programme managers need to seek feed-back from end-users on whether the programme and its lessons learned are helping to improve the NPP operational safety and/or the effectiveness of regulatory oversight.

COMMUNICATION OF OPEX		
Attributes	Measures (How to do this)	Metrics (How to measure) and Tools
Timely communication of OPEX by licensee to regulator [Licensee OPEX programme]	Monitor completion of event notifications (like Licensee Event Reports (LERs))	Ratio of completed LERs within allowed time delay by quarter/year and by licensee/site Average reporting time by the licensee for events
Timely communication of OPEX by regulator to different stakeholders for information or evaluation [RB/TSO OPEX programme]	Clear timeline and point of contact (PoC) expectations for all forms of communication (Letters, Notices, Info Bulletins from Regulator to licensees; information of other stakeholders, ...)	Average time delay to report event(s) to stakeholders (licensees, IRS...)
Communication should clearly and concisely identify the issue of concern and put it in the proper perspective [RB/TSO OPEX programme]	Clear procedures are communicated through notices and training of staff	
	Use, to the extent possible, clear, consistent terminology and nomenclature	Feedback from trainees that the terminology and nomenclature are understood
	Clearly identify the issue, the safety significance and the response expected	Feedback loop
Transparency	Systematic, documented decision-making process for accessing lessons learned and recommendations	Confirmation that process is in place and being used
Communication should be effectively targeted to the (right) audience (within the regulator and the licensee): <ul style="list-style-type: none"> • Decision-makers • End users • Technical specialists • Inspectors [Licenses and RB/TSO OPEX programmes]	Communicate with stakeholders directly, in meetings and through safety and technical groups	Feedback loop

COMMUNICATION OF OPEX (Cont.)		
Effective sharing of OPEX with licensees [RB/TSO OPEX programme]	Share OPEX with stakeholders	No. of OPEX letters, info notices, bulletins issued by quarter/year
Effective sharing of OPEX information through international reporting systems [Licensee and RB/TSO OPEX programmes]	Share OPEX with nuclear regulators in other countries	No. of national events reported to international bodies (IRS, FINAS, IRSRR, WANO, etc.) Ratio of events (of total significant national events) reported internationally.
Effective sharing of OPEX information through wider collaboration [Licensee and RB/TSO OPEX programmes]	Share OPEX information with non-nuclear regulators, standards associations, vendors and manufacturers	No. of events and OPEX information shared with other organisations. No. of OPEX information items received from other organisations.
	Leverage opportunities to meet and share OPEX/lessons learned among concerned organisations	No. of meetings, conferences, working groups, etc. attended where OPEX is shared.
IMPACT ON THE DESIGN AND SAFE OPERATION OF POWER REACTORS (NPPs)		
Attributes	Measures (How to do this)	Metrics (How to measure) and Tools
Maintain knowledge of OPEX and lessons learned over the long term [Licensee and regulator/TSO OPEX programmes]	Develop an effective knowledge management database for OPEX with <ul style="list-style-type: none"> • Ease of access • Flexibility for expansion (new discoveries) • Ability to preserve data over time (keep important lessons current (top of mind)) 	Feedback loop
Avoid recurrence of events [Licensee OPEX programme]	Highlight the recurring events	No. and trend of recurring events over an appropriate time interval
Correctly identifies the safety significance and root cause(s) [Licensee OPEX Programme]	OPEX management committee to review the safety significance and root cause analyses	No. of incorrectly analysed events
Follow-up of timely completion of Corrective Actions (CAs) [Licensee OPEX programme]	Monitor the completion of CAs Develop a process that confirms that CAs were completed in due time	No. of CAs completed on time No. of CAs opened per quarter No. of CAs closed per quarter No. of CAs remaining open per quarter (carry over)
Reviews appropriateness of Corrective Actions [Licensee OPEX programme]	Monitor the frequency of CAs management Review Committees (licensees)	Monitor the impact of corrective actions on conditional core damage frequency (CCDF) No. of CAs deemed by the OPEX review committee to be incorrectly identified/coded for cause(s), root cause and follow-up action
Evaluates the effectiveness of corrective actions [Licensee OPEX programme]	Develop a process for evaluating the effectiveness of corrective actions in addressing root cause(s) Monitor recurrence of identified root causes of events	No. and trend of recurring root causes
Implementation by licensees of regulatory requests arising from OPEX [RB OPEX programme]	An effective process to monitor corrective actions in response to regulatory requests Track open regulatory action items arising from OPEX	Peer- reviews (IRRS, WANO) No. of open regulatory requirements No. of national event reports which led to regulatory action on the licensee; No. of international event reports which led to regulatory action on the licensee

IMPACT ON THE DESIGN AND SAFE OPERATION OF POWER REACTORS (NPPs) (Cont.)		
Timely completion of regulatory action items arising from OPEX [RB OPEX programme]	Track timeliness of completion of regulatory action items arising from OPEX	Average time to completion of action items per quarter or per year
Identifies the appropriate timeline and level of responsibility	Regulatory body may decrease the time to complete CAs, to avoid recurrence of events	No. of letters from the regulatory body to reduce the timeline for the CA plan
Shares best practices	Share info among like-minded, interested bodies	(see Communications for metric)
Implements best practices	Regulator is effectively implementing OPEX lessons learned	No. of enforcement letters sent to licensees resulting from OPEX No. of national event reports which led to regulatory action on the licensee No. of international event reports which led to regulatory action on the licensee
Licensees take appropriate action with respect to documented OPEX recommendations	Track events that could have been avoided if licenses effectively implemented regulatory recommendations and guidance (from OPEX)	No. of instances (events, inspection findings, etc.) where OPEX guidance was not followed or adhered to
REGULATORY OVERSIGHT EFFECTIVENESS		
Attributes	Measures (How to do this)	Metrics (How to measure) and Tools
OPEX forms important input to inspection programmes, technical analysis, regulatory review, and new regulatory requirements	Track open regulatory action items arising from OPEX	Number of open regulatory actions
OPEX should be part of the core training for staff	To verify that OPEX is included in the training of staff	Verify
Regulatory OPEX programme should not only be reactive but focus on precursors and low level events	Systematic review / inspection of licensee's program for inclusions of precursors and low level events	Number of such inspections
Makes effective use of available resources	Measure of Resources spent on OPEX programme (time/money/effort)	Number / % of person-days (time accounting system...), costs
OTHER ISSUES (Parking lot) –These were felt to be not in scope or were perhaps part of the scope of Groups 1,2		
Attributes	Measures (How to do this)	Metrics (How to measure)
Group 2?	Internal review of appropriateness	No of events that generate tech analysis and/or regulatory recommendations
		No. or % of national reports for which in-depth technical analysis is performed No of events (from LERs) analysed per quarter No of international events analysed per quarter
Group 2?	Internal review of quality	No. of reports that were corrected by the OPEX review committee
Group 2?	Clear rationale for corrective actions (CAs)	Rationale for CAs should be clearly documented and understood

4. CLOSING PLENARY SESSION

4.1 Workshop closing remarks

Michael Maqua from the hosting organisation and Vice-Chairman of WGOE led the workshop closing session. In his presentation he provided an overview of the breakout group discussions held during the workshop on the three topics, using operating experience in

- identifying/gathering OPEX;
- processing OPEX information; and
- assessing outcomes of OPEX programmes.

The focus of his presentation was on the conclusions, commendable practices, and challenges identified during the breakout group discussions.

The main findings for the first breakout group related to identifying/gathering OPEX were related to criteria for measurement of distribution of information, required reporting including required reporting quality, and the regulatory follow-up for significant events.

The second working group dealt with the processing of information related OPEX. The main conclusions are related to the timeliness, the value, the quality, the analysis, and further generic aspects in the OPEX process. Such a generic challenge is the lack of information that might stop the cause analysis before all underlying causes are identified.

The third working group developed and proposed measures and tools to assess the outcomes of OPEX programmes related to communications, its impact on NPP design and operational safety, and on the regulatory oversight effectiveness. For all steps attributes, measures, and metrics were identified. For most of the areas, attributes, measures, and metrics were identified, however few gaps were identified in some of the areas where improvements could be made. For example, metrics regarding transparency and OPEX databases could be an area for further improvement.

5. GENERAL WORKSHOP CONCLUSIONS

The following conclusions emerged from the workshop and provide an overview of the effectiveness measures and commendable practices identified by the participants during the workshop. The workshop conclusions and commendable practices are based on workshop discussions which might not reflect a consensus opinion of all NEA member countries. Nevertheless, these can be utilised as a general benchmark for basic comparisons in those areas shared by OPEX experts from NEA member countries.

Tools and criteria were identified for various steps of OPEX programmes. Few missing tools or verification measures were detected. Specific criteria were developed to measure effectiveness. That means that major parts of existing OPEX programmes could be assessed with respect to their process effectiveness. OPEX programme managers should systematically review the outcomes that define an effective OPEX programme and apply the appropriate metrics or tools. OPEX programme managers should develop the programme and assess its impact on NPP operational the effectiveness of regulatory oversight.

Based on the working group discussion following generic recommendations were derived:

- The missing tools and measures identified during the discussion should be developed for further enhancement of the OPEX process.
- These should be considered to address missing verifications in the OPEX programmes review tools like self-assessment, peer reviews, international missions.
- Collaboration with non-nuclear industry and regulators on OPEX should be increased.

Overall the workshop provided an effective means for the participants to share their knowledge and insight on OPEX programme and process effectiveness. A number of commendable practices were identified that the participants were encouraged to take back to their home organisations with the goal of enhancing their own OPEX processes and to improve nuclear safety oversight, to better capture and share OPEX information within their own organisations and the broader international community.

A special thank was expressed to all of the presenters, working group facilitators, and the research institutions in the neighbourhood of GRS Munich that opened their laboratories for the technical visits. The planning and organisation of the workshop by GRS was excellent and it greatly contributed to the success of the workshop.

6. WORKSHOP EVALUATION FORM RESULTS

6.1 Evaluation form

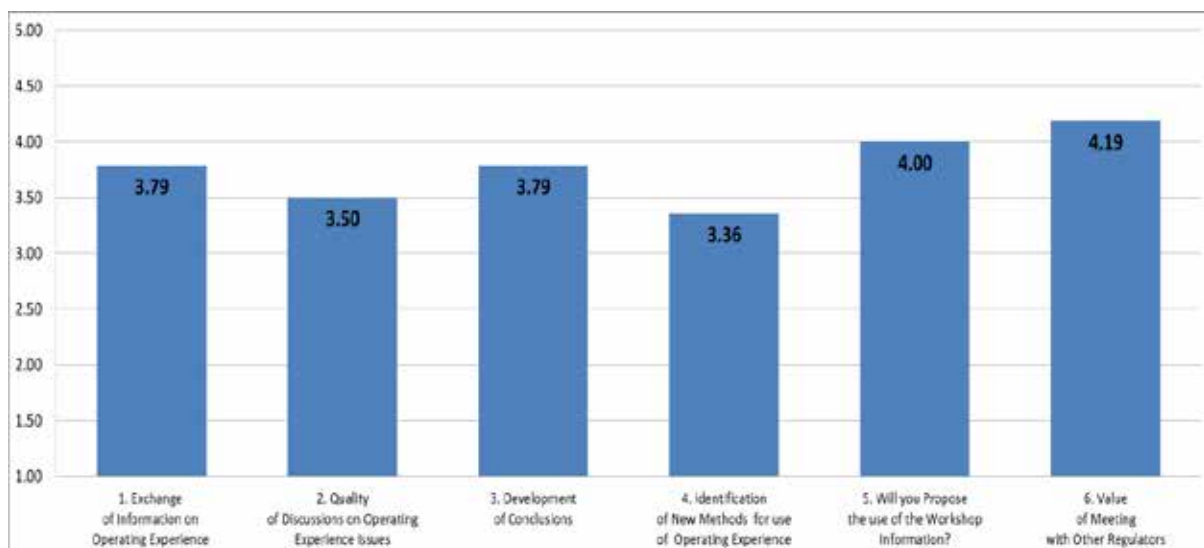
All participants at the workshop were requested to complete an evaluation form. The results of this questionnaire summarised below, are utilised by WGIP in setting up future workshops and to look at key issues for in the programme of work over the next few years. Of the 43 total participants 28 responses 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 (which also reflect scores from the previous workshops - for comparison purposes) along with a brief written summary.

6.2 General

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

Garching September 2014 workshop: General survey questions: Q1-6



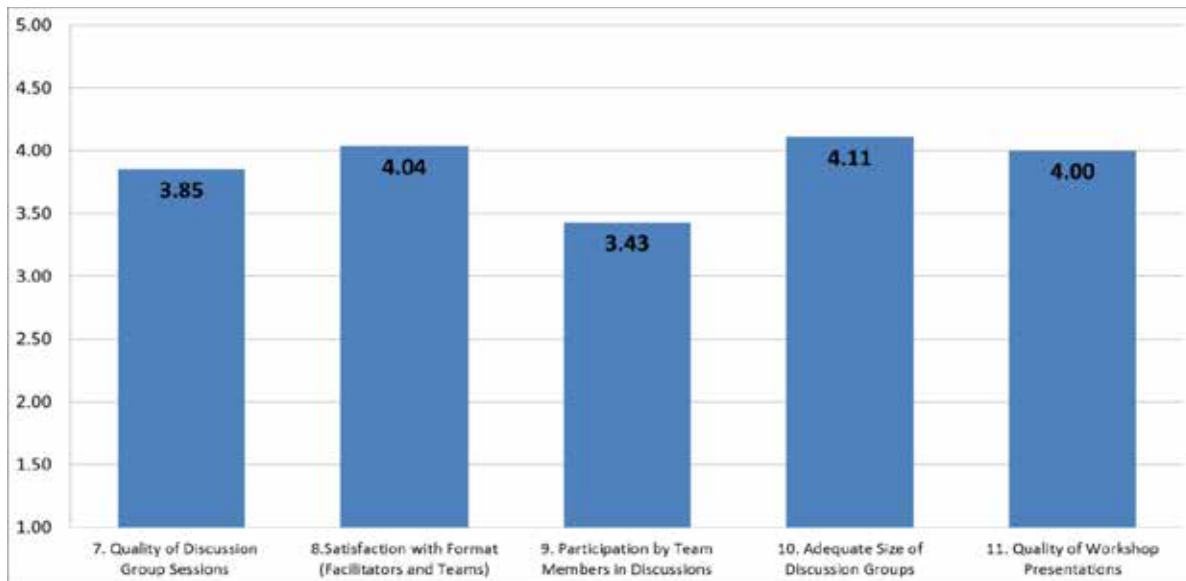
These responses to the general survey questions indicate that overall, there was general satisfaction with the conduct of the workshop. Most of the participants valued meeting with other regulators to discuss their operating experience and inspection programmes (average 4.19, with a range of responses 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 3.50, with a range of responses from 2 to 5, and an average 3.79, with a range of responses from 2 to 5, respectively). Development of conclusions (average 3.79, with a range of responses from 2 to 5) and identifying new methods for using operating experience (average 3.36 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 4.00, with a range of responses from 2 to 5).

6.3 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.

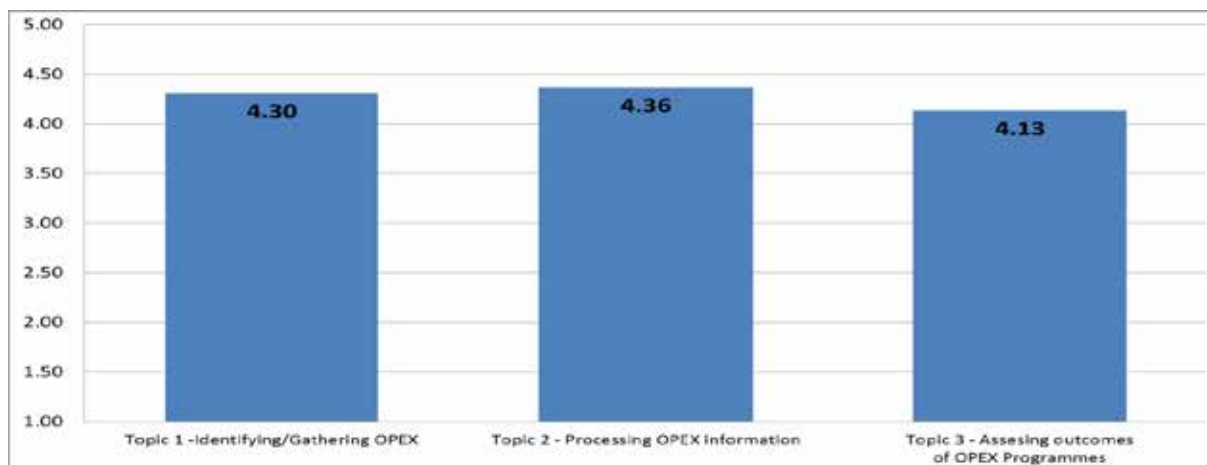
Garching September 2014 WGOE workshop: Format effectiveness: Q7-11



Comparing these WGOE results with the previous the workshop in Helsinki, Finland in 2011 finds very similar result ranges. They confirm that WGOE members continue to be more efficient in preparing and running a workshop. The success of each workshop is dependent on good preparation by the WGOE and co-ordination between the facilitators and recorders for each topic. As discussed in previous proceedings, social interaction outside the workshop sessions clearly enhances the discussions.

6.4 Workshop Topics

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



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

6.5 Future workshops

Workshop participants who responded were unanimous in endorsing future workshops. The results also showed that most participants also agree with the existing format regarding the number of topics and the length of the workshop.

6.6 Suggested future topics

Participants were asked to provide their input on potential future topics. While no specific analysis was applied to the results, WGIP and the CNRA will evaluate these and use them in proposing topics for future workshops. The topics that were ranked as the highest priority (randomly listed) include:

- Safety Culture
- Maintenance related to OPEX
- Measuring Effectiveness
- Information exchange on the setup of countries OPEX-programmes
- Categorisation of events
- Deployment a regular OPEX programme review service (to supplement IRRS OPEX reviews) across all regulators
- What are the criteria to declare an event as significant?
- Continue work on the same topic (OPEX programme effectiveness measures)
- Performance indicators for OPEX programmes in regulatory body
- Connective Actions Evaluation/Effectiveness

6.7 Additional comments received

Additional feedback from participants is provided below:

- I suggest sending a questionnaire prior to the workshop, it helps specify the topics and it forces participants to start reflexion.
- Organise training to be more effective in facilitating breakout sessions.
- Provide computers/laptops with English version of Word and PowerPoint and connectable to a beamer.
- Location of workshop was good.
- Size of the groups should be no more than eight or nine persons.
- Format is ok=> However, ensure that facilitators are moderators and that they do not dominate group work
- Need more time for discussion of group's results.
- Participants may be asked to come prepared in advance and/or to give inputs prior to the future workshops.
- Presentations were interesting and gave a "break".

7. LIST OF PARTICIPANTS**BELGIUM**

PACI Georges
VAN DEN BERGHE Yves

TRACTEBEL
BEL V

CANADA

CORCORAN Peter
POULET Benoit

Canadian Nuclear Safety Commission
Canadian Nuclear Safety Commission

CZECH REPUBLIC

DYMOVSKY Igor
JAKES Miroslav

State Office for Nuclear Safety
State Office for Nuclear Safety

FINLAND

KAIJANEN Mika
LAAKSONEN Rami

Radiation and Nuclear Safety Authority (STUK)
Teollisuuden Voima Oyj

FRANCE

BILDE Lena
CRUTEL Vincent
TAVEL Charles-Henri
VAUCHER Rachel
WATTRELOS Didier

Institute for Radiological Protection and Nuclear Safety (IRSN)
IRSN
French Nuclear Safety Authority (ASN)
ASN
IRSN

GERMANY

DREES Ludwig
GOTTSCHALL Manuela
HÖHNDORF Lukas
MAQUA Michael
PREISCHL Wolfgang
REHR Josephine
RICHTER Mandy
WEISS Frank-Peter

Institute of Flight System Dynamics
GRS
Institute of Flight System Dynamics
GRS
GRS
Sicherheit und Zertifizierung (ESN)
ESN
GRS

HUNGARY

JUHASZ Laszlo

Hungarian Atomic Energy Authority

JAPAN

ICHIKI Ryuichi
ISHII Yoichi

Japan Nuclear Safety Institute
Nuclear Regulation Authority

NETHERLANDS

VAN DER VEEN Henk Ministry of Infrastructure

RUSSIA

KHAZANOV Adolf Scientific and Engineering Centre for
Nuclear and Radiation Safety (SECNRS)
ZAKHAROV Oleg SECNRS

SLOVENIA

VRANKAR Leopold Slovenian Nuclear Safety Administration

SWEDEN

SEVERIN Mats Forsmarks Kraftgrupp AB
BROMAN Kenneth Swedish Radiation Safety Authority
GUDMUNDSSON Anita Ringhals AB Vattenfall
ÖHRN Angelica Swedish Radiation Safety Authority
SETTERSTAL Nils Erik Oskarshamm

UNITED ARABS EMIRATES

KEARNEY Mark Federal Authority for Nuclear Regulation (FANR)
MOHAMMED Salem FANR

UNITED STATES OF AMERICA

CHERNOFF Harold Nuclear Reactor Regulation (NRC)
GARMON David NRC

INTERNATIONAL ORGANISATIONS

BALLESTEROS-AVILA Antonio European Commission (EC)
PEINADOR VEIRA Miguel EC
ZERGER Benoit EC
JIANG Fuming International Atomic Energy Agency (IAEA)
PIPLANI Vivek IAEA
CHIARELLI Riccardo World Association of Nuclear Operators (WANO)
SALGADO Nancy Nuclear Energy Agency

8. RECENT WGOE AND RELATED-CNRA REPORTS

[NEA/CNRA/R\(2015\)1](#) Update of the use of International Operating Experience Feedback for Improving Nuclear Safety

[NEA/CNRA/R\(2014\)1](#) WGOE Report on Fukushima Daiichi NPP Precursor Events

[NEA/CNRA/R\(2012\)3](#) International Operating Experience Workshop Proceedings, Helsinki, Finland, 14-16 June 2011

[NEA/CNRA/R\(2012\)3/ADD1](#) WGOE Workshop Proceedings: Utilising Operating Experience in Regulatory Inspection Programmes and Appendix

[NEA/CNRA/R\(2012\)1](#) WGOE Report: Maintaining and Transferring Knowledge on Operating Experience

[NEA/CNRA/R\(2011\)9](#) Operating Experience Report: Counterfeit, Suspect and Fraudulent Items (CSFI)

[NEA/CNRA/R\(2011\)8](#) Status of Country Regulatory Response to the Forsmark-1 Event 25 July 2006 and CSNI DiDELSYS Task Group Report Recommendations

[NEA/CNRA/R\(2011\)6](#) Operating Experience Report: Recent Failures of Large Oil-Filled Transformers

[NEA/CNRA/R\(2011\)5](#) Operating Experience Report: Investigating Trending Utilising the International Database

[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)

These reports, as well, as all CNRA reports are available online at:

<http://www.oecd-nea.org/nsd/docs/indexcnra.html>

APPENDIX A: WORKSHOP PROGRAMME

OECD Nuclear Energy Agency Committee on Nuclear Regulatory Activities (CNRA) Working Group on Operating Experience (WGOE) International Workshop on Operating Experience Programme Effectiveness Measures 8-10 September 2014 Garching, Germany Hosted by the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS)		
Day 1, September 08	Schedule	
Topic	Time	
1 st Session		Main Conference Room
Opening remarks by Prof. Dr. Weiss, GRS, and Mr. Benoit Poulet, WGOE Chair	10:00-10:15	
The importance of OPEX programmes CNRA welcome remarks, Kai Weidenbrück, BMUB, Germany	10:15-11:00	
Coffee Break	11:00-11:15	Lobby
Developing and managing effective lessons learnt and continuous improvement programmes Riccardo Chiarelli WANO	11:15-12:15	Importance of OPEX programmes
Lunch Break	12:15-13:45	Restaurant of the Hahn-Meitner-Institute
Introduction to the workshop topic Dr. Michael Maqua, GRS	13:45-14:30	Developing and managing effective lessons learnt and continuous improvement programmes
Breakout session guidance and Coffee Break	14:30-15:00	Lobby
Breakout session	15:00-16:45	Main Conference room and 2 further meeting rooms
Day one wrap-up	16:45-17:00	Main Conference Room

Day 2, September 09		
Opening remarks	09:00-09:15	Main Conference Room
Predictive analysis applied to flight operations Lukas Höhdorf M.Sc., Institute of Flight System Dynamics, Technische Universität München	09:15-10:00	
Coffee break	10:00-10:30	Lobby
Breakout session	10:30-12:00	Main Conference room and 2 further meeting rooms
Lunch	12:00-13:30	Restaurant of the Hahn-Meitner-Institute
Breakout session	13:30-15:30	Main Conference room and 2 further meeting rooms
Coffee break	15:30-16:00	Lobby
Break	16:00-17:30	<ul style="list-style-type: none"> · Institute of Flight System Dynamics · Max Planck Institute for Plasma Physics (fusion reactor research) · GRS Analysis Simulator
Evening reception	Hofbräuhaus	
Day 3, September 10		
Welcome remarks	09:00-09:15	Main Conference Room
Breakout session	09:15-10:45	Main Conference room and 2 further meeting rooms
Coffee Break	10:45-11:15	Lobby
Groups – preparation of the presentations	11:15-12:30	Main Conference room and 2 further meeting rooms
Lunch	12:30-13:30	Restaurant of the Hahn-Meitner-Institute
Human factor research in GRS Wolfgang Preischl, GRS	13:30-14:00	Main Conference Room
Presentation and discussion of working group results	14:00-15:00	Main Conference Room
Closing remarks by Benoit Poulet, WGOE Chair	15:00-15:30	Main Conference Room

APPENDIX B: PRESENTATIONS

B.1	Highlights from opening address	47
B.2	Developing and managing effective lessons learnt and continuous improvement programmes	51
B.3	Introduction to the workshop topic	59
B.4	Predictive analysis applied to flight operations.....	71
B.5	Generic human and organisational performance feedback from reportable events in German plants	81
B.6	Information collection	89
B.7	Processing OPEX information	93
B.8	Effective OPEX programs.....	99
B.9	Conclusion of the workshop results	103
B.10	WGOE International Workshop on Operating Experience Programme Effectiveness Measures Facilitators' Training	111

WGOE International Workshop on Operating Experience Program Effectiveness Measures

Highlights From Opening Address

September 8, 2014 - Garching, Germany

The Importance of OPEX Programs

- OPEX Programs are mentioned in 16 CNRA Green Booklets
- OPEX Programs are Cross-cutting:
 - Improvements (backfit) to safety systems
 - Improved operator training
 - Improved procedures
 - Improved inspection and maintenance practices
 - Improved emergency response
 - Improved regulatory framework
 - Improvements in many other areas...

OPEX Program Concerns

- Lessons may be learned but they may also be forgotten or lost over time.
- Response to information learned from the experience of others may be insufficient and/or ineffective.
- There may be tendency to consider foreign operating experience as not being relevant to one's own program or situation.
- OPEX is not always reported in a timely manner.

OPEX Program Challenges

- OPEX Programs are complex
- OPEX Activities are diverse and may require several types of expertise.
- Implementation of OPEX lessons learned can be very difficult and may take several years.
- There are many Organizations that operate OPEX Programs.
- The effectiveness, benefits, and value of OPEX Programs are not easily demonstrated.

**WGOE International Workshop on
Operating Experience Program
Effectiveness Measures**

September 8, 2014 - Garching, Germany




Developing and Managing Effective Lessons Learnt and Continuous Improvement Programmes



Riccardo Chiarelli, WANO OE Team Leader
International Workshop on Operating
Experience Programme Effectiveness Measures
08 September 2014



This is WANO



The logo for WANO's 25th anniversary, featuring the number '25' in a large, stylized font, with 'YEARS OF' written below it. Underneath are two globes and the acronym 'WANO' with the years '1989-2014' at the bottom.

WANO Mission

To maximise the safety and reliability 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.



A large, faint watermark of the WANO logo is visible in the background of the slide. It consists of the letters 'W', 'A', 'N', and 'O' in a large, spaced-out font, with a globe behind them.

Membership



WANO membership lets industry professionals focus on one goal: excellence in nuclear safety

Membership is voluntary and every nuclear power plant across the globe is a member.

- q Operating companies
- q Owners
- q Others with significant impact on nuclear safety

More than 130 members work together to achieve the best possible safety standards.



Interactive WANO Member World Map available at www.wano.info

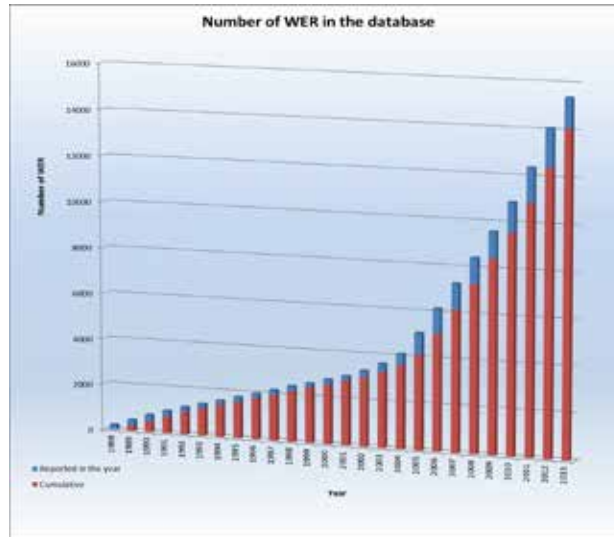
Operating Experience (OE)



The OE programme provides members with the opportunity to learn from events at other plants.



Event reported to WANO



OE in WANO



- q SOER – Significant Operating Experience Reports
- q SER – Significant Event Reports
- q JIT – Just-In Time
- q Analysis Reports
- q CEO updates
- q Hot topics



Precursors



In 2013, around 50% of the significant and noteworthy events* could have been prevented, or their consequences reduced, if the lessons learned provided in WANO SOERs or SERs.

“However, we don’t know what we prevented, we’ll only know when we were unsuccessful!”

J. Hurst, Former WANO OE Team Leader

* reported to WANO

Examples – Severe weather



The Fukushima effect



- q Public & political confidence shaken in some regions
 - q Japan, Germany
- q Momentum returning in others
 - q China, India
- q WANO looked hard at itself
 - q Post Fukushima Commission Report
 - q 5 strategic responses
 - q 12 projects

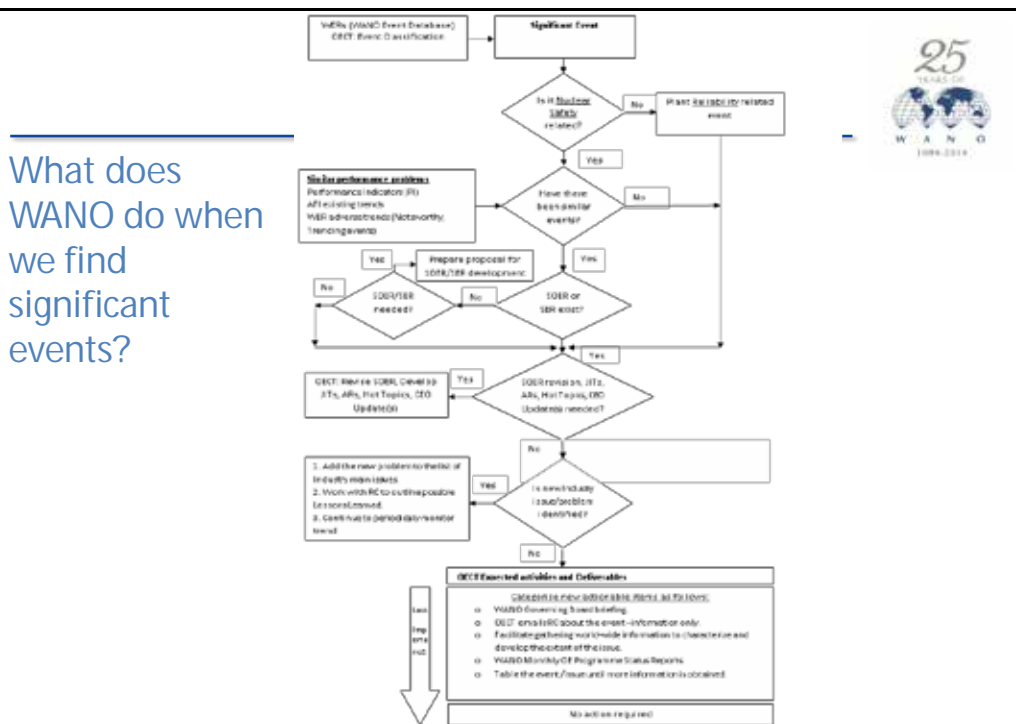


What can OE do?



- q WANO OE: Effectively helping members to increase their OE effectiveness

- q Focus on low level events: There is evidence that low level events are precursors for more significant events. Actions to correct these low level events can help prevent these turning into significant events.



OE Effectiveness

- q SOER recommendations are checked at every PR
- q All events received are screened for significance and recurrence
- q Significant events are screened periodically for further actions
- q Involvement of senior management is reinforced
- q Trends are continuously monitored through the database



Thank you for listening

For more information please visit
www.wano.info



Working Group on Operating Experience (WGOE)

WGOE International Workshop on Operating Experience Programme Effectiveness Measures

Introduction to the Workshop Topic

Dr. Michael Maqua, WGOE
Garching, September 08, 2014



Contents

- Workshop Objectives
- Main Expected Results
- Practical Issues

GRS

Objective of the Workshop

The main objectives of the workshop are to provide a forum for the exchange of information on the licensees' and regulators' programmes on OPEX and approaches to assess or even measure the effectiveness of these programmes. Participants will have the opportunity to meet with their counterparts from other countries and organisations to discuss current and future issues on the selected topic. They will develop conclusions and commendable practices regarding the issues and identify methods to help improve their own OPEX feedback and assessment methodologies.

3

Introduction to the Topic – WGOE Workshop, Garching 2014

GRS

Operating Experience Effectiveness – old version

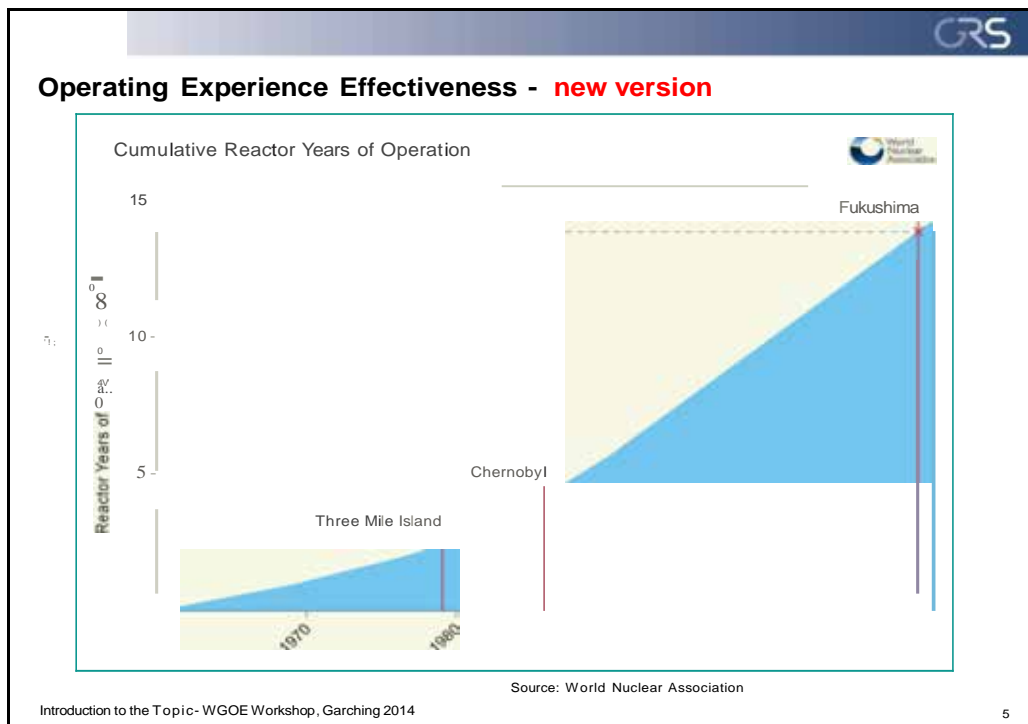
The chart displays the cumulative reactor-years of nuclear power reactors from 1965 to 2005. The y-axis represents 'Cumulative Reactor-Years' from 0 to 14000. The x-axis shows years from 1965 to 2005. Key events are marked with arrows: NRX (1967), SL-1 (1971), BF-1/2 (1975), TMI-2 (1979), and Chernobyl-4 (1986). The cumulative experience grows steadily over time, reaching approximately 13000 reactor-years by 2005.

Figure 1 — Nuclear Power Reactors Operating Experience

Source: PRIS, IAEA

4

Introduction to the Topic – WGOE Workshop, Garching 2014



GRS

Topic Idea

On the 5th meeting on the Convention on Nuclear Safety in April 2011 one participant said:

“We should stop with the Convention, because it was proven that we were not successful.”

The basic intention of the Convention is

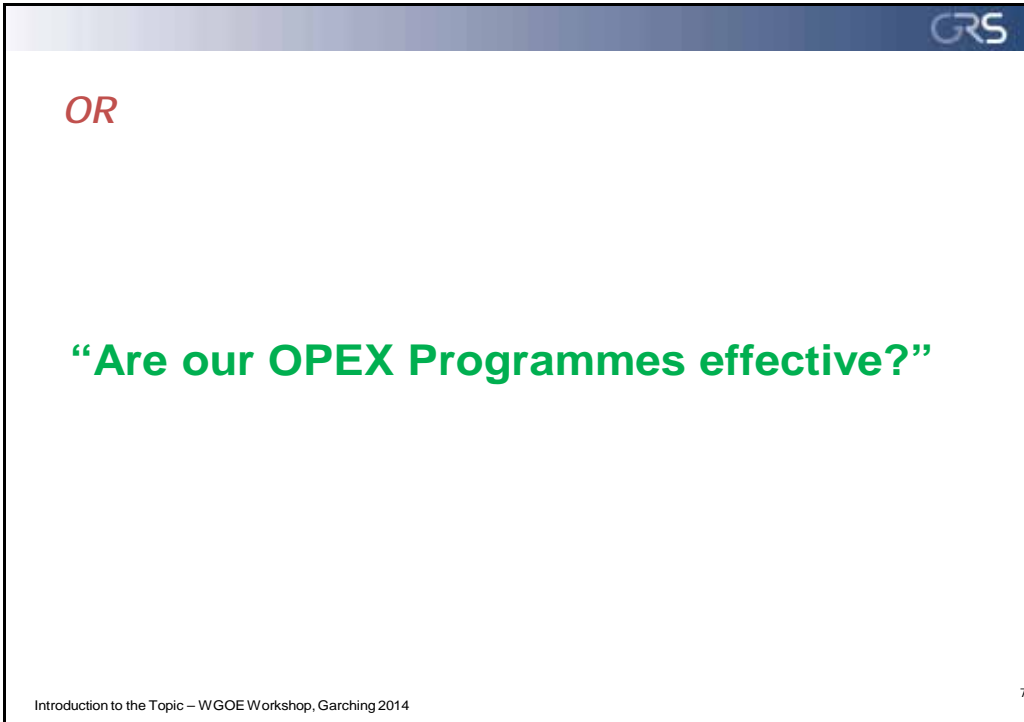
“Never Again”

And this intention was not met.

Even this statement was just provocative, it leads direct to the question:

“Are we performing our operating experience analysis correctly?”

Introduction to the Topic – WGOE Workshop, Garching 2014 6



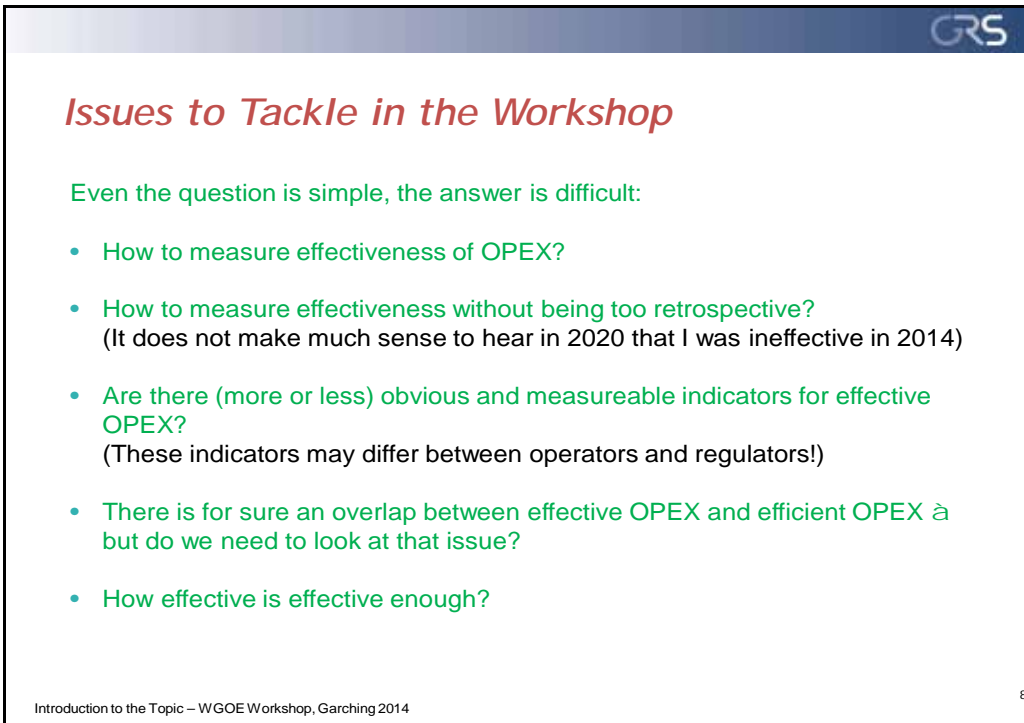
GRS

OR

“Are our OPEX Programmes effective?”

Introduction to the Topic – WGOE Workshop, Garching 2014

7



GRS

Issues to Tackle in the Workshop

Even the question is simple, the answer is difficult:

- How to measure effectiveness of OPEX?
- How to measure effectiveness without being too retrospective?
(It does not make much sense to hear in 2020 that I was ineffective in 2014)
- Are there (more or less) obvious and measureable indicators for effective OPEX?
(These indicators may differ between operators and regulators!)
- There is for sure an overlap between effective OPEX and efficient OPEX à but do we need to look at that issue?
- How effective is effective enough?

Introduction to the Topic – WGOE Workshop, Garching 2014

8



Issues to Tackle in the Workshop

Even the theory is difficult, we cannot close our eyes ...

We have to look for improvement measures:

- Which measures could improve the effectiveness of OPEX programs?
- How can the improvement by these measures be checked?
- Are there predictive tools to assess the influences of new measures?



How to Tackle the Issues in the Workshop


We have few presentation

but

We have sufficient time for discussion among the participants.

We need you to achieve a result!

Therefore we will break into **3 Breakout Groups** to discuss the topic.




Breakout Group (1): Identifying/gathering OPEX

This group should focus on developing measures and tools that apply to the area of identifying/collecting OPEX.

The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The following is provided solely to stimulate conversation on what attributes could be measured to ensure:

11



Breakout Group (1): Identifying/gathering OPEX

Timeliness:
§ That OPEX is considered within an appropriate amount of time.

Value:
§ That the threshold for information that is considered in the OPEX programme is adequate.
§ That the sources being considered within an OPEX programme are adequate.
§ That OPEX is being stored appropriately.

Quality
§ That the appropriate amount of information is being provided in an OPEX report.

12



Breakout Group (2): Processing OPEX information

This group should focus on developing measures and tools that apply to the processing of OPEX information once it has been collected.

The processing of OPEX information includes the storing and evaluation of OPEX information.

The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The following is provided solely to stimulate conversation on what attributes could be measured to ensure:

13



Breakout Group (2): Processing OPEX information

Timeliness

§ That OPEX is being evaluated in a timely manner.

Value

§ That the criteria for screening an item for further evaluation are appropriate.


Quality

§ That OPEX is stored in a retrievable manner.

§ That effective evaluation of an OPEX issue has taken place.

§ That an effective outcome/application from the evaluation of an OPEX issue has been proposed.

14




***Breakout Group (3):
Assessing outcomes of OPEX programmes***

Timeliness
§ That the outcomes from OPEX initiatives are assessed in a timely manner.

Value
§ That the value added from OPEX initiatives is worth the cost.

Quality
§ That the OPEX initiatives accomplish their purpose.

15



***Breakout Group (3):
Assessing outcomes of OPEX programmes***

This group should focus on developing measures and tools that assess an organization's effectiveness in implementing OPEX initiated activities.

Within this area, the measures and tools should specifically review the effectiveness of:

16



***Breakout Group (3):
Assessing outcomes of OPEX programmes***

The communication of OPEX.
 The effectiveness of OPEX on regulatory oversight and requirements.
 The effectiveness of OPEX on NPP design.
 The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The following is provided solely to stimulate conversation on what attributes could be measured to ensure:

17



Main expected outcomes

The goal of the workshop is
 § to identify effectiveness measures and
 § performance assessment tools applicable to
 OPEX programmes.

These measures and tools will be focused on improving
 § the adoption of OPEX-derived safety improvements and
 § overall OPEX programme effectiveness.

18

Expected outcomes from the Breakout Groups

- On Wednesday any Breakout Group should **present** its findings!
- These findings should be laid down in a **presentation** (PowerPoint) (ready at lunch time).
- Selected WGOE representatives will formulate the **general workshop conclusions** on Wednesday noon (during lunch and the GRS presentation).
- These **general conclusions** will be presented at the end of the meeting.

19

Expected outcomes from the Breakout Groups

After the meeting, the meeting proceedings have to be developed.

This task could be done by GRS, if nobody else volunteers.

The proceedings will contain

§ A description of the workshop content and outcomes based on the Breakout Group presentations.

§ The presentations made.

And,

Potentially,

§ Some recommendations for further work of WGOE or tasks to be considered by CNRA, CSNI and other Working Groups

20

Practical Issues

Meeting starts any morning the main meeting room

- § Breakout group 1 meets in room
- § Breakout group 2 meets in room
- § Breakout group 3 meets in room

Lunch will be served in the cantina of MPI (anybody receives a ticket).

Coffee breaks are planned in the Foyer adjacent to the main meeting room.

The participants to the different tours on Tuesday need to decide on Monday to ensure that there is no overload on one tour

The evening reception on Tuesday will be in the Hofbräuhaus! [Video 1:30](#)

I wish

you a very successful
meeting!



Institute of Flight System Dynamics Technische Universität München TUM

Predictive Analysis applied to Flight Operations



Florian Holzapfel, Ludwig Drees, Stefan Schiele, Javensius Sembiring, Lukas Höhdorf, Chong Wang, and Christopher Zaglauer

Presenter
Ludwig Drees and Lukas Höhdorf

Presented at OPEX Workshop
08~10th September 2014, GRS, Garching, Germany

Institute of Flight System Dynamics
Technische Universität München
Garching, Germany

Background

2

Mission Statement

- ▣ Predicting statistically valid accident probabilities for an individual airline based on available evidence from **accident free** operation.
- Accounting for airline-specific factors such as operations, training, etc. ▣

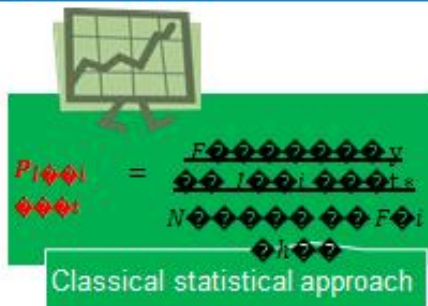


Predictive Analysis:

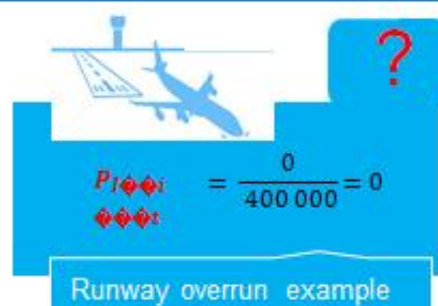
Making **quantitative statements** about the future state based on **previous experience and knowledge**.

BUT How to implement Predictive Analysis for practical application?

Solution ? 3



Classical statistical approach



Runway overrun example



VS.



Simple statistical approach is inappropriate and **unsuitable for rare events**

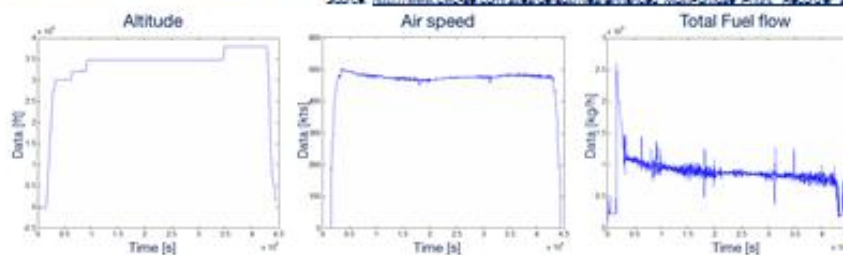
*Serious Incidents as defined in ICAO Annex 13

Flight Data 4

- Obtained from the "Quick Access Recorder" (QAR)
- Up to 3000 parameters are recorded
- Frequency usually between ¼ Hertz and 8 Hertz
- Number of the recorded parameters increased significantly in the last years.



Source: <http://www.euro-nac.com/files/2012/01/Technical-MultiPurpose-Flight-Recorder-EMBR-320>



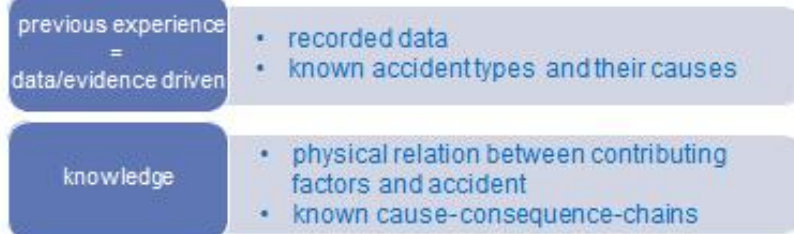
Basic Hypothesis

5

Predictive Analysis:

Making **quantitative statements** about the future state based on:

- **previous experience**
- **knowledge**



Basic Hypothesis:

1. Accidents cannot be directly observed in daily operation, however, the **contributing factors still occur at high frequency** so they can be measured or observed with statistical significance.
2. The relation between the contributing factors and the accident can be described by the laws of physics and cause-consequence-chains based on operational and procedural knowledge.

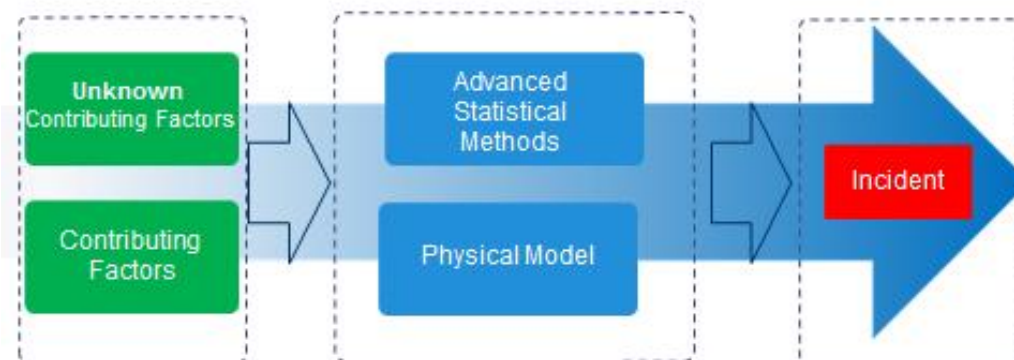


Institute of
Flight System Dynamics

Technische Universität München **TUM**

Predictive Analysis Concept

6

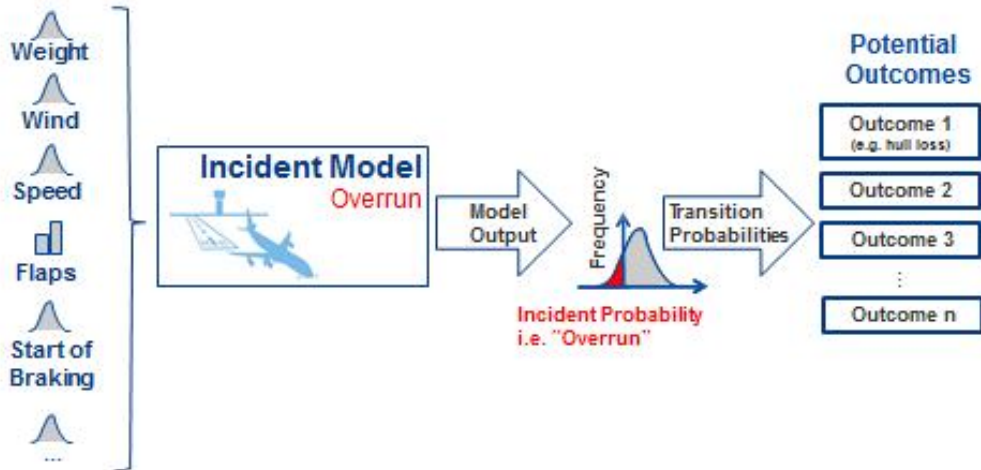


Institute of
Flight System Dynamics

Technische Universität München **TUM**

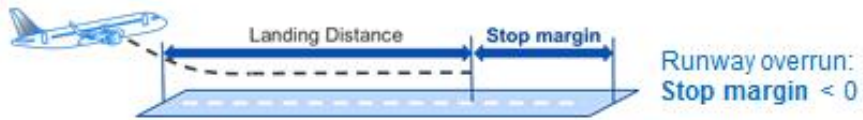
Predictive Analysis on Runway Overrun 7

Contributing Factors (Model Input)



Predictive Analysis on Runway Overrun 8

Step 1 Incident metric



Step 2 Functional relationships between contributing factors:

Physical relationships

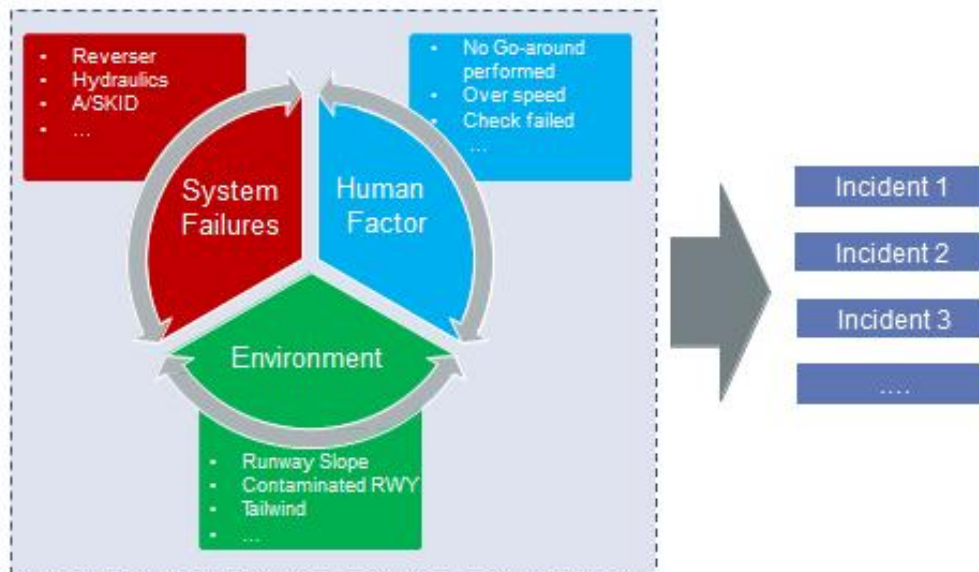


$$\left(\frac{1}{2} \rho V^2 C_{D0} + \frac{1}{2} \rho V^2 C_{D\alpha} \right) S + \dot{m} V - \mu (m g - \frac{1}{2} \rho V^2 C_{L\alpha} S) = m \frac{dV}{dt}$$

Operational relationships



Incident Model – Causal Chains 9

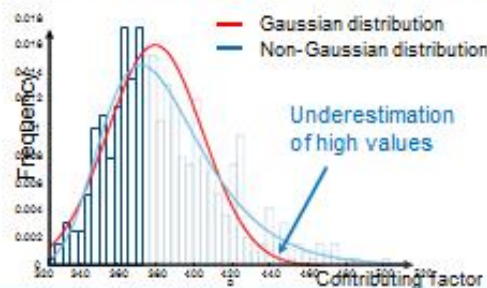


Making Data Talk 10

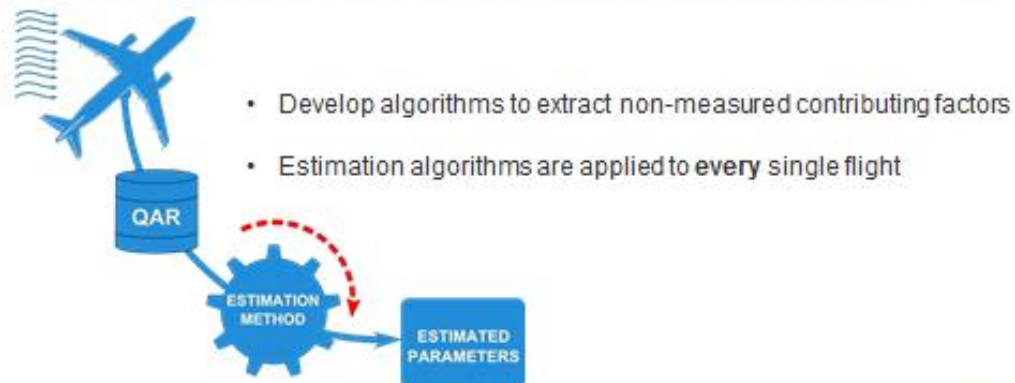
- Asking the right question can significantly increase the information we obtain.



- Quality of statistical statements depend on how we look at the data.

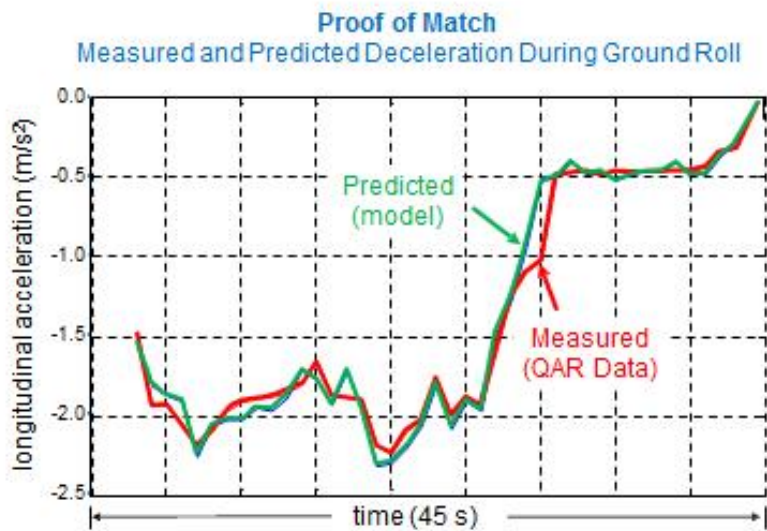


Reading Between Lines – Parameter Estimation 11



Parameter Estimation Implementation during Ground Roll		
Parameter	Expected Value	Standard Deviation
$\dot{\alpha}_c$	0.1285	0.1517
$\dot{\alpha}_{c\dot{\alpha}}$	0.1373	0.0042
$\mu_{r\dot{\alpha}}$	0.0197	0.0048
$\mu_{r\dot{\alpha}\dot{\alpha}}$	0.1123	0.0038

Reading Between Lines – Parameter Estimation 12



Predict 13

Method: Overview of Simulation Methods

Analytical solution	Monte-Carlo simulation	Subset simulation
<ul style="list-style-type: none"> Mathematically exact solution Little computing time if solvable Not applicable for complex geometry Difficult to solve for high dimensions 	<ul style="list-style-type: none"> Easy to implement Able to solve for complex geometry and high dimensions Deteriorating efficiency for small probabilities 	<ul style="list-style-type: none"> Able to solve for very small probabilities Little number of samples required Subset algorithm implementation requires some time

Quantifying Main Drivers 14

What are the main drivers behind the incident probabilities?

Wind

Postholder	ENV
Influenceable	No
---	---

Flaps

Postholder	TRA
Influenceable	Yes
---	---

Speed Deviation

Postholder	TRA
Influenceable	Yes
---	---

...

Postholder	---
Influenceable	---
---	---

Incident Model Overrun

Quantify the sensitivities of the contributing

	Human (HUM)			Maintenance (MAN)			Operations (OP)		
	Training	Selection	Flight	Inspection Interval	Scheduled Maintenance	Age of Equipment	Planning	Ground OP	ATC
ATC Type 1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ATC Type 2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ATC Type 3	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ATC Type 4	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

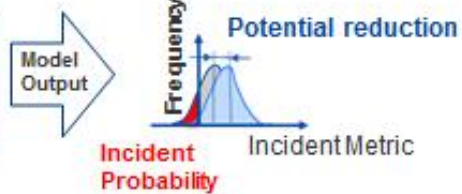
Change Management 15

Contributing Factors (Model Input)

- Weight
- Wind
- Speed
- Flaps
- Start of Braking
- Touchdown



- Distribution based on actual flight operation (FDM)
- Distribution proposed by Flight Safety Manager



- Predictive analysis allows the assessment of the impact of mitigation actions **BEFORE** implementing them
- Impact of mitigation actions to **OTHER** incidents automatically considered (e.g. runway overrun vs. hard landing vs. tail strike)

Identifying the Unknown 16

Correlation Coefficient

Dependence

Parameter 1 Parameter 2

Only captures **constant** dependency between two parameters

Copula

Dependence

Parameter 1 Parameter 2

Capable of capturing **variable (nonlinear)** dependencies between more than two parameters

Future Work

17

1. Comparison between planned and actual performance
 - Takeoff planning
 - Landing distances
 - Fuel consumption
 - ...



Mismatch can be expressed to quantify growth factors

2. Exploitation and correlation of further data sources:
 - ATM data
 - Weather data
 - Training data
 - Maintenance records
 - ...



Institute of
Flight System Dynamics

Technische Universität München



Summary

18



Predictive Analysis enables airlines:

To **QUANTIFY** airline-specific incident and accident probabilities **BEFORE** things go wrong.

PREDICTIVE ANALYSIS

To **QUANTIFY** the effectiveness potential mitigation actions **BEFORE** implementing them.



Institute of
Flight System Dynamics

Technische Universität München





Thank you!

Professor
Florian Holzapfel (florian.holzapfel@tum.de)

Flight Safety Group
Ludwig Drees (ludwig.drees@tum.de)
Javensius Sembiring (javensius.sembiring@tum.de)
Lukas Höhndorf (lukas.hoehndorf@tum.de)
Chong Wang (chong.wang@tum.de)
Stefan Schiele (stefan.schiele@tum.de)

 Institute of Flight System Dynamics

Technische Universität München 



International Workshop on Operating Experience Program Effectiveness Measures
GRS Garching, Germany, 8 – 10 September 2014

Generic Human and Organizational Performance Feedback from Reportable Events in German Plants

- Methodology, Example Year 2011 -

Wolfgang Preischl, GRS- Garching



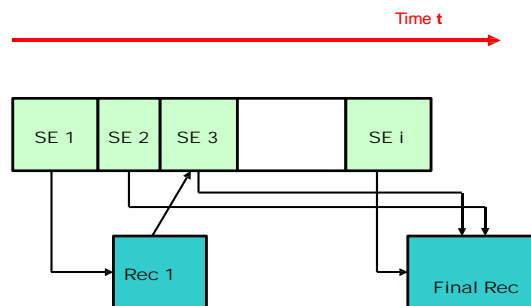
Introduction

- § In a majority of cases a combination of technical (T), human and organizational factors (HOF) root causes are contributing to significant events.
- § The German event reporting and classification criteria are focusing on technical impacts which might bias the generic learning process from HOF root causes.
- § Initiated by a single or a smaller group of events GRS is issuing generic notes including HOF improvement recommendations if necessary.
- § In order to supplement that activity and to obtain a broader view on HOF root causes over a longer period of time GRS developed a specific methodology evaluating all reported events with such contributions.
- § The presentation briefly describes the methodology and provides first results obtained (application example: events reported in 2011).

Investigation Process, Single Event

- § Assessment of potential HOF contribution
- § In depth investigation based on an accepted Man/Machine (M/M)-model integrating technical and HOF aspects
 - Technical description of the event
 - Development of an event model (break down into sub-events)
 - Identification of human errors
 - Search for root causes promoting made errors
 - Modeling the impact of administrative and organizational measures (e. g. measures to avoid, detect and correct)
- § Provision of a chronological representation of all relevant sub-events

Structure of the Event Model



- § Each sub event (SE) describes one human error and is modeled by a M/M- System
- § M/M-Systems with successful recovery are added



Human Error Definition, GRS Root Cause Analysis Methodology HUF

§ Each object (part of the plant, e. g. valve or procedure) has a given function/task. That raises requirements on humans interacting with an object.

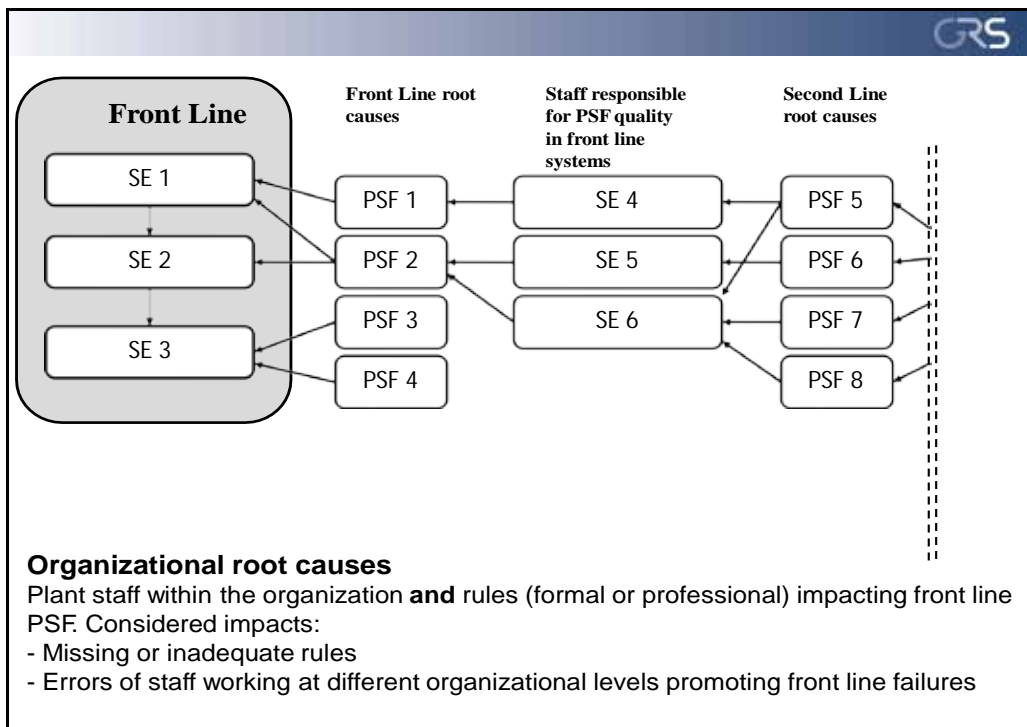
§ Definition:

Any human behavior not in compliance with the requirements of an object is evaluated as an error



Characteristics of HUF

- § About 400 given attributes (including performance shaping factors (PSF), factors promoting errors if unfavorable designed)
- § 5 groups of PSFs with about 150 attributes (additional link possibility "biased by organizational impact")
- § Organizational impact defined as " Plant staff within the organization and quality of formal/informal rules impacting front line PSF" (see slide no. 7)
- § Additional categories to collect experience about
 - attributes indicating safety culture problems
 - the effectiveness of failure detection and failure compensating measures



Generic Evaluation, Approach

- § Brief description of HOF relevant events selected from all events occurred in a defined period of time (description focus: HOF aspects)
- § Broader description of events with safety relevant HOF impact
- § Generic evaluation of all revealed HOF attributes contributing to onset and course of the events



Generic HOF Evaluation, Considered Attributes

- § Evaluation attributes have been derived from HUF data base codes
- § Anomalies in relation to
 - Plant status (e. g. outage)
 - Locations in the plant (e. g. switch gear)
 - Kind of tasks (e. g. maintenance)
 - Group of persons (e. g. external staff)
 - Kind of errors (e. g. commission errors)
 - Error promoting PSFs (e. g. lack of experience)
 - New technologies und procedures (e. g. digital I&C)
- § Organizational deficiencies (e. g. work preparation less than adequate)
- § Ability to detect made errors degraded (e. g. periodic testing)
- § Indication for a decreasing safety culture (e. g. informal non-safe work practice)



Definition „Safety Relevant HOF Impact“

Human and organizational factors are treated like a safety relevant system function. Definition of “safety relevant HOF impact”:

- § Significant degradation of a technical safety function and HOF root causes are contributing (e. g. complete loss of residual heat removal during mid-loop operation due to a commission error of reactor operator).
- § Minor degradation of a technical safety function and observed HOF root causes impair different measures to prevent, identify and recover errors (e. g. loss of one emergency diesel generator and several measures to detect the problem failed).

Example „Reportable Events, Year 2011“

- § 106 new events in 2011
- § 104 considered (2 events from research reactors not considered due to very different boundary conditions)
- § All events with investigation status “finished”
- § All events classified category N (lowest German reporting category) and INES 0
- § 53 events impacted by HOF
- § All German plants contributed, broad range of plant operational states (including decommissioning)
- § 24 Events with safety relevant HOF impact

Safety Relevant HOF Impact, Example

- § Event title „Check valve xxx (part of cooling water supply system for safety relevant components) incomplete closed, cooling capacity of one train reduced due to bypass flow
- § Routine walk around reveals a drop leakage at the check valve
- § Assembling error causes damage of the valve, screw locking tabs not assembled, comparable omission errors at five additional valves, errors propagate undetected for a long time
- § Unacceptable work attitude of assembling personnel
- § Measures to assure quality of work failed (e. g. check by second person)
- § Available work procedures were inaccurate and in part erroneous, procedure deficiency undetected for a long time
- § Repeated deviation from periodic valve inspection regulations (visual inspection requires disassembling of valve)



Results (1)

- § Plant status „outage“ dominant
- § 28 from 53 events in the context of maintenance and change of construction activities, 10% during test activities
- § 10% errors made by constructors (outside the plant, undetectable by the quality assurance measures of the plant)
- § Most errors occurred outside central control room (e. g. interaction with components, work preparation, quality assurance of documentation)
- § Allocation to specific staff (e. g. contractor, shift or department member) difficult
- § Human factors engineering (labels, design of procedures, instruments and indicators) contributes in about 37% of the considered events
- § Human centered PSFs (professional knowledge, individual performance capacity) contributes in about 26% of the considered events



Results (2)

- § Lack of information about PSFs promoting errors made by task performers within the organization (e. g. work preparation, supervision, quality assurance of work equipment and work results) or by the constructor
- § Organizational impact in about 80% of the investigated events (work preparation 28%, operational experience feedback and corrective action 7%, Quality assurance of work results 28%, quality assurance of incoming goods 13%, provision of instructions and regulations 4%)
- § Significant impact of organizational factors in the context of design and construction changes
- § Degraded measures to detect errors contribute in about 64% of the considered events
- § Degraded redundancy and diversity principle 53% (including events where only one train failed but precursors in other trains were identified)
- § Concerning safety culture or new technology no relevant observations

Results, Multiple Deficiencies

- § Grouping of the contributing attributes in accordance to “human factors engineering- frontline (A)”, “organization (B)” and “ability to detect errors (C)”

- § 64% of the reported events with multiple deficiencies within the groups A, B, C (all 24 events classified “safety relevant HOF impact”)

- § B and C deficiencies are dominating (all events classified safety relevant)

Conclusion

- § The first application (events reported in 2011) demonstrates usefulness of the approach and the obtained insights. The investigations will be continued.
- § The time delay between reporting and generic investigation is an inherent disadvantage.
- § Quality of organizational factors and measures to detect made errors are relevant parts of the safety conception of the plant but not sufficiently represented in the reporting and classification requirements.
- § Generic HOF deficiencies identified in a single event with minor significance might be latently available in more safety relevant areas of the plant (broad impact of such deficiencies).
- § Reducing number and significance of reported events requires a reinforced role of HOF during notification and development of corrective measures.

INFORMATION COLLECTION AND GATHERING BREAKOUT

WGOE International Workshop on Operating Experience
Program Effectiveness Measures

OVERVIEW

- Objective
- Setting
- Scope
- Use criteria for effectiveness (timeliness, value and quality)
- Develop measures (main results)
- Develop tools (not relevant)



MOVING INFORMATION

- *X % of incoming operating experience documents are distributed to recipients within Y days of receipt*
 - Separate measure for each document type
 - Distributed
 - Internal or external
 - Recipients
 - Awareness
 - Actions
 - Encourages timely movement of information and appropriate monitoring of operating experience sources

REQUIRED REPORTING

- *X % of required reports are submitted and timely based on a sample of Y events*
 - Review a sample of events
 - Determine if required reports were submitted
 - Determine if required reports were timely
 - Encourages the effectiveness of reporting by licensees

REQUIRED REPORT QUALITY

- Review X % of licensee required reports for quality within Y days of receipt
- X % of required reports reviewed do not need clarification
 - While focused on licensee required reports this measure can be applied to other report types (e.g., IRS)
 - Clarification is needed if a report is unclear or difficult to understand
 - Encourages quality and clarity in required reports

REGULATOR FOLLOW-UP FOR SIGNIFICANT EVENTS

- Regulator follow-up on significant events completed within Y days
 - Follow-up per existing programs could involve different types of communications
 - Inspection
 - Meeting
 - Teleconference
 - Encourages high quality information on significant events is available in a timely manner

DIE MAUSEFANGERIN
GENEHMIGT

WGOE : Programme Effectiveness Measures

GROUP N ° 2 : PROCESSING OPEX INFORMATION

Develop measures and tools to evaluate how OPEX is processed after it's received

1	Mr.	Laszlo	Juhasz	Hungary	7	Mr.	Vincent	Crutel	France
2	Mr.	David	Garmon	USA	8	Mr.	Oleg	Zakharov	Russia
3	Mr.	Fuming	Jiang	IAEA	9	Mr.	Georges	Paci	Belgium
4	Mr.	Yoichi	Ishii	Japan	10	Mr.	Mats	Severin	Sweden
5	Mr.	Kenneth	Broman	Sweden	11	Mr.	Rami	Laaksonen	Finland
6	Mr.	Miguel	Peinador Veira	Netherlands	12	Mr.	Nils-Erik	Setterstal	Sweden

TIMELINESS

Generally up to the program to develop a scheme

- à Significance
- à Applicability
- à Difficulty of an Evaluation
- à Time for initial screening
- à Time for detailed analysis

VALUE

- à **High (Safety Significance, Generic applicability)**
 - Accessible Information
 - High Quality Evaluation
 - Relevant Corrective Actions
 - Relevant Lessons Learned...
 - Timeliness
- à **Medium (Moderate ...)**
- à **Low (Some ...)**

➡ **Potential Measures : Balance between resources and outcomes**

Group 2 – Processing OPEX Information 10 September 2014 3

QUALITY

- à **High**
 - All the important attributes are present
- à **Medium**
 - Some of the attributes need improvement
- à **Low**
 - Some of the important attributes are missing

➡ **Potential measures : Best practices, Acceptable, Needs improvement**

Group 2 – Processing OPEX Information 10 September 2014 4

Attributes of Effective Evaluation.

1. **GENERAL ATTRIBUTES**
 - à Adequate Resources
 - à Qualification of involved OPEX personnel
 - à Management involvement
2. **SCREENING PROCESS** *Initial Review*
 - à Competent (dedicated, diverse backgrounds) reviewers
 - à Established screening criteria for significance (INES, PRA/PSA ...)
 - à Prioritizing for timeliness goals
 - à Ease of applicability of criteria
3. **ANALYSIS (Readable/Understandable by General Engineer Audience)** *Event Description*
 - à Initial condition
 - à Chronology of the event
 - à Clearly describe safety concerns

Potential measures : Best practices, Acceptable, Needs improvement

Group 2 – Processing OPEX Information
10 September 2014
5

Attributes of Effective Evaluation.

Significance Evaluation

- à Impact on analyzed accident sequences
- à Real / Potential safety consequences
- à Affected Equipment / Procedures
- à Affected safety functions / Barriers
- à Good practices : PSA, Precursor ...

Root Cause / Contributing Cause

- à Completed using generally accepted method (including training)
- à Relevant pre-event activities (Human factors, Ops and maintenance)

Generic Aspect / Missed Opportunity

Challenge à Based on potential lack of information

Good Practice à Evaluation should consider near misses and similar events when possible

Group 2 – Processing OPEX Information
10 September 2014
6

Attributes of Effective Evaluation.

3 . RESPONSE (LEARNING, CORRECTIVE ACTIONS...)

Corrective Actions

- à SMART philosophy (Specific, Measurable, Achievable, Realistic, Timely)
- à Prioritized
- à Implementation plans with consideration of risks
- à Directed toward appropriate audience

Insights (Lessons learned)

- à Focus executive summary
- à Identification of key stakeholders and specific messages

Group 2 – Processing OPEX Information 10 September 2014 7

Attributes of Storage Scheme

Centralized storage for OPE information

- Track items as necessary
- Storage and ability to attached/ref, files...
- Systematic code word used
- Capability of trend analysis { challenge
- Search functions
- Stakeholders access
- Information directed to appropriate audience
- Storage Scheme support Timeliness goal
- User-friendly Structure
- Training for use
- Clear ownership of the overall process

Group 2 – Processing OPEX Information 10 September 2014 8

RECOMMENDED Measures

∅ TIMELINESS

TIME FOR INITIAL SCREENING AND FOR DETAILED ANALYSIS

∅ VALUE

BALANCE BETWEEN RESOURCES AND OUTCOMES

∅ QUALITY

(Go/No Go) BEST PRACTICES, ACCEPTABLE, NEEDS IMPROVEMENT BASED ON ATTRIBUTES FOR EVALUATION AND STORAGE SCHEME

Thank you for your attention



Effective OPEX Programs

Develop Measures and Tools to Assess Outcomes of
Operational Experience (OPEX) Programs
WGOE Workshop – GRS Garching, Germany – Group 3
September 2014

GROUP 3

- **Composition**
 - Regulators
 - TSOs
 - Industry/Operators
 - European Clearing House
- **Approach: Value through Outcomes**
 - Attributes
 - Measures (What we can do)
 - Metrics (How we could do this)

Effective OPEX Programs

Overall Objectives – Group 3

- Develop/propose **measures** and **tools/metrics** to assess the outcomes of OPEX programs in the areas of:
 - Communication of OPEX
 - Impact on the Design and Safety Performance of NPPs
 - Effective Regulatory Oversight

Communication of OPEX 1/2

COMMUNICATION OF OPEX		
Attributes	Measures (How to do this)	Metrics (How to measure) and Tools
Timely communication of OPEX by licensee to regulator [Licensee OPEX program]	Monitor completion of Licensee Event Reports (LERs)	Ratio of completed LERs within allowed time delay by quarter/year and by licensee/site Average reporting time by the licensee for events
Timely communication of OPEX by regulator to different stakeholders for information or evaluation [RB/TSO OPEX program]	Clear timeline and point of contact (PoC) expectations for all forms of communication (Letters, Notices, Info Bulletins from Regulator to licensees; information of other stakeholders, ...)	Average time delay to report event(s) to stakeholders (licensees, IRS...)
Communication should clearly and concisely identify the issue of concern and put it in the proper perspective [RB/TSO OPEX program]	Clear procedures are communicated through notices and training of staff	No. of OPEX letters, info notices, bulletins by quarter/year
	Use, to the extent possible, clear, consistent terminology and nomenclature	Feedback from trainees that the terminology and nomenclature are understood
	Clearly identify the issue, the safety significance and the response expected	Feedback loop
Transparency	Systematic, documented decision-making process for accessing lessons learned and recommendations	Confirmation that process is in place and being used

Communication of OPEX 2/2

Communication should be effectively targeted to the (right) audience (within the regulator and the licensee): <ul style="list-style-type: none"> • Decision-makers • End users • Technical specialists • Inspectors [Licensee and RB/TSO OPEX programs]	Communicate with stakeholders directly, in meetings and through safety and technical fora	Feedback loop
Effective sharing of OPEX with licensees [RB/TSO OPEX program]	Share OPEX with stakeholders	No. of OPEX letters, info notices, bulletins issued by quarter/year
Effective sharing of OPEX information through international reporting systems [Licensee and RB/TSO OPEX programs]	Share OPEX with nuclear regulators in other countries	No. of national events reported to international bodies (IRS, WANO, etc.) Ratio of events (of total significant national events) reported internationally.
Effective sharing of OPEX information through wider collaboration [Licensee and RB/TSO OPEX programs]	Share OPEX information with non-nuclear regulators, standards associations, vendors and manufacturers	No. of events and OPEX information shared with other organizations. No. of OPEX information items received from other organizations.
	Leverage opportunities to meet and share OPEX/lessons learned among concerned organizations	No. of meetings, conferences, working groups, etc. attended where OPEX is shared.

Safe Power Reactors 1/2


IMPACT ON THE DESIGN AND SAFE OPERATION OF POWER REACTORS (NPPs)		
Attributes	Measures (How to do this)	Metrics (How to measure) and Tools
Maintain knowledge of OPEX and lessons learned over the long term [Licensee and regulator/TSO OPEX programs]	Develop an effective knowledge management database for OPEX with <ul style="list-style-type: none"> · Ease of access · Flexibility for expansion (new discoveries) · Ability to preserve data over time (keep important lessons current (top of mind) 	Feedback loop
Avoid recurrence of events [Licensee OPEX program]	Highlight the recurring events	No. and trend of recurring events over an appropriate time interval
Follow-up of timely completion of Corrective Actions (CAs) [Licensee OPEX program]	Monitor the completion of CAs Develop a process that confirms that CAs were completed in due time	No. of CAs completed on time No. of CAs opened per quarter No. of CAs closed per quarter No. of CAs remaining open per quarter (carry over)
Reviews appropriateness of Corrective Actions [Licensee OPEX program]	Monitor the frequency of CAs management Review Committees (licensees)	No. and frequency of management review committee meetings Monitor the impact of corrective actions on conditional core damage frequency (CCDF) No of CAs deemed by the OPEX review committee to be incorrectly identified/coded for cause(s), root cause and follow-up action
Evaluates the effectiveness of corrective actions [Licensee OPEX program]	Develop a process for evaluating the effectiveness of corrective actions in addressing root cause(s) Monitor recurrence of identified root causes of events	No. and trend of recurring root causes

Safe Power Reactors 2/2

Implementation by licensees of regulatory requests arising from OPEX [RB OPEX program]	An effective process to monitor corrective actions in response to regulatory requests Track open regulatory action items arising from OPEX	Peer- reviews (IRRS, WANO) Number of open regulatory requirements No. of national event reports which led to regulatory action on the licensee No. of international event reports which led to regulatory action on the licensee
Timely completion of regulatory action items arising from OPEX [RB OPEX program]	Track timeliness of completion of regulatory action items arising from OPEX	Average time to completion of action items per quarter or per year
Correctly identifies the safety significance and root cause(s)	OPEX management committee to review the safety significance and root cause analyses	No. of incorrectly analyzed events
Identifies the appropriate timeline and level of responsibility	Regulatory body may decrease the time to complete CAs, to avoid recurrence of events	No. of letters from the regulatory body to reduce the timeline for the CA plan
Shares best practices	Share info among like-minded, interested bodies	(see Communications for metric)
Implements best practices	Regulator is effectively implementing OPEX lessons learned	No. of enforcement letters sent to licensees resulting from OPEX No. of national event reports which led to regulatory action on the licensee No. of international event reports which led to regulatory action on the licensee
Licensees take appropriate action with respect to documented OPEX recommendations	Track events that could have been avoided if licensees effectively implemented regulatory recommendations and guidance (from OPEX)	No. of instances (events, inspection findings, etc.) where OPEX guidance was not followed or adhered to

Effective Regulatory Oversight

REGULATORY OVERSIGHT EFFECTIVENESS		
Attributes	Measures (How to do this)	Metrics (How to measure) and Tools
OPEX forms important input to inspection programs, technical analysis, regulatory review, and new regulatory requirements	Track open regulatory action items arising from OPEX	Number of open regulatory actions
OPEX should be part of the core training for staff	Verify that OPEX is included in the training of staff	Verify
Regulatory OPEX program should not only be reactive but focus on precursors and low level events	Systematic review / inspection of licensee's program for inclusions of precursors and low level events	Number of such inspections
Makes effective use of available resources	Measure of Resources spent on OPEX program (time/money/effort)	Number / % of person-days (time accounting system...), costs



Working Group on Operating Experience (WGOE)

Workshop on Operating Experience Programme Effectiveness Measures

Conclusion of the Workshop Results

Benoit Poulet, Canada, WGOE Chair
Michael Maqua, Germany; WGOE Vice-Chair


WGOE Workshop Results, September 2014 1



Workshop Statistics

§	No. of Participants:	41
§	No. of Organizations:	27
§	No. of Countries:	14
§	No. of international:	4


WGOE Workshop Results, September 2014 2



Objective of the Workshop

- § Discuss approaches to assess or even measure the effectiveness of OPEX programs
- § Identify commendable practices and methods to improve OPEX feedback and assessment methodologies

WGOE Workshop Results, September 2014 3





Intention of the Workshop

“However,
we don’t know what we prevented,
we’ll only know when we were unsuccessful.”

J. Hurst, Former WANO OE Team Leader

WGOE Workshop Results, September 2014 4





Issues to Tackle

Which measures could improve the effectiveness of OPEX programs?

How can the improvement by these measures be checked?

Are there predictive tools to assess the influences of new measures?

WGOE Workshop Results, September 2014 5





Work Organisation (1)

Discussions in 3 Breakout Groups:

- § Identifying/gathering OPEX
- § Processing OPEX information
- § Assessing outcomes of OPEX programs



WGOE Workshop Results, September 2014 6

 **Work Organisation (2)** 

Common issues to discuss for all Breakout Groups:

- § Timeliness
- § Value
- § Quality


WGOE Workshop Results, September 2014 7

 **Main Results Group 1** 

Group 1 proposed criteria for measurement of

- § Moving information
- § Required reporting
- § Required reporting quality
- § Regulatory follow-up for significant events

WGOE Workshop Results, September 2014 8




Main Results Group 2(1)

Criteria developed for rating against timeliness, value and quality

- Ø **TIMELINESS**
aspects: significance, applicability, difficulty of an evaluation, time for initial screening, time for detailed analysis
potential measure: time for initial screening and for detailed analysis
- Ø **VALUE**
potential measure: balance between resources and outcomes
- Ø **QUALITY**
(go/no go) test regarding: best practices, acceptable, needs improvement based on attributes for evaluation and storage scheme



WGOE Workshop Results, September 2014 9



Main Results Group 2(2)

- Ø **Analysis**
potential aspects: best practices, acceptable, needs improvement
- Ø **Generic Aspects / missed opportunities**
challenge: based on potential lack of information
good practice: evaluation should consider near misses and similar events when possible

WGOE Workshop Results, September 2014 10



 **Main Results Group 3(1)** 

Develop/propose measures and tools to assess the outcomes of OPEX programs

- § communications
- § impact on the design and safe operation of power reactors (NPPs)
- § regulatory oversight effectiveness
- § Others

For all steps attributes, measures, and metrics were identified


WGOE Workshop Results, September 2014 11

 **Main Results Group 3(2)** 

For most of the issues attributes, measures, and metrics were identified, but some gaps show areas for potential development

- § No metric regarding transparency and OPEX databases

WGOE Workshop Results, September 2014 12



Summary (1)


The goal of the workshop was

- § to identify effectiveness measures and
- § assessment tools applicable to OPEX programs.

Measures and tools are focused on improving

- § adoption of OPEX-derived safety improvements and
- § overall OPEX program effectiveness

WGOE Workshop Results, September 2014 13





Summary (2)

Results:

1. Tools and criteria were identified for various steps of OPEX programs
2. Few missing tools or verification measures were detected
3. Specific criteria developed to measure effectiveness
4. That means that major parts of existing programs could be assessed with respect to their effectiveness



WGOE Workshop Results, September 2014 14

 **Summary (3)** 

Generic Results:

1. Missing tools and measures should be developed
2. It should be considered to address missing verifications in OPEX programs review tools like self-assessment, peer reviews, international missions
3. Collaboration with non-nuclear industry and regulators on OPEX should be increased

WGOE Workshop Results, September 2014 15



 

**Thank you very much for your attendance
and your work!**

**Special thanks to all presenters and
facilitators!**

Have a safe trip home!

WGOE Workshop Results, September 2014 16

 Agence pour l'énergie nucléaire
Nuclear Energy Agency 



Working Group on Operating Experience (WGOE)

**WGOE International Workshop on
Operating Experience
Programme Effectiveness Measures**

Facilitators' Training

Dr Michael Maqua, WGOE
Garching, September 07, 2014



1

 Agence pour l'énergie nucléaire
Nuclear Energy Agency 

Contents

- Ø Workshop Objectives
- Ø Breakout Groups
- Ø Facilitator's Role
- Ø Main Expected Results
- Ø Practical Issues

2



 Agence pour l'énergie nucléaire
Nuclear Energy Agency 

Objective of the Workshop

The main objectives of the workshop are

- to provide a forum for the exchange of information on the licensees' and regulators' programmes on OPEX and approaches to assess or even measure the effectiveness of these programmes.
- Participants will have the opportunity to meet with their counterparts from other countries and organisations to discuss current and future issues on the selected topic.
- They will develop conclusions and commendable practices regarding the issues and identify methods to help improve their own OPEX feedback and assessment methodologies.

3


 Agence pour l'énergie nucléaire
Nuclear Energy Agency 

Objective of the Workshop (2)


There will be three breakout groups responsible for developing measures and tools in the following areas:

- identifying/gathering OPEX;
- processing OPEX information;
- assessing outcomes of OPEX programmes.

4



Agence pour l'énergie nucléaire
Nuclear Energy Agency




Breakout Group (1): Identifying/gathering OPEX

This group should focus on developing measures and tools that apply to the area of identifying/collecting OPEX.


The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The following is provided solely to stimulate conversation on what attributes could be measured to ensure:

5




Agence pour l'énergie nucléaire
Nuclear Energy Agency




Breakout Group (1): Identifying/gathering OPEX

- **Timeliness:**
 - *That OPEX is considered within an appropriate amount of time.*
- **Value:**
 - *That the threshold for information that is considered in the OPEX programme is adequate.*
 - *That the sources being considered within an OPEX programme are adequate.*
 - *That OPEX is being stored appropriately.*
- **Quality**
 - *That the appropriate amount of information is being provided in an OPEX report.*

6



Agence pour l'énergie nucléaire
Nuclear Energy Agency




Breakout Group (2): Processing OPEX information

This group should focus on developing measures and tools that apply to the processing of OPEX information once it has been collected.


- ⌋ The processing of OPEX information includes the storing and evaluation of OPEX information.
- ⌋ The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The following is provided solely to stimulate conversation on what attributes could be measured to ensure:

7




Agence pour l'énergie nucléaire
Nuclear Energy Agency




Breakout Group (2): Processing OPEX information

- ⌋ **Timeliness**
 - *That OPEX is being evaluated in a timely manner.*
- ⌋ **Value**
 - *That the criteria for screening an item for further evaluation are appropriate.*
- ⌋ **Quality**
 - *That OPEX is stored in a retrievable manner.*
 - *That effective evaluation of an OPEX issue has taken place.*
 - *That an effective outcome/application from the evaluation of an OPEX issue has been proposed.*

8




Agence pour l'énergie nucléaire
Nuclear Energy Agency




Breakout Group (3): Assessing outcomes of OPEX programmes

- **Timeliness**
 - *That the outcomes from OPEX initiatives are assessed in a timely manner.*
- **Value**
 - *That the value added from OPEX initiatives is worth the cost.*
- **Quality**
 - *That the OPEX initiatives accomplish their purpose.*

9



Agence pour l'énergie nucléaire
Nuclear Energy Agency





Breakout Group (3): Assessing outcomes of OPEX programmes

This group should focus on developing measures and tools that assess an organization's effectiveness in implementing OPEX initiated activities.

Within this area, the measures and tools should specifically review the effectiveness of:

10



 Agence pour l'énergie nucléaire
Nuclear Energy Agency 

***Breakout Group (3):
Assessing outcomes of OPEX programmes***

- The communication of OPEX.
- The effectiveness of OPEX on regulatory oversight and requirements.
- The effectiveness of OPEX on NPP design.
The proposed measures and tools should be effective in measuring aspects that affect timeliness, value and quality.

The following is provided solely to stimulate conversation on what attributes could be measured to ensure:

11

 Agence pour l'énergie nucléaire
Nuclear Energy Agency 


Facilitator's role

“A client asked me the other day what makes a great facilitator. Here's what we came up with. I thought a list of the top characteristics of an effective facilitator would be of interest for those managers, speakers and trainers.”


<http://www.allbusiness.com/company-activities-management/sales-selling-sales/11469773-1.html>

1. Stimulates the interaction and the free sharing of thoughts and ideas.
2. Creates the safe environment in order for the group to open up and become actively engaged in the discussion.
3. Are masterful and engaging listeners.

12




Agence pour l'énergie nucléaire
Nuclear Energy Agency




Facilitator's role (2)

4. Provides the structure for the discussion. Sets the parameters, the intention and guides the conversation.
5. Supports the well-being of each participant as well as the group.
6. Acknowledges the participants and makes them right (and never makes anyone wrong.)
7. Utilizes the art of the question to create and cultivate new possibilities that stimulate new thinking.
8. Taps into the wisdom of each person, as the value derived in each discussion is a result of the co-creation and wisdom of the group (vs. dominates the discussion.)

13





Agence pour l'énergie nucléaire
Nuclear Energy Agency



Facilitator's role (3)

9. Is charge neutral and responsive rather than reactive.
10. Is fluid and flexible vs. rigid. (Is light and dances gracefully within the conversation.)
11. Connects with the group.
12. Plans effectively yet is fluid based on the atmosphere and needs of the audience.
13. Is authentic and shares themselves with others/is fully self-expressed.
14. Has fun and is passionate about the transformational process that occurs - if done successfully!



14

 Agence pour l'énergie nucléaire
Nuclear Energy Agency 

Main expected outcomes

- u The goal of the workshop is
 - *to identify effectiveness measures and*
 - *performance assessment tools*
 - applicable to OPEX programmes.*
- u These measures and tools will be focused on improving
 - *the adoption of OPEX-derived safety improvements*
 - and*
 - *overall OPEX programme effectiveness.*


15

 Agence pour l'énergie nucléaire
Nuclear Energy Agency 


Expected outcomes from the Breakout Groups

- u On Wednesday any Breakout Group should present its findings!
- u These findings should be laid down in a presentation (PowerPoint) (ready at lunch time).
- u Selected WGOE representatives will formulate the general workshop conclusions on Wednesday noon (during lunch and the GRS presentation).
- u These general conclusions will be presented at the end of the meeting.

16




Agence pour l'énergie nucléaire
Nuclear Energy Agency




Expected outcomes from the Breakout Groups

- ⌋ After the meeting, the meeting proceedings have to be developed.
- ⌋ This task could be done by GRS, if nobody else volunteers.
- ⌋ The proceedings will contain
 - *A description of the workshop content and outcomes based on the Breakout Group presentations.*
 - *The presentations made.*
 - *And,*
 - *Potentially,*
 - *Some recommendations for further work of WGOE or tasks to be considered by CNRA, CSNI and other Working Groups*

17



Agence pour l'énergie nucléaire
Nuclear Energy Agency



Practical Issues

- ⌋ Meeting starts any morning the main meeting room
 - *Breakout group 1 meets in room*
 - *Breakout group 2 meets in room*
 - *Breakout group 3 meets in room*
- ⌋ Lunch will be served in the cantina of MPI (anybody receives a ticket).
- ⌋ Coffee breaks are planned in the Foyer adjacent to the main meeting room.
- ⌋ The participants to the different tours on Tuesday need to decide on Monday to ensure that there is no overload on one tour
- ⌋ The evening reception will be in the Hofbräuhaus!

18