IAEA-TECDOC-1653

Best Practices in the Management of an Operating Experience Programme at Nuclear Power Plants

IAEA
International Atomic Energy Agency

IAEA SAFETY RELATED PUBLICATIONS

IAEA SAFETY STANDARDS

Under the terms of Article III of its Statute, the IAEA is authorized to establish or adopt standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards.

The publications by means of which the IAEA establishes standards are issued in the **IAEA Safety Standards Series**. This series covers nuclear safety, radiation safety, transport safety and waste safety, and also general safety (i.e. all these areas of safety). The publication categories in the series are **Safety Fundamentals, Safety Requirements** and **Safety Guides**.

Safety standards are coded according to their coverage: nuclear safety (NS), radiation safety (RS), transport safety (TS), waste safety (WS) and general safety (GS).

Information on the IAEA's safety standards programme is available at the IAEA Internet site

http://www-ns.iaea.org/standards/

The site provides the texts in English of published and draft safety standards. The texts of safety standards issued in Arabic, Chinese, French, Russian and Spanish, the IAEA Safety Glossary and a status report for safety standards under development are also available. For further information, please contact the IAEA at P.O. Box 100, A-1400 Vienna, Austria.

All users of IAEA safety standards are invited to inform the IAEA of experience in their use (e.g. as a basis for national regulations, for safety reviews and for training courses) for the purpose of ensuring that they continue to meet users' needs. Information may be provided via the IAEA Internet site or by post, as above, or by e-mail to Official.Mail@iaea.org.

OTHER SAFETY RELATED PUBLICATIONS

The IAEA provides for the application of the standards and, under the terms of Articles III and VIII.C of its Statute, makes available and fosters the exchange of information relating to peaceful nuclear activities and serves as an intermediary among its Member States for this purpose.

Reports on safety and protection in nuclear activities are issued in other publications series, in particular the **Safety Reports Series**. Safety Reports provide practical examples and detailed methods that can be used in support of the safety standards. Other IAEA series of safety related publications are the **Provision for the Application of Safety Standards Series**, the **Radiological Assessment Reports Series** and the International Nuclear Safety Group's **INSAG Series**. The IAEA also issues reports on radiological accidents and other special publications.

Safety related publications are also issued in the **Technical Reports Series**, the **IAEA-TECDOC Series**, the **Training Course Series** and the **IAEA Services Series**, and as **Practical Radiation Safety Manuals** and **Practical Radiation Technical Manuals**. Security related publications are issued in the **IAEA Nuclear Security Series**.

BEST PRACTICES IN THE MANAGEMENT OF AN OPERATING EXPERIENCE PROGRAMME AT NUCLEAR POWER PLANTS

The following States are Members of the International Atomic Energy Agency:

AFGHANISTAN
ALBANIA
ALGERIA
ANGOLA
ARGENTINA
ARMENIA
AUSTRALIA
AUSTRIA
AZERBAIJAN
BAHRAIN
BANGLADESH
BELARUS
BELGIUM
BELIZE
BENIN
BOLIVIA
BOSNIA AND HERZEGOVINA
BOTSWANA
BRAZIL
BULGARIA
BURKINA FASO
BURUNDI
CAMBODIA
CAMEROON
CANADA
CENTRAL AFRICAN REPUBLIC
CHAD
CHILE
CHINA
COLOMBIA
CONGO
COSTA RICA
CÔTE D'IVOIRE
CROATIA
CUBA
CYPRUS
CZECH REPUBLIC
DEMOCRATIC REPUBLIC OF THE CONGO
DENMARK
DOMINICAN REPUBLIC
ECUADOR
EGYPT
EL SALVADOR
ERITREA
ESTONIA
ETHIOPIA
FINLAND
FRANCE
GABON
GEORGIA
GERMANY
GHANA
GREECE
GUATEMALA
HAITI
HOLY SEE
HONDURAS
HUNGARY
ICELAND
INDIA
INDONESIA
IRAN, ISLAMIC REPUBLIC OF
IRAQ
IRELAND
ISRAEL
ITALY
JAMAICA
JAPAN
JORDAN
KAZAKHSTAN
KENYA
KOREA, REPUBLIC OF
KUWAIT
KYRGYZSTAN
LATVIA
LEBANON
LESOTHO
LIBERIA
LIBYAN ARAB JAMAHIRIYA
LIECHTENSTEIN
LITHUANIA
LUXEMBOURG
MADAGASCAR
MALAWI
MALAYSIA
MALI
MALTA
MARSHALL ISLANDS
MAURITANIA
MAURITIUS
MEXICO
MONACO
MONGOLIA
MONTENEGRO
MOROCCO
MOZAMBIQUE
MYANMAR
NAMIBIA
NEPAL
NETHERLANDS
NEW ZEALAND
NICARAGUA
NIGER
NIGERIA
NORWAY
OMAN
PAKISTAN
PALAU
PANAMA
PARAGUAY
PERU
PHILIPPINES
POLAND
PORTUGAL
QATAR
REPUBLIC OF MOLDOVA
ROMANIA
RUSSIAN FEDERATION
SAUDI ARABIA
SENEGAL
SERBIA
SEYCHELLES
SIERRA LEONE
SINGAPORE
SLOVAKIA
SLOVENIA
SOUTH AFRICA
SPAIN
SRI LANKA
SUDAN
SWEDEN
SWITZERLAND
SYRIAN ARAB REPUBLIC
TAJIKISTAN
THAILAND
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA
TUNISIA
TURKEY
UGANDA
UKRAINE
UNITED ARAB EMIRATES
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
UNITED REPUBLIC OF TANZANIA
UNITED STATES OF AMERICA
URUGUAY
UZBEKISTAN
VENEZUELA
VIETNAM
YEMEN
ZAMBIA
ZIMBABWE

The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

IAEA-TECDOC-1653

BEST PRACTICES IN THE MANAGEMENT OF AN OPERATING EXPERIENCE PROGRAMME AT NUCLEAR POWER PLANTS

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2010

COPYRIGHT NOTICE

For further information on this publication, please contact:

Operational Safety Section
International Atomic Energy Agency
Vienna International Centre
A-1400 Vienna, Austria

Printed by the IAEA in Austria
August 2010
IAEA-TECDOC-1653

IAEA Library Cataloguing in Publication Data

Best practices in the management of an operating experience programme at nuclear power plants. – Vienna : International Atomic Energy Agency, 2010.
p. ; 30 cm. – (IAEA-TECDOC series, ISSN 1011-4289 ; no. 1653)
ISBN 978-92-0-108510-8
Includes bibliographical references.

1. Nuclear power plants – Management. 2. Nuclear facilities – Safety measures. 3. Reactor operation. I. International Atomic Energy Agency. II. Series.

IAEAL 10-00646

FOREWORD

The IAEA Fundamental Safety Principles (IAEA Safety Standards Series No. SF-1) state the need for operating organizations to establish a programme for the feedback and analysis of operating experience in nuclear power plants. Such a programme ensures that operating experience is analysed, events important to safety are reviewed in depth, lessons learned are disseminated to the staff of the organization and to the relevant national and international organizations and corrective actions are effectively implemented.

In IAEA Operational Safety Review Team (OSART) and Peer Review of the effectiveness of the Operational Safety Performance Experience Review (PROSPER) missions, weaknesses in the management of operating experience (OE) programmes have been identified as one of the root causes of the recurrence of events. This publication has been developed to provide advice and assistance to nuclear installation managers and related institutions, including contractors and support organizations, to strengthen and enhance the management of their OE processes. In this publication, a number of barriers to the successful management of an OE programme have been identified. Managers are encouraged to review and evaluate these barriers with a view to identifying and eliminating them within their own organizations.

This publication is the outcome of a coordinated effort involving the participation of experts from nuclear organizations in several Member States. It was developed to support successful management of an OE programme, various elements of which are specified in the IAEA Safety Requirements on the Safety of Nuclear Power Plants: Operation (IAEA Safety Standards Series No. NS-R-2). This publication also complements the report on PROSPER Guidelines: Guidelines for Peer Review and for Plant Self-Assessment of Operational Experience Feedback Process (IAEA Services Series No. 10). It is intended to form part of a suite of publications developing the principles set forth in these guidelines. Other publications in this suite are: Trending of Low Level Events and Near Misses to Enhance Safety Performance in Nuclear Power Plants (IAEA-TECDOC-1477); Effective Corrective Actions to Enhance Operational Safety of Nuclear Installations (IAEA-TECDOC-1458); Best Practices in Identifying, Reporting and Screening Operating Experience at Nuclear Power Plants (IAEA-TECDOC-1581); Best Practices in the Utilization and Dissemination of Operating Experience at Nuclear Power Plants (IAEA-TECDOC-1580); and Best Practices in the Organization, Management and Conduct of an Effective Investigation of Events at Nuclear Power Plants (IAEA-TECDOC-1600). This publication will be used for future revision of the IAEA Safety Guide on A System for the Feedback of Experience from Events in Nuclear Installations (IAEA Safety Standards Series No. NS-G-2.11).

The IAEA wishes to thank all the participants and their Member States for their valuable contributions. The IAEA officer responsible for this publication was S. Fotedar of the Division of Nuclear Installation Safety.

EDITORIAL NOTE

The use of particular designations of countries or territories does not imply any judgement by the publisher, the IAEA, as to the legal status of such countries or territories, of their authorities and institutions or of the delimitation of their boundaries.

The mention of names of specific companies or products (whether or not indicated as registered) does not imply any intention to infringe proprietary rights, nor should it be construed as an endorsement or recommendation on the part of the IAEA.

CONTENTS

1. INTRODUCTION

1.1. Background

The IAEA Safety Fundamentals publication Fundamental Safety Principles [1], states the need to establish leadership and management for safety that uses feedback of operating experience to prevent recurrence of accidents and to enhance safety (Principle 3).

The IAEA Safety Requirements publication on Safety of Nuclear Power Plants: Operation (IAEA Safety Standards Series No. NS-R-2) [2] establishes requirements for the safe operation of a nuclear power plant and emphasizes the key attributes of an operating experience feedback programme (paragraphs 2.21-2.26).

The IAEA Safety Guide on A System for the Feedback of Experience from Events in Nuclear Installations (NS-G-2.11) [3] states the need for a commitment from the management of the various participating organizations involved in the national operating experience feedback programme to ensure that the programme is effective and efficient (paragraph 2.9).

As a result of these requirements, together with various programmes run by other international organizations such as the OECD-NEA, INPO and WANO, most nuclear power plants and utilities now operate an operating experience (OE) programme. The more successful plants and utilities exhibit an ingrained belief that an effective and efficient OE programme is essential for good business in terms of increasing safety margins, as well as profitability and long term asset management.

However, INSAG-23, improving the International System for Operating Experience Feedback [4], in section 1.1, acknowledged the general improvement in operational safety performance of nuclear facilities, but expressed concern over the recurrence of safety significant events, which indicates a lack of learning and not applying lessons from experience.

Also, safety reviews performed by the IAEA reveal that, while most of the elements of the OE process are now in place, the overall management of the programme in terms of policy planning and goal setting is still a weakness. These weaknesses have also resulted in inadequate learning from experience.

This publication seeks to provide managers at nuclear facilities with best practices in the management of operating experience, and also provides an overarching link to the referenced IAEA publications (see Figure 1).

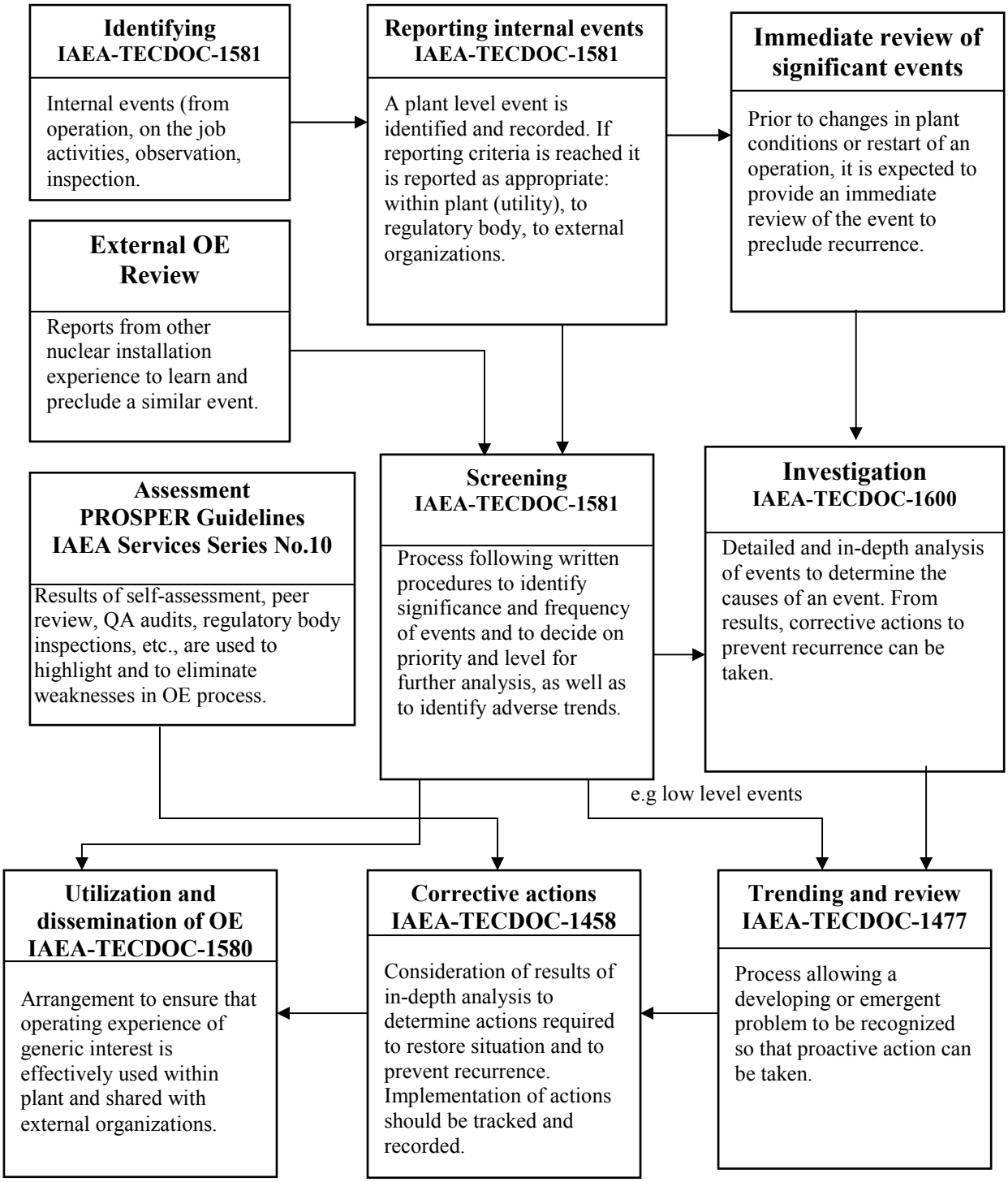


FIG. 1. Typical OE process and IAEA publications on its various elements.

1.2. Objective

This publication has been developed to provide advice, assistance and good practices in the management of the OE programme to nuclear utilities, individual nuclear plants, regulatory organizations and other related institutes.

It is recognized that alternative means may exist and that organizations might effectively achieve this overall performance objective without meeting some or part of the specific criteria, attributes or practices described in the present publication.

1.3. Scope

This publication outlines the key management attributes and characteristics for the successful implementation, review and continuous improvement of an OE programme at nuclear utility companies and individual nuclear plants. The information available under an OE programme for these organizations comprises: external operating experience, internal event reports, including reports on low level events and near misses and other relevant operating performance information such as performance indicators and non-compliance reports on quality assurance etc. While focused on nuclear power plants/utilities, the principles outlined in this publication also apply to other nuclear installations and regulatory organizations. The publication forms part of the IAEA TECDOC series in support of the IAEA Safety Service, Peer Review of the effectiveness of the Operational Safety Performance Experience Review 'PROSPER'. It is not the intent of this publication to address the detailed level of implementation of individual OE processes; these are covered in other TECDOCs, which are referenced where appropriate throughout this publication.

The publication also includes as appendices examples of the management of operating experiences in different nuclear power plants/utilities/facilities. An overview of OE resources, successes achieved and challenges faced in management of OE are also illustrated in these examples.

1.4. Structure

Throughout this publication, generic terms are used (e.g. manager, line manager, coordinator) to describe responsibilities of personnel. Section 4 provides the definitions of these terms as used in this publication.

2. ESSENTIAL MANAGEMENT CHARACTERISTICS

The most important role for managers is to foster a positive environment in order to create, maintain and continuously improve an OE programme such that it is an essential part of the day to day and long term operation of their plant/utility. They ensure that the programme is fully integrated within the nuclear safety fundamentals and the safety culture of individuals and the organization as a whole.

Managers' decisions regarding the activities of the OE programme are driven by maintaining and improving safety performance as the overriding priority. The best performing plants maintain the correct focus on both essential safety improvement and the search for improved

plant performance through OE. Managers ensure that adequate resources are allocated to the OE process to ensure timely learning from events and to prevent an overload of information.

2.1. Strategy

2.1.1. Programme scope

Plant and utility managers establish an OE programme that, as a minimum, meets the regulatory requirements and the standards/guidelines laid down by international organizations such as the IAEA, OECD-NEA and WANO. The scope of the OE programme seeks to proactively and reactively learn from both internal and external OE. This is achieved by first establishing an open and no blame culture, in which reporting is encouraged and reinforced throughout the organization (see Appendix VII and Ref. [5]).

For internal OE, managers ensure that criteria are established for reporting, screening and categorizing events and minor deviations, allocating resources to investigation and/or trend/pattern analysis in a graded approach according to significance (see Ref. [6-8])

Managers ensure that internal OE information is disseminated within the plant and, where there are multiple plant utilities, across the utilities. OE is managed through a central coordinating support function to ensure that intra-utility experience is shared and acted upon appropriately (see Ref. [9]).

Managers ensure that relevant internal OE (as defined by external organization/regulatory body criteria) is disseminated in a timely manner to share learning and prevent recurrence in other nuclear plants/utilities (see Ref. [10]).

For external OE, managers ensure that guidelines on determining what external OE is applicable to the plant/utility are established. Sources of external OE (both positive, i.e. good practices and negative, i.e. event information) are outlined in the PROSPER Guidelines (see Figure 1 of Ref. [11]).

Managers ensure that corrective actions are taken to prevent recurrence of both internal and external events. These actions are prioritized based on their significance and implemented in a timely manner (see Ref. [12]).

2.1.2. Delivery expectations

Managers establish and reinforce clear expectations, policies and procedures that ensure OE is an integrated activity within the plant/utility. In the best performing plants, such expectations manifest themselves as an ingrained belief that an effective and efficient OE programme is essential for good business in terms of increasing safety margins, input to periodic safety reviews, input to plant ageing management, updating the probabilistic safety assessment, as well as improved profitability and long term asset management (see Ref. [2]).

Individuals throughout the organization take OE as a core value, learning not only from events but from their own day to day work experience as well. Thus, the OE programme is seen not as an imposed requirement, but more as an essential element that supports day to day activities. When this is achieved, the OE programme is considered by external reviews to be a cornerstone of the utility/ plant safety culture.

2.1.3. Improvement expectations

Managers establish and reinforce clear expectations, which ensure that the OE programme is continuously improved. This is achieved through a routine self-assessment process and periodic external evaluation and review against industry standards and best practices (e.g. IAEA OSART and PROSPER missions or WANO Peer Reviews). Various areas to be covered during self-assessment of the OE programme are detailed in the PROSPER Guidelines [11].

2.2. Organization and resources

2.2.1. Organizational framework

The organizational framework for an OE programme will be dependent on the plant/utility structure. Single plants have all the attributes outlined in Section 2.1 above, but resources are contained within the plant staff structure. Multiple plant utilities tend to have a central coordinating and support function to screen, analyse and distribute OE.

Whatever the organizational framework, managers establish adequate policies and procedures that clearly define the scope of the OE programme, the organization, and the roles and responsibilities of key staff to operate the programme.

The general manager (see Section 4) has the overall responsibility to ensure the effective and efficient implementation of the OE programme.

One manager (see Section 4) is the OE process owner and has the overall responsibility and accountability for the OE programme. This manager also evaluates the process implementation, recommending to the general manager such improvement actions as necessary.

Line managers (see Section 4) are accountable for ensuring that the outcome of OE in their area of responsibility is shared and acted upon.

OE coordinators (see Section 4) are responsible for the overall implementation and coordination of the OE programme (for both internal and external OE).

2.2.2. Resource allocation

2.2.2.1. Staff

Adequate numbers of suitably qualified and experienced staff are appointed to deliver the defined scope of the OE programme. High priority is given to the appointment of knowledgeable and respected staff to the key OE programme posts to ensure that managers and operations and maintenance staff acknowledge and support the OE programme activities.

Best practice indicates that staff who are knowledgeable of plant operational procedures, operational practices, nuclear plant technology and management processes, and key plant staff are most successful in the OE role. Where practicable, a dedicated team allocated full time to the delivery of the OE programme ensures that appropriate levels of quality and consistency are maintained.

Managers ensure that adequate numbers of staff are trained in event analysis techniques. This is extended to staff beyond those dedicated to the delivery of the OE programme to the

operation, maintenance and engineering functions, to ensure that there is a wide knowledge base of the techniques. Best practice indicates that such trained staff routinely apply this training so that skills are maintained. Managers are responsible for keeping the appropriate numbers of staff rotated and available for these activities.

Managers also ensure that an independent lead investigator and appropriate technical specialists are nominated to the investigation team, and that the team is given adequate time to complete the investigation process and is protected from undue external or internal pressures (see Ref. [8]).

Managers ensure that OE staff are subjected to continuous professional development in their field of expertise. This is achieved by exposure to industry best practice, for example, through participation in international peer review programmes, secondments to operations, engineering and maintenance departments, and training in the latest event investigation techniques.

Managers ensure that the plant/utility training programmes adequately inform all staff about the role and expectations of the OE programme.

Where contract staff are included in the plant's OE programme, managers ensure that adequate training on the plant OE processes is provided. Managers also monitor and review contractor participation and performance within the programme, and notify any performance deficiencies where necessary via routine contractor– management meetings.

2.2.2.2. Tools and equipment

Managers ensure that the OE programme is adequately supported with the necessary infrastructure and information technology (IT) tools to permit all staff easy access to OE data. This includes access to internal event databases, external OE screening data, corrective action programmes and trend/pattern analysis. Best practice shows that this is most effective where the IT tools are integrated into the plant/utility intranet facilities.

Where necessary, managers ensure that appropriate commercially available software is made available to OE staff to support event investigation methodologies and trend/pattern analysis by direct and root causes and causal factors (e.g. HPES, TAPROOT, MORT, SOLVE).

In addition to internal publications, managers ensure that computer intranet display screens are routinely updated and widely available to share current OE data (e.g. plant status, recent events, safety updates).

2.2.2.3. Budget

The general manager ensures that there is adequate funding to support the continued operation and development of the OE programme, as defined above.

The general manager also ensures that corrective actions resulting from the OE programme are given adequate priority within the short and long term investment plans to ensure continued safe operation and long term asset management.

2.3. Oversight and accountability

2.3.1. Daily meetings

Managers maintain routine oversight of the OE programme via daily meetings (operation or production meetings as appropriate). Internal event reports are subject to screening, review and categorization confirmation. Based on the event reports, any impact on routine operations is determined and appropriate allocation of resources is agreed. Priority for root cause analysis (RCA) is allocated depending on significance.

Significant external OE (i.e. industry or utility events of major significance and of relevance to the operating plant) is shared with the meeting participants by the OE coordinator. Where appropriate, managers initiate any immediate actions considered necessary to safeguard the plant against any immediate risk of occurrence/recurrence, pending full event screening and RCA.

Managers promote the use of pre-job briefings and OE materials (e.g. 'just-in-time' (JIT) bulletins see Section 4) to minimize the risk from infrequently performed or high risk activities. Managers hold staff to account for effective application of such OE materials.

2.3.2. Periodic OE review meetings

At periodic review meetings, managers maintain oversight of the OE programme as a routine, including internal, utility and external OE data, the corrective action programme (CAP), trend and pattern analysis, self-assessments, audits and resource prioritization. Such meetings are held relatively frequently (e.g. weekly to monthly) and are attended by staff from all relevant departments. There are a number of good practice examples of such meetings (see Ref. [12]), including Corrective Action Review Boards (CARBs).

Managers hold staff accountable for timely event evaluation/analysis and corrective action closure. Effectiveness reviews are carried out against individual actions and at the final close out of events. Such actions are peer checked to ensure that they have addressed the root causes.

Managers ensure that OE performance indicators (see Ref. [7, 9]) and business indicators are reviewed and corrective actions are in place to address adverse trends in the programme. Managers hold staff accountable for updating performance indicators and programme performance trends.

2.3.3. Nuclear safety committee

In order to promote independent oversight and challenge, periodic reports on the OE programme performance together with plant safety and reliability performance are made by managers to the appropriate nuclear safety committee (note: this is a generic term for a plant/utility safety committee, as appropriate for the individual organization). The Nuclear Safety Committee reviews OE programme results and compares them with plant safety and reliability objectives, advising the general manager and his or her managers, as appropriate, on any deviation from desired performance.

The Nuclear Safety Committee meetings typically take place at a medium frequency (e.g. monthly, quarterly or every six months, depending on plant/utility arrangements) and serve to provide input to annual/periodic safety review meetings of plant performance with the regulatory bodies.

2.3.4. External independent review and oversight

The general manager ensures that OE programmes are periodically externally reviewed (best practice indicates this is typically up to three years) by independent bodies such as the IAEA (OSART, PROSPER), or WANO (Peer Reviews) to assess plant and OE performance against industry best practice. Such reviews promote continuous improvement against international benchmarks and evolving standards. In countries with larger nuclear programmes, this activity may also be delivered in part by a national peer review programme.

The general manager takes ownership of the output from such external reviews and agrees on a corrective action plan. Once the action plan is agreed, the general manager assigns adequate management accountability and resources to ensure timely completion of the action plan. Industry best practice suggests that plants/utilities gain significant benefit from carrying out self assessments/effectiveness reviews to ensure that the actions taken have addressed the root causes of the review findings.

In addition, the plant OE programme is subject to regulatory oversight (see Ref. [13]).

2.4. Programme results and effectiveness reviews

2.4.1. Performance indicator reviews

Managers ensure that a suitable set of performance indicators are developed to enable safety and business performance to be trended and managed; these include both OE process indicators and OE programme effectiveness indicators (see Ref. [7,9]).

Knowledgeable staff are allocated the responsibility and held accountable for maintaining the performance indicator data, identifying trends in the performance indicator data and reporting to the meetings defined in Section 2.3. Managers ensure that responsible staff report trends and deviations from established targets/objectives and, where necessary, recommend corrective action or revised performance indicator targets according to safety/business needs.

2.4.2. OE learning input to training

Managers ensure that applicable lessons learned from the OE programme and corrective actions are adequately transferred to plant staff (i.e. operations, maintenance, engineering, etc.) via the plant/utility training systems (see Ref. [9]). Peer review results indicate that event reports (i.e. the written text), while relatively easy to disseminate, are a volatile medium and do not always maximize learning. Thus, managers ensure that appropriately prioritized and focused training materials are delivered. Best practice indicates that where it is warranted, line managerial participation in training ensures that learning is achieved.

Additionally, the outcomes of the OE programme (e.g. corrective actions, trends and patterns, human factors/error reduction techniques) are fed into the plant/utility entry level training programme.

2.4.3. Corrective action and incident investigation improvements

Managers ensure that the OE database is reviewed for internal events to determine if improper use of the OE programme failed to prevent event recurrence. If necessary, an individual incident assessment is carried out to determine how effectively OE has been used or incorporated into plant programmes. Corrective actions are created to strengthen the OE programme if potential improvements are required. Best practice indicates that such continual assessment of OE data can help to prevent event recurrence and improve overall plant performance.

2.4.4. Self-assessment and continuous improvement

Managers ensure that periodic self-assessments of the OE programme are carried out in order to promote self-critical behaviour and continuous improvement. Such self-assessments will typically cover (among other matters) adequacy of the event screening arrangements, corrective action adequacy and prioritisation. The IAEA PROSPER guidelines (see Ref. [11]) provide a full framework for such self-assessments. Managers ensure that the outputs from such self-assessments and the reviews outlined in Section 2.3 above are reviewed and acted upon at a specified frequency, typically on an annual basis.

Any deviation from the overall established plant/utility plan is assessed and corrective actions are developed. Such deviations are also considered in light of the overall strategy, policy, procedures and performance indicators in use. Where necessary, revisions to the strategic business management objectives are considered and implemented. Such annual reviews can also provide input to regulatory periodic review meetings.

2.4.5. Other techniques

Where practicable, managers foster other techniques to determine the effectiveness of the OE programme, including finding the satisfaction level of key stakeholders (e.g. staff, vendors, contractors, regulators, customers and, where practicable, the general public) through adequately designed feedback questionnaires, surveys and interviews.

3. SIGNIFICANT BARRIERS TO SUCCESSFUL MANAGEMENT OF AN OE PROGRAMME

3.1. Lack of management engagement

Lack of management engagement typically manifests itself through the following:

- Managers allow production priorities to prevail above safety aspects and OE programme demands.
- Managers fail to ensure adequate resources and funding.
- Managers fail to set long term goals and objectives for the OE programme.
- Managers exhibit poor leadership and management skills.
- Managers fail to provide and define an adequate OE policy and process.
- Managers are not routinely in the field supporting the OE programme.
- Managers fail to establish an adequate reward system to support safety performance.

3.2. Lack of openness

Lack of openness typically manifests itself through the following:

- Managers claim that confidentiality or propriety information prevents sharing experience.
- Managers and shift/maintenance teams keep problems and deficiencies to themselves.
- Managers exhibit a lack of willingness to share experience in a timely manner.
- Managers fail to ensure that minor events and near misses are reported.
- Managers fail to ensure that OE is shared with the utility and the national or international community.
- Managers are not willing to expose plant weaknesses in a competitive environment.
- Managers do not foster an open and 'blame free' culture ('blame free' is taken to be a just culture where errors of omission/commission are considered as learning opportunities but deliberate violation, negligence or sabotage are appropriately dealt with through disciplinary procedures).

3.3. Isolationism

Isolationism typically manifests itself through the following:

- Managers being unwilling to benchmark against best practice/best organizations.
- Managers being unwilling to take part in external peer reviews (e.g. IAEA OSART, IAEA PROSPER, WANO Peer Review).
- Managers exhibit a lack of effective use of external operating experience.
- Managers fail to detect a gradual deviation from international best practice standards.
- Managers fail to ensure that external OE documents and standards are correctly translated into the native language.
- Managers exhibit an inability to communicate at different levels.

3.4. Lack of ownership

Lack of ownership typically manifests itself through the following:

- Managers fail to realize that people are fallible and that even the best performers can make mistakes.
- Managers do not respect the work of OE programme coordinators and see it as a burden and not an activity that adds value.
- Managers allow significant backlogs to accrue (e.g. defects, procedural updates, modification completion, corrective actions).
- Managers exhibit a close-minded attitude ("It's not my responsibility or problem").

3.5. Weaknesses in staff selection and training

Weaknesses in staff selection and training typically manifest itself through the following:

- Managers do not assign knowledgeable, experienced and respected staff to the OE programme.
- Managers fail to promote and sustain adequate levels of training based on the OE programme output.
- Managers allow staff transfer or retire without adequate retention of tacit knowledge/experience (i.e. loss of corporate memory).

- Managers fail to include human performance subjects in staff training with sufficient scope and frequency.
- Managers fail to promote opportunities for learning from good practices.

3.6. OE process deficiencies

OE process deficiencies typically manifest themselves through the following:

- Managers fail to promote the adequate reporting, coding and trending of low level events and near misses.
- Managers fail to see beyond the direct cause of events and do not address the root cause(s) or underlying process issues and root cause trends.
- Managers do not recognize low level events and near misses as precursors/contributors to more significant events.
- Managers do not promote or encourage a focus on human performance and organizational aspects during the event screening and investigation processes.
- Managers tolerate a lack of a systematic approach to the OE programme, including screening of external OE, investigation and corrective action prioritization.
- Managers tolerate a lack of clarity in reporting of events, which then does not fully communicate their applicability to other plants/designs.
- Managers fail to provide tools to allow for prompt and easy access to OE information.
- Managers fail to ensure adequate dissemination of OE to all staff.

3.7. Overconfidence and complacency

Overconfidence and complacency typically manifest themselves through the following:

- Managers see the OE programme as a burden and not an activity that adds value.
- Managers often dismiss external OE by the simple justification that “it cannot happen here”.
- Managers react defensively to suggestions for improvement.
- Managers tolerate deficiencies that are identified via the OE programme.
- Managers exhibit a lack of self-criticism and an acceptance of low standards.
- Managers fail to deal with employee safety concerns promptly.
- Managers fail to correct the findings of external reviews of OE in a timely manner.
- Managers fail to establish and maintain meaningful performance indicators to monitor the OE programme.

3.8. Lack of clear responsibility and accountability

Lack of clear responsibility and accountability typically manifests itself through the following:

- Managers do not adequately discharge their oversight, supervision and accountability roles.
- Managers fail to ensure that suitable and sufficient self-assessment is in place at all organizational levels.
- Managers fail to set appropriate corrective actions to address the deficiencies in the OE programme.
- Managers fail to ensure adequate OE focus due to the complexity of organizational structure/hierarchy.

4. DEFINITIONS

4.1. General manager

The most senior person within the plant/utility, typically the chief executive officer, managing director or chief nuclear operations officer.

4.2. Managers

The senior manager within the plant/utility, one level below the general manager (see Section 4.1). Typically, a manager with executive responsibility and accountability including significant control of budget and resources. Usually, the managers at this level would have the overall responsibility and accountability for the OE programme.

4.3. Line managers

Managers responsible of day to day control one level below the senior manager (see Section 4.2) within a plant. Typically a manager/leader of teams and day to day work activities.

4.4. OE coordinator

The person responsible for the overall implementation and coordination of the OE programme (for both internal and external OE); reports directly to the senior manager who has the overall accountability for the OE programme (see Section 4.2).

4.5. Staff

In the context of this publication, staff includes all the employees, managers and contractors (where applicable) of the facility.

4.6. Just-in-time (JIT)

A tool to provide staff with timely information about previous events such that the risk of recurrence is mitigated (i.e. to get the right information to the right staff at the right time).

*(**Note**: JIT information provides key aspects of OE to the staff who actually operate and maintain the plant.*

A supervisor describes the key points of the JIT OE and then asks staff a series of questions that probe their knowledge of the plant-specific policies or procedures that, if applied correctly, should prevent such an event at their plant. When incorporating OE lessons learned into daily work activities, the scope of the OE review depends on the risk and complexity of the task and on how often it is performed by the assigned staff. The OE addressed during a task review for more complex, infrequently performed and high risk tasks is not limited to industry operating experience. It may include lessons learned from internal OE, equipment work history and even personal experience.

4.7. Internal OE

Internal OE relates to the plant/utility and can address issues within a company that include greater detail specific to the organization and work programmes.

4.8. External OE

External OE is obtained from sources outside of the plant/utility, typically from external organizations such as the IAEA/NEA Incident Reporting System (IRS), IAEA Power Reactor Information System (PRIS), World Association of Nuclear Operator (WANO), Institute of Nuclear Power Operations (INPO) and Candu Owners Group (COG).

APPENDIX I

OE MANAGEMENT AT RESEARCH TECHNOLOGY OPERATIONS, CHALK RIVER LABORATORIES, AECL, CANADA

Brief description of nuclear facility

A nuclear installation consisting of a 130 MW research reactor and 13 licensed nuclear facilities, staffed by ~2600 employees, on three distinct sites. Main activities include:

(1) Reactor development;

(2) CRL nuclear operations;

(3) Research and development;

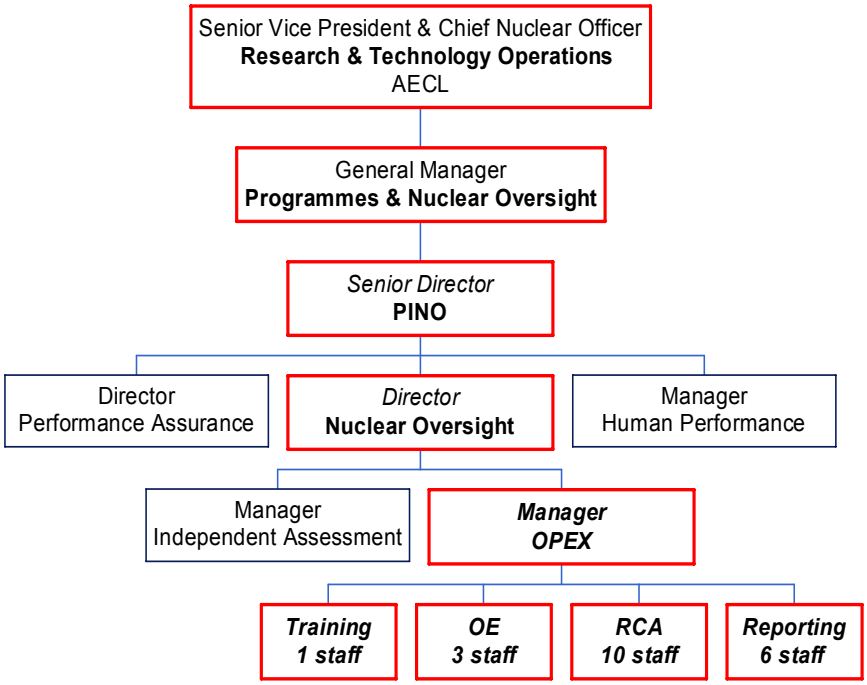
(4) Isotope production;

(5) Waste management and decommissioning.

Overview of OE arrangements

A centralized OE group that is permanently resourced and trained to support the organization. The group is spread over two time zones and supported by a cadre of permanently dedicated OE coordinators and action tracking coordinators throughout the organization.

Overview of OE resources



Management arrangements

Attributes

- An electronic tool for problem identification and corrective action;
- Strong senior management commitment;
- Permanently resourced and comprising 20 dedicated professional;
- OE training for employees permanently ingrained into organization.

Key focus areas

- Past: Regulatory reporting;
- Present: Increase in all significant levels of reporting and senior management oversight;
- Future: Aggressive trending of low level events and near misses.

Successes

- Increase in event reporting (380 in 2005 to ~4221 in 2007);
- Increase in RCAs completed (increase of 150% from 2005 to 2007);
- Increase in sharing internal and external OE;
- Increase staff from 4 to 20 in the past three years.

Lessons learned

- Do homework first; more benchmarking at the beginning;
- Strong change control required at all levels;
- Right people, right time in right place;
- Determine final output and work backwards;
- Focused training module.

Good practices to share

- Senior manager as a champion;
- Strong management engagement and commitment;
- Strong leadership at all levels;
- Easy to use process;
- Training, training and more training;
- Dedicated RCA team.

APPENDIX II

OE MANAGEMENT AT MOCHOVCE NUCLEAR POWER PLANT, SLOVAKIA

Brief description of nuclear facility

Slovenske elektrarne – ENEL utility operates two nuclear power plants in southern Slovakia – Bohunice and Mochovce nuclear power plants. Both plants are of the same design (WWER 440/V213).

The Mochovce plant operates two units; Unit 1 has supplied electricity to the network since 1998, and Unit 2 since 2000. The Mochovce units rank among the newest WWER 440/V 213 nuclear blocks and benefit from all the improvements already made at the plant.

Overview of OE arrangements

The basic management expectations concerning the OE programme are defined by the utility's policy. Assessment of the effectiveness of the OE programme is performed locally at the plant and independently at the utility level. This utility assessment serves as input to overall improvement process of OE programme at the plant.

Management arrangements

The IAEA performed a pre-OSART mission in 1994 before the Mochovce plant began operation. Based on the recommendations of the mission, the Mochovce plant established an OE programme and an organizational structure to support it. The plant operation started with a fully functioning OE system.

The plant director is responsible for implementation of an effective OE programme, in accordance with the national regulatory body requirements, WANO and IAEA expectations and the utility's policy.

The OE programme owner is head of the safety division, who ensures that reported events and near misses are screened and analysed, and that corrective actions are taken with regard to the safety significance of the problem.

Implementation of daily activities connected with the OE programme, screening, investigation of events, assessment of effective implementation of the corrective actions taken, assessment of OE programme effectiveness through performance indicators, and updating information in the OE database are the responsibility of head of the OE section. The section is located in the Safety Division and consists of three engineers and one technician. Results of event investigations and relevant corrective actions are approved by the Corrective Actions Review Board (CARB), a group consisting of a cross-section of managers. CARB meetings are organized at least once a month and are led by the head of the safety division.

Since the beginning of the plant operation, a key focus of the Mochovce plant management in the OE area has been improving human performance using lessons learned from internal as well as external OE. With regard to this effort, management support of the OE programme is also demonstrated by the plant's policy on reporting, assessment and use of near misses. Management recognizes errors as an inherent part of human behavior and as opportunities to

learn. It encourages timely and open reporting of near misses, presenting this attitude in daily practice using all possible methods (coaching, meetings with staff, input into training, bulletins, newspapers, posters, plant tours, observations, etc.).

With regard to improving the reporting culture of all staff, the Mochovce plant with the support of the United Kingdom, Department of Trade and Industry, performed a special one-year project focused on improving the near misses programme. The outcomes of the project have significantly improved personnel reporting of human performance problems. This allows management to take proactive measures.

Screening is performed at a daily production meeting and independently by appointed engineers within the Safety Division, including OE staff.

The basic categories of events at the Mochovce plant are as follows:
(1) Significant events and events that meet criteria for reporting to the national regulatory body;
(2) Low level events;
(3) Near misses;
(4) Conditions adverse to quality.

All these categories are evaluated using a risk assessment tool.

Low level events and near misses evaluated as potentially significant, 'high risk', are treated in the same way as significant events (i.e. prompt evaluation for compensatory measures, root cause analysis performed or coordinated by the OE section, corrective actions approved by CARB). Low level events and near misses with medium and low risk as well as conditions adverse to quality are resolved within the relevant departments.

In accordance with the plant management's policy for the OE programme, root cause analyses are performed by personnel trained in RCA techniques. Currently, approximately twenty engineers have been trained externally (WANO, IAEA, TapRoot, Conger and Elsea) and about fifty employees have been trained internally. The preferred methodologies for RCA are HPES and TapRoot.

The plant management ensures that an international review of the OE programme is performed at least every three years.

Good practice to share
The result of investigations of significant events are independently reviewed by colleagues (in a managerial position) from the Bohunice plant. This practice improves the overall completeness of the investigation process and ensures that the Bohunice plant experiences are also incorporated into recommendations developed concerning a particular event.

APPENDIX III

OE MANAGEMENT AT THE NUCLEAR POWER CORPORATION OF INDIA LIMITED, INDIA

Brief description of nuclear utility

- Nuclear Power Corporation of India Limited;
- 17 reactors in operation and 5 reactors in different stages of construction and commissioning;
- Most of the reactors are PHWRs except two operating BWRs and two WWERs under construction.

Overview of OE arrangements

- A centralized OE committee at headquarters;
- An operating experience review committee (OERC) and station operation review committee (SORC) at each station for a pair of reactors;
- An independent regulatory body.

Overview of OE resources

- Centralized OE committee at headquarters consisting of four persons;
- OERC at each station consisting of nine persons;
- SORC at each station consisting of nine persons.

Management arrangements

Key focus areas

- Past: Implementation of human performance and error prevention tools in all activities of design, construction, commissioning and operation of nuclear power plants;
- Present: Sustaining improved performance and striving for continual improvements;
- Future: Matching developing standards and setting very challenging goals.

Successes

- Sustained excellence in all KPIs and maintained an availability factor above 90%;
- Long run of continuous operation of units, typically the Kaiga plant had a continuous run of 500 days of operation;
- Completion of construction and commissioning of the twin Tarapur Units 3&4 540 MWe PHWRs in less than five years;
- Replacement of coolant channels in four reactors, of primary system feeders of all 306 channels in three of the reactors, and of all 88 primary system heat exchangers (boilers) in two reactors was accomplished successfully. Also, major upgrading and life extension activities were carried out in three units that had been built to earlier standards.

Challenges

- OE for contract employees;
- Use of OE from operating plants in design and construction of new plants;
- Improved reporting to international community (e.g. WANO, COG).

Good practices to share

- A centralized feedback system with structured OE programme and clear headquarters and station instructions;
- Periodic video conferencing and meeting of personnel on OE among stations with the coordination of headquarters;
- Multi-tier review system with clear responsibilities.

APPENDIX IV

OE MANAGEMENT AT CHASHMA NUCLEAR POWER PLANT, UNIT 1, PAKISTAN

Brief description of nuclear facility
One PWR unit of 325 MWe, in commercial operation since September 2000, second unit under construction.

Overview of OE arrangements
A plant level system is in place consisting of in-house and industry OE streams. These are looked after by a dedicated section currently under a training manager.

The in-house system comprises a higher level event notification report (ENR) process and a low level plant condition report (PCR) process.

To augment increased utilization of industry experiences during routine activities at the plant, the contents of the WANO website have been made available on LAN for ease of access and convenience during retrieval of required information at times of need by general plant personnel. Similar efforts are on going to make available information from US NRC, IAEA-NEA IRS, and other sources of OE for prompt and easy use by personnel.

Overview of OE resources
At present, one engineer is assigned to the OE programme, with a possible further increase in the number of personnel in the section in the near future. Separate computerized databases are available for the in-house and industry OE streams, both of which are coupled with tracking and follow-up facilities. These databases are intended to be transformed into an Oracle based system in the future. The plant condition report system has already started to be developed as an Oracle system. This reporting system is currently available, and other facilities are being added with the ultimate aim of making available a full-fledged paperless system.

Management arrangements
Attributes
- The OE system is centralized and provides a single point interface.

Key focus areas
- Development of supporting software;
- Backlog monitoring/reporting;
- Standing of OE as an independent and respected function within the organization.

Successes
- Procedures made available covering the whole range of OE functions;
- Complete WANO website is available on the LAN, which is kept up to date for use by plant personnel.

Challenges

- Organization wide recognition/acceptance of OE as a tool;
- Qualified RCA specialists;
- Computerized tools to support RCA;
- Development/transition in a LAN-based database system for OE;
- Timely completion and thoroughness of investigations.

Good practices to share

- Multi-disciplinary investigations;
- OE process throughput is reported to management via monthly reports, and varying area specific representations, as and when required;
- Use of recommendations instead of corrective actions in investigation/analysis to help expedite timely availability of reports.

APPENDIX V

OE MANAGEMENT AT ČEZ, a.s, CZECH REPUBLIC

Brief description of nuclear facility

Two nuclear power plants: Dukovany WWER 4 × 440 MWe, in operation since 1985
Temelin WWER 2 ×1000 MWe, in operation since 2000

Overview of OE arrangements

- The groups of internal OE are independent of operation; there is one leader and two engineers at each site.
- The group of external OE is common for both plants and comprises one leader and two engineers.
- The process documentation is common for both plants.

Management arrangements

Process goal

To contribute to the permanent improvement of the safe and reliable operation of nuclear power plants in the Czech Republic and to prevent the occurrence of significant events, particularly from repeating causes.

Principles:

- Safety culture;
- Teamwork;
- Openness;
- Trust.

Mistakes, if they occur, are used as a source of useful experience.

Staff are encouraged to find, report and clear shortcomings in the work in order to prevent possible future problems. The threshold is set uniformly for both plants.

Key Focus areas

- Dukovany nuclear power plant
  - Stabilization in both categories (significant events and failures);
  - Focusing on the operational staff induced events.

- Temelin nuclear power plant
  - Continuous decrease in the category of significant events;
  - Focus on supply induced events.

Successes

- Evaluations of both power stations and in particular of the OE programme, by international missions from WANO and OSART have been positive.

Challenges

- A period of event free operation is needed so that public opinion will be supportive of the construction of a new nuclear unit power plant.

Good practices to share

- Separation of the OE management process from responsibility for operation;
- Direct exchange of information among VVER operators (Temelin, Dukovany, Bohunice, Mochovce, Paks).

APPENDIX VI

OE MANAGEMENT AT EXELON NUCLEAR, UNITED STATES OF AMERICA

Brief description of nuclear facility

- Exelon Nuclear, a business unit of Exelon corporation;
- 17 reactors in operation;
- 12 units are BWRs and 5 units are PWRs.

Overview of OE arrangements

- A centralized OE committee at headquarters;
- An OE review committee and station operation review committee;
- Station Ownership Committee (SOC), a department level review committee at each site and at headquarters;
- Management Review Committee (MRC), a director level review committee at each site and at headquarters;
- Nuclear Regulator Commission, an independent regulatory body at each site.
- State level independent regulatory oversight at each site.

Overview of OE resources

- Centralized OE committee at headquarters consists of four persons full time (Note: review committee members participate in addition to their routine duties);
- SOC at each station consists of eight persons, a minimum five needed for a quorum;
- MRC at each station consists of eight persons, a minimum five needed for a quorum.

Management arrangements

Key focus areas

- Quality of causal analysis products to include organizational and cultural lessons;
- Development of a performance improvement organization that integrates human performance and programmes;
- Continued improvements in implementation of human performance tools and best practices.

Successes

- Nine out of ten sites are INPO/WANO 1;
- Sustained excellence in all KPIs and an availability factor above 90%;
- Long run of continuous operation of units.

Challenges

- Outage use of OE for contract employees**.**

Good practices to share

- Multi-tier review system with clear responsibilities and supporting procedures.
- Distribution of internal OE through the Exelon Nuclear Event Reporting System.

APPENDIX VII

EXTRACTS FROM 'EFFECTIVE MANAGEMENT OF THE OE PROGRAMME', BY ADAM GIECI, VUJE INC., SLOVAKIA

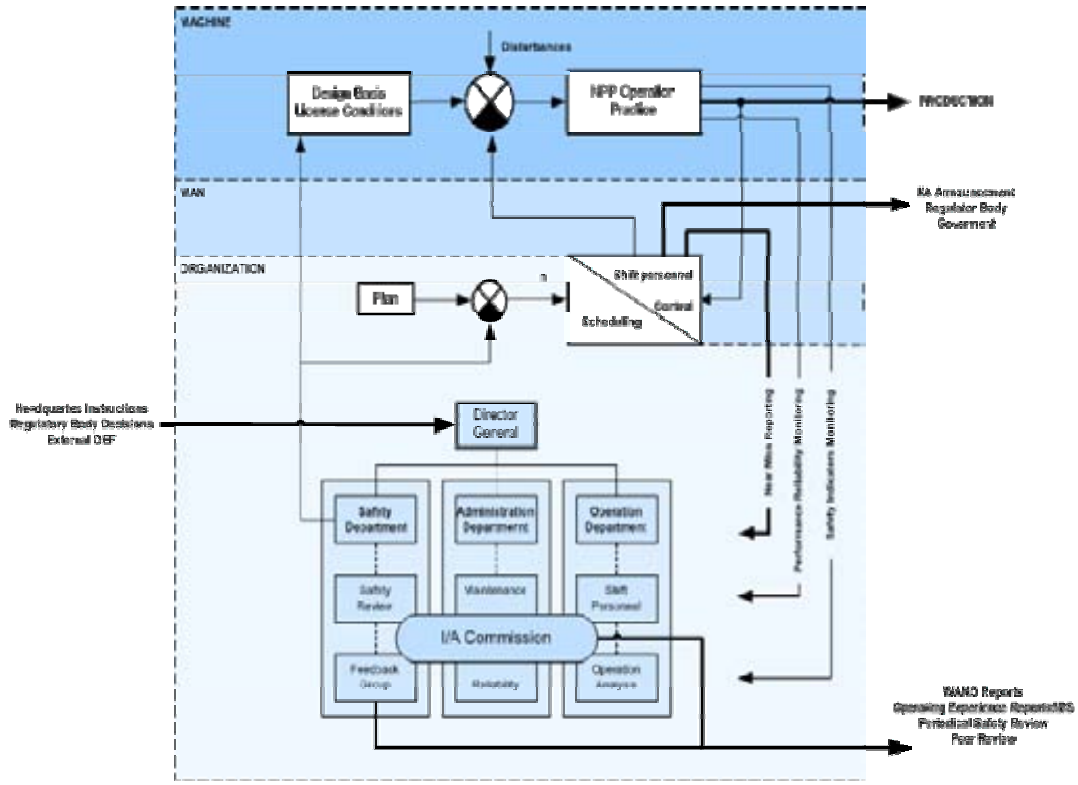


FIG. 2. Information flows and feedback loops of an OE programme.

Adam Gieci's model in Figure 2 illustrates the complex information flows and feedback loops of a typical OE regulation within a nuclear power plant. The background to this model is the man– machine– organization framework.

In the context of this publication, Gieci's model demonstrates how the OE programme penetrates the whole organization of a plant or utility. His presentation looks beyond the typical hierarchical management control structures of a nuclear power plant to the essential element of horizontal information processing that managers need to support for the successful implementation and maintenance of an OE programme.

In his presentation, Gieci focuses on the essential characteristics of organizational development and the role of management in supporting and improving organizational safety performance with reference to work by Reason, Westrum and Hudson (see following extracts).

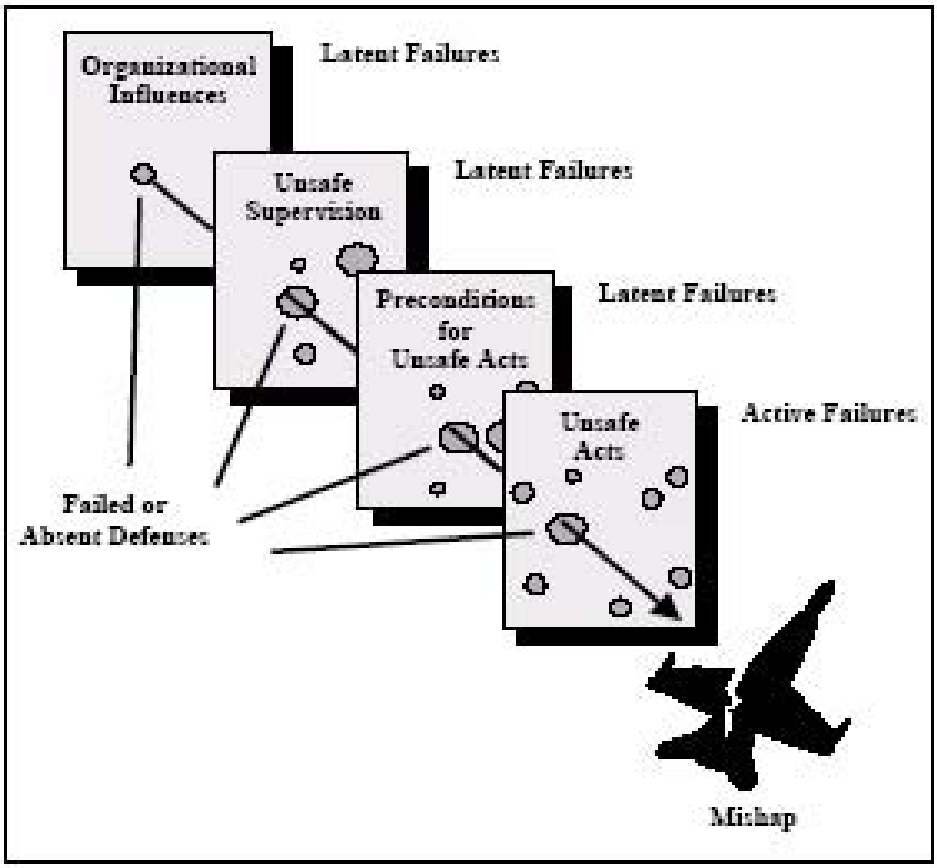


FIG. 3. Reason's 'Swiss cheese' model.

James Reason developed the 'Swiss cheese' model shown in Figure 3 to explain the concept of latent failures within organizations that set up accident potential. In his model, unrevealed latent organizational failures are represented by the holes in the barriers which, if aligned, can lead to a failure or an event. Within organizations these barriers are represented by, for example, management actions, documentation and procedures, training of staff, safety in design and construction (e.g. defence in depth).

This TECDOC focuses on the manager's role in minimizing the latent failures within the OE programme. In particular, Section 3 of this publication elaborates some of the possible managerial barriers to the successful implementation of an OE programme.

PATHOLOGICAL	BUREAUCRATIC	GENERATIVE
Do not want to know	May not find out	Actively seek information
Messengers are shot	Listened if they arrive	Messengers are trained
Responsibility is shirked	Responsibility is compartmentalized	Responsibility is shared
Bridging is discouraged	Allowed but neglected	Bridging is rewarded
Failure is punished or covered up	Organization is just and merciful	Inquiry and redirection
New ideas are actively crushed	New ideas present problems	New ideas are welcomed

FIG. 4. Westrums classification of organizational types.

In his papers, Ron Westrum proposes that handling of information and communication are key features of organiszations. He has identified three different types of organization (or phases of organizational development) which are in Figure 4.

In the context of this publication, where an OE programme is wholly dependent on information flow, the Westrum model is particularly relevant to a culture of open reporting, sharing of information, and fostering of a 'blame free' environment. The leadership of managers in establishing openness in the reporting culture is fundamental to the success of the OE programme.

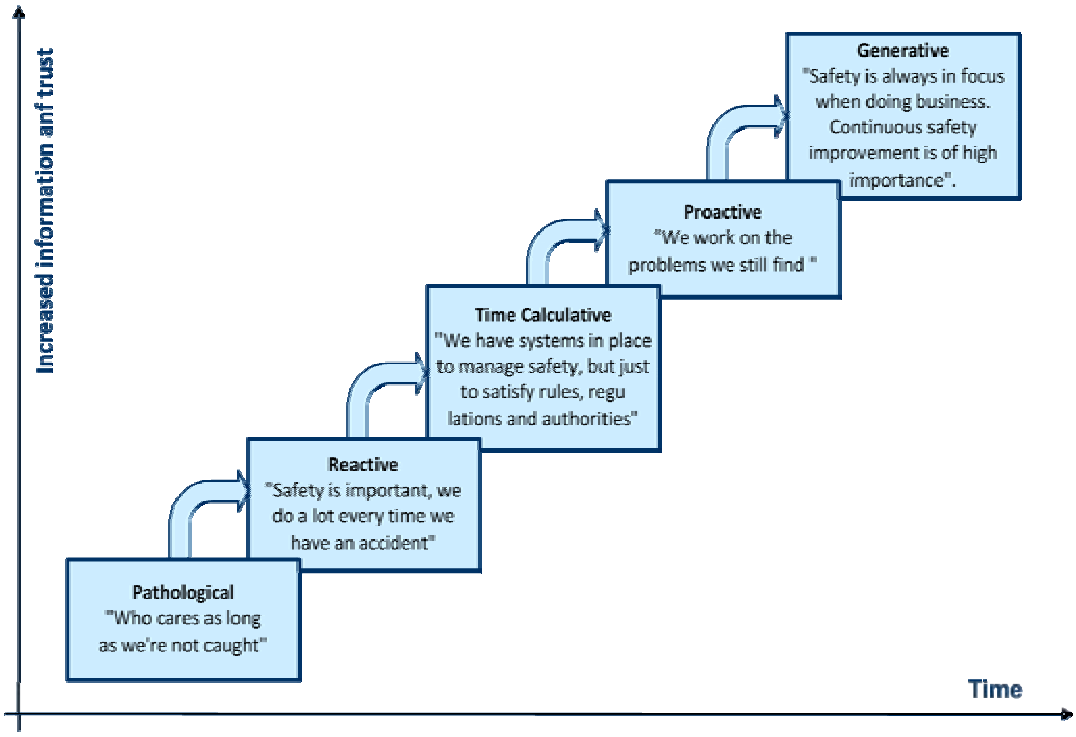


FIG. 5. Hudson's organizational culture maturity ladder.

Patrick Hudson's model shows a number of phases of organizational development. His model is particularly relevant to the prevailing cultures necessary to the successful implementation of an effective OE programme.

In the context of this publication, the managerial challenge is to lead the organizational development along the progressive steps, and/or to maintain the 'Generative' phase.

REFERENCES

[1] EUROPEAN ATOMIC ENERGY COMMUNITY, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, WORLD HEALTH ORGANIZATION, Fundamental Safety Principles: Safety Fundamentals, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Operation, IAEA Safety Standards Series No. NS-R-2, IAEA, Vienna (2000).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, A System for the Feedback of Experience from Events in Nuclear Installations, IAEA Safety Standards Series No. NS-G-2.11, IAEA, Vienna (2006).

[4] INTERNATIONAL NUCLEAR SAFETY GROUP, Improving the International System for Operating Experience Feedback, INSAG-23, International Atomic Energy Agency, Vienna (2008).

[5] GIECI, A., "Effective Management of the OE Programme" presentation at "MMOTION Project", Helsinki and Trnava, 2009.

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Best Practices in Identifying, Reporting and Screening Operating Experience at Nuclear Power Plants, IAEA-TECDOC-1581, IAEA, Vienna (2007).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Trending of Low Level Events and Near Misses to Enhance Safety Performance in Nuclear Power Plants, IAEA-TECDOC-1477, IAEA, Vienna (2005).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Best Practices in the Organization, Management and Conduct of an Effective Investigation of Events at Nuclear Power Plants, IAEA-TECDOC-1600, IAEA, Vienna (2008).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Best Practices in the Utilization and Dissemination of Operating Experience at Nuclear Power Plants, IAEA-TECDOC-1580, IAEA, Vienna (2008).

[10] INTERNATIONAL NUCLEAR SAFETY GROUP, Strengthening the Global Nuclear Safety Regime, INSAG-21, International Atomic Energy Agency, Vienna (2006).

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, PROSPER Guidelines: Guidelines for Peer Review and for Plant Self-Assessment of Operational Experience Feedback Process, IAEA Services Series No. 10, IAEA, Vienna (2003).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY, Effective Corrective Actions to Enhance Operational Safety of Nuclear Installations, IAEA-TECDOC-1458, IAEA, Vienna (2005).

[13] OECD-NUCLEAR ENERGY AGENCY, Regulatory Challenges in Using Nuclear Operating Experience, OECD/NEA, Paris, (2006).

CONTRIBUTORS TO DRAFTING AND REVIEW

Brown, C.G.	Magnox South,United Kingdom
Chiarelli, R.	International Atomic Energy Agency
Coovert, R.	Exelon Nuclear, United States of America
Desgagne, E.	Canadian Nuclear Safety Commission, Canada
Fotedar, S. K.	International Atomic Energy Agency
Fowles, G.	CANDU Owners Group Inc., Canada
Gieci, A.	VÚJE, Inc., Slovakia
Heuertz, S.	Duke Energy, United States of America
Joppen, F.	S K. CEN, Belgium
Khan, U.	Chashma 1 Nuclear Power Plant, Pakistan
Lipar, M.	International Atomic Energy Agency
McKenna, J	Atomic Energy of Canada Limited, Canada
Peng, J.	Permanent Mission of China to the IAEA
Prohaska, G.	International Atomic Energy Agency
Sabate, R.	Asociacion Nuclear Ascó-Vandellós II , Spain
Shepherd, P.	Consultant, United Kingdom
Venkatachalam, M.	Nuclear Power Corporation of India Limited, India
Zahradka, D	Mochovce Nuclear Power Plant, Slovakia
Zelinka, Z.	Temelin Nuclear Power Plant, Czech Republic

Consultants Meeting

Vienna, Austria: 25–29 September 2006, 20–24 July 2009

Technical Meeting

Vienna, Austria: 25–29 August 2008

No. 21, July 2006

IAEA
International Atomic Energy Agency

Where to order IAEA publications

In the following countries IAEA publications may be purchased from the sources listed below, or from major local booksellers. Payment may be made in local currency or with UNESCO coupons.

Australia
DA Information Services, 648 Whitehorse Road, Mitcham Victoria 3132
Telephone: +61 3 9210 7777 • Fax: +61 3 9210 7788
Email: service@dadirect.com.au • Web site: http://www.dadirect.com.au

Belgium
Jean de Lannoy, avenue du Roi 202, B-1190 Brussels
Telephone: +32 2 538 43 08 • Fax: +32 2 538 08 41
Email: jean.de.lannoy@infoboard.be • Web site: http://www.jean-de-lannoy.be

Canada
Bernan Associates, 4611-F Assembly Drive, Lanham, MD 20706-4391, USA
Telephone: 1-800-865-3457 • Fax: 1-800-865-3450
Email: order@bernan.com • Web site: http://www.bernan.com

Renouf Publishing Company Ltd., 1-5369 Canotek Rd., Ottawa, Ontario, K1J 9J3
Telephone: +613 745 2665 • Fax: +613 745 7660
Email: order.dept@renoufbooks.com • Web site: http://www.renoufbooks.com

China
IAEA Publications in Chinese: China Nuclear Energy Industry Corporation, Translation Section, P.O. Box 2103, Beijing

Czech Republic
Suweco CZ, S.R.O. Klecakova 347, 180 21 Praha 9
Telephone: +420 26603 5364 • Fax: +420 28482 1646
Email: nakup@suweco.cz • Web site: http://www.suweco.cz

Finland
Akateeminen Kirjakauppa, PL 128 (Keskuskatu 1), FIN-00101 Helsinki
Telephone: +358 9 121 41 • Fax: +358 9 121 4450
Email: akatilaus@akateeminen.com • Web site: http://www.akateeminen.com

France
Form-Edit, 5, rue Janssen, P.O. Box 25, F-75921 Paris Cedex 19
Telephone: +33 1 42 01 49 49 • Fax: +33 1 42 01 90 90 • Email: formedit@formedit.fr

Lavoisier SAS, 14 rue de Provigny, 94236 Cachan Cedex
Telephone: + 33 1 47 40 67 00 • Fax +33 1 47 40 67 02
Email: livres@lavoisier.fr • Web site: http://www.lavoisier.fr

Germany
UNO-Verlag, Vertriebs- und Verlags GmbH, August-Bebel-Allee 6, D-53175 Bonn
Telephone: +49 02 28 949 02-0 • Fax: +49 02 28 949 02-22
Email: info@uno-verlag.de • Web site: http://www.uno-verlag.de

Hungary
Librotrade Ltd., Book Import, P.O. Box 126, H-1656 Budapest
Telephone: +36 1 257 7777 • Fax: +36 1 257 7472 • Email: books@librotrade.hu

India
Allied Publishers Group, 1st Floor, Dubash House, 15, J. N. Heredia Marg, Ballard Estate, Mumbai 400 001,
Telephone: +91 22 22617926/27 • Fax: +91 22 22617928
Email: alliedpl@vsnl.com • Web site: http://www.alliedpublishers.com

Bookwell, 24/4800, Ansari Road, Darya Ganj, New Delhi 110002
Telephone: +91 11 23268786, +91 11 23257264 • Fax: +91 11 23281315
Email: bookwell@vsnl.net • Web site: http://www.bookwellindia.com

Italy
Libreria Scientifica Dott. Lucio di Biasio “AEIOU”, Via Coronelli 6, I-20146 Milan
Telephone: +39 02 48 95 45 52 or 48 95 45 62 • Fax: +39 02 48 95 45 48

Japan
Maruzen Company, Ltd., 13-6 Nihonbashi, 3 chome, Chuo-ku, Tokyo 103-0027
Telephone: +81 3 3275 8582 • Fax: +81 3 3275 9072
Email: journal@maruzen.co.jp • Web site: http://www.maruzen.co.jp

Korea, Republic of
KINS Inc., Information Business Dept. Samho Bldg. 2nd Floor, 275-1 Yang Jae-dong SeoCho-G, Seoul 137-130
Telephone: +02 589 1740 • Fax: +02 589 1746
Email: sj8142@kins.co.kr • Web site: http://www.kins.co.kr

Netherlands
Martinus Nijhoff International, Koraalrood 50, P.O. Box 1853, 2700 CZ Zoetermeer
Telephone: +31 793 684 400 • Fax: +31 793 615 698 • Email: info@nijhoff.nl • Web site: http://www.nijhoff.nl

Swets and Zeitlinger b.v., P.O. Box 830, 2160 SZ Lisse
Telephone: +31 252 435 111 • Fax: +31 252 415 888 • Email: infoho@swets.nl • Web site: http://www.swets.nl

New Zealand
DA Information Services, 648 Whitehorse Road, MITCHAM 3132, Australia
Telephone: +61 3 9210 7777 • Fax: +61 3 9210 7788
Email: service@dadirect.com.au • Web site: http://www.dadirect.com.au

Slovenia
Cankarjeva Zalozba d.d., Kopitarjeva 2, SI-1512 Ljubljana
Telephone: +386 1 432 31 44 • Fax: +386 1 230 14 35
Email: import.books@cankarjeva-z.si • Web site: http://www.cankarjeva-z.si/uvoz

Spain
Díaz de Santos, S.A., c/ Juan Bravo, 3A, E-28006 Madrid
Telephone: +34 91 781 94 80 • Fax: +34 91 575 55 63 • Email: compras@diazdesantos.es
carmela@diazdesantos.es • barcelona@diazdesantos.es • julio@diazdesantos.es
Web site: http://www.diazdesantos.es

United Kingdom
The Stationery Office Ltd, International Sales Agency, PO Box 29, Norwich, NR3 1 GN
Telephone (orders): +44 870 600 5552 • (enquiries): +44 207 873 8372 • Fax: +44 207 873 8203
Email (orders): book.orders@tso.co.uk • (enquiries): book.enquiries@tso.co.uk • Web site: http://www.tso.co.uk

On-line orders:
DELTA Int. Book Wholesalers Ltd., 39 Alexandra Road, Addlestone, Surrey, KT15 2PQ
Email: info@profbooks.com • Web site: http://www.profbooks.com

Books on the Environment:
Earthprint Ltd., P.O. Box 119, Stevenage SG1 4TP
Telephone: +44 1438748111 • Fax: +44 1438748844
Email: orders@earthprint.com • Web site: http://www.earthprint.com

United Nations (UN)
Dept. I004, Room DC2-0853, First Avenue at 46th Street, New York, N.Y. 10017, USA
Telephone: +800 253-9646 or +212 963-8302 • Fax: +212 963-3489
Email: publications@un.org • Web site: http://www.un.org

United States of America
Bernan Associates, 4611-F Assembly Drive, Lanham, MD 20706-4391
Telephone: 1-800-865-3457 • Fax: 1-800-865-3450
Email: order@bernan.com • Web site: http://www.bernan.com

Renouf Publishing Company Ltd., 812 Proctor Ave., Ogdensburg, NY, 13669
Telephone: +888 551 7470 (toll-free) • Fax: +888 568 8546 (toll-free)
Email: order.dept@renoufbooks.com • Web site: http://www.renoufbooks.com

Orders and requests for information may also be addressed directly to:

Sales and Promotion Unit, International Atomic Energy Agency
Vienna International Centre, PO Box 100, 1400 Vienna, Austria
Telephone: +43 1 2600 22529 (or 22530) • Fax: +43 1 2600 29302
Email: sales.publications@iaea.org • Web site: http://www.iaea.org/books

10-36751