

IAEA Safety Standards

for protecting people and the environment

Operating Experience Feedback for Nuclear Installations

Specific Safety Guide

No. SSG-50



IAEA

International Atomic Energy Agency



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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. The publication categories in the series are **Safety Fundamentals**, **Safety Requirements** and **Safety Guides**.

Information on the IAEA's safety standards programme is available on 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: Vienna International Centre, PO Box 100, 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 email to Official.Mail@iaea.org.

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 in nuclear activities are issued as **Safety Reports**, which provide practical examples and detailed methods that can be used in support of the safety standards.

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OPERATING EXPERIENCE FEEDBACK FOR NUCLEAR INSTALLATIONS



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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 SAFETY STANDARDS SERIES No. SSG-50

OPERATING EXPERIENCE FEEDBACK FOR NUCLEAR INSTALLATIONS

SPECIFIC SAFETY GUIDE

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2018

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FOREWORD

by Yukiya Amano
Director General

The IAEA's Statute authorizes the Agency to “establish or adopt... standards of safety for protection of health and minimization of danger to life and property” — standards that the IAEA must use in its own operations, and which States can apply by means of their regulatory provisions for nuclear and radiation safety. The IAEA does this in consultation with the competent organs of the United Nations and with the specialized agencies concerned. A comprehensive set of high quality standards under regular review is a key element of a stable and sustainable global safety regime, as is the IAEA's assistance in their application.

The IAEA commenced its safety standards programme in 1958. The emphasis placed on quality, fitness for purpose and continuous improvement has led to the widespread use of the IAEA standards throughout the world. The Safety Standards Series now includes unified Fundamental Safety Principles, which represent an international consensus on what must constitute a high level of protection and safety. With the strong support of the Commission on Safety Standards, the IAEA is working to promote the global acceptance and use of its standards.

Standards are only effective if they are properly applied in practice. The IAEA's safety services encompass design, siting and engineering safety, operational safety, radiation safety, safe transport of radioactive material and safe management of radioactive waste, as well as governmental organization, regulatory matters and safety culture in organizations. These safety services assist Member States in the application of the standards and enable valuable experience and insights to be shared.

Regulating safety is a national responsibility, and many States have decided to adopt the IAEA's standards for use in their national regulations. For parties to the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The standards are also applied by regulatory bodies and operators around the world to enhance safety in nuclear power generation and in nuclear applications in medicine, industry, agriculture and research.

Safety is not an end in itself but a prerequisite for the purpose of the protection of people in all States and of the environment — now and in the future. The risks associated with ionizing radiation must be assessed and controlled without unduly limiting the contribution of nuclear energy to equitable and sustainable development. Governments, regulatory bodies and operators everywhere must ensure that nuclear material and radiation sources are used beneficially, safely and ethically. The IAEA safety standards are designed to facilitate this, and I encourage all Member States to make use of them.

THE IAEA SAFETY STANDARDS

BACKGROUND

Radioactivity is a natural phenomenon and natural sources of radiation are features of the environment. Radiation and radioactive substances have many beneficial applications, ranging from power generation to uses in medicine, industry and agriculture. The radiation risks to workers and the public and to the environment that may arise from these applications have to be assessed and, if necessary, controlled.

Activities such as the medical uses of radiation, the operation of nuclear installations, the production, transport and use of radioactive material, and the management of radioactive waste must therefore be subject to standards of safety.

Regulating safety is a national responsibility. However, radiation risks may transcend national borders, and international cooperation serves to promote and enhance safety globally by exchanging experience and by improving capabilities to control hazards, to prevent accidents, to respond to emergencies and to mitigate any harmful consequences.

States have an obligation of diligence and duty of care, and are expected to fulfil their national and international undertakings and obligations.

International safety standards provide support for States in meeting their obligations under general principles of international law, such as those relating to environmental protection. International safety standards also promote and assure confidence in safety and facilitate international commerce and trade.

A global nuclear safety regime is in place and is being continuously improved. IAEA safety standards, which support the implementation of binding international instruments and national safety infrastructures, are a cornerstone of this global regime. The IAEA safety standards constitute a useful tool for contracting parties to assess their performance under these international conventions.

THE IAEA SAFETY STANDARDS

The status of the IAEA safety standards derives from the IAEA's Statute, which authorizes the IAEA to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property, and to provide for their application.

With a view to ensuring the protection of people and the environment from harmful effects of ionizing radiation, the IAEA safety standards establish fundamental safety principles, requirements and measures to control the radiation exposure of people and the release of radioactive material to the environment, to restrict the likelihood of events that might lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation, and to mitigate the consequences of such events if they were to occur. The standards apply to facilities and activities that give rise to radiation risks, including nuclear installations, the use of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.

Safety measures and security measures¹ have in common the aim of protecting human life and health and the environment. Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security.

The IAEA safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. They are issued in the IAEA Safety Standards Series, which has three categories (see Fig. 1).

Safety Fundamentals

Safety Fundamentals present the fundamental safety objective and principles of protection and safety, and provide the basis for the safety requirements.

Safety Requirements

An integrated and consistent set of Safety Requirements establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future. The requirements are governed by the objective and principles of the Safety Fundamentals. If the requirements are not met, measures must be taken to reach or restore the required level of safety. The format and style of the requirements facilitate their use for the establishment, in a harmonized manner, of a national regulatory framework. Requirements, including numbered ‘overarching’ requirements, are expressed as ‘shall’ statements. Many requirements are not addressed to a specific party, the implication being that the appropriate parties are responsible for fulfilling them.

¹ See also publications issued in the IAEA Nuclear Security Series.

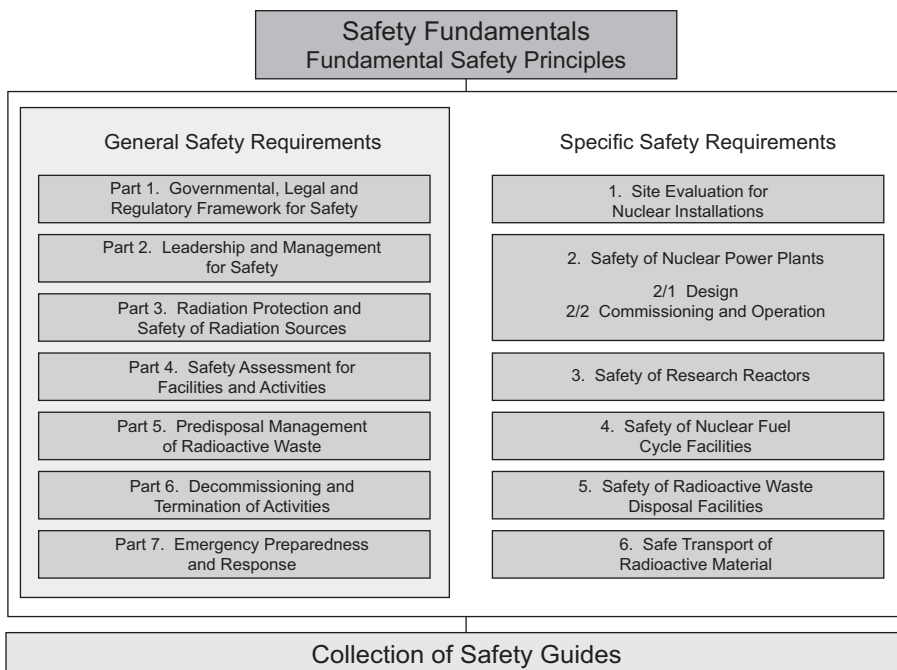


FIG. 1. The long term structure of the IAEA Safety Standards Series.

Safety Guides

Safety Guides provide recommendations and guidance on how to comply with the safety requirements, indicating an international consensus that it is necessary to take the measures recommended (or equivalent alternative measures). The Safety Guides present international good practices, and increasingly they reflect best practices, to help users striving to achieve high levels of safety. The recommendations provided in Safety Guides are expressed as ‘should’ statements.

APPLICATION OF THE IAEA SAFETY STANDARDS

The principal users of safety standards in IAEA Member States are regulatory bodies and other relevant national authorities. The IAEA safety standards are also used by co-sponsoring organizations and by many organizations that design, construct and operate nuclear facilities, as well as organizations involved in the use of radiation and radioactive sources.

The IAEA safety standards are applicable, as relevant, throughout the entire lifetime of all facilities and activities — existing and new — utilized for peaceful purposes and to protective actions to reduce existing radiation risks. They can be used by States as a reference for their national regulations in respect of facilities and activities.

The IAEA's Statute makes the safety standards binding on the IAEA in relation to its own operations and also on States in relation to IAEA assisted operations.

The IAEA safety standards also form the basis for the IAEA's safety review services, and they are used by the IAEA in support of competence building, including the development of educational curricula and training courses.

International conventions contain requirements similar to those in the IAEA safety standards and make them binding on contracting parties. The IAEA safety standards, supplemented by international conventions, industry standards and detailed national requirements, establish a consistent basis for protecting people and the environment. There will also be some special aspects of safety that need to be assessed at the national level. For example, many of the IAEA safety standards, in particular those addressing aspects of safety in planning or design, are intended to apply primarily to new facilities and activities. The requirements established in the IAEA safety standards might not be fully met at some existing facilities that were built to earlier standards. The way in which IAEA safety standards are to be applied to such facilities is a decision for individual States.

The scientific considerations underlying the IAEA safety standards provide an objective basis for decisions concerning safety; however, decision makers must also make informed judgements and must determine how best to balance the benefits of an action or an activity against the associated radiation risks and any other detrimental impacts to which it gives rise.

DEVELOPMENT PROCESS FOR THE IAEA SAFETY STANDARDS

The preparation and review of the safety standards involves the IAEA Secretariat and five safety standards committees, for emergency preparedness and response (EPReSC) (as of 2016), nuclear safety (NUSSC), radiation safety (RASSC), the safety of radioactive waste (WASSC) and the safe transport of radioactive material (TRANSSC), and a Commission on Safety Standards (CSS) which oversees the IAEA safety standards programme (see Fig. 2).

All IAEA Member States may nominate experts for the safety standards committees and may provide comments on draft standards. The membership of

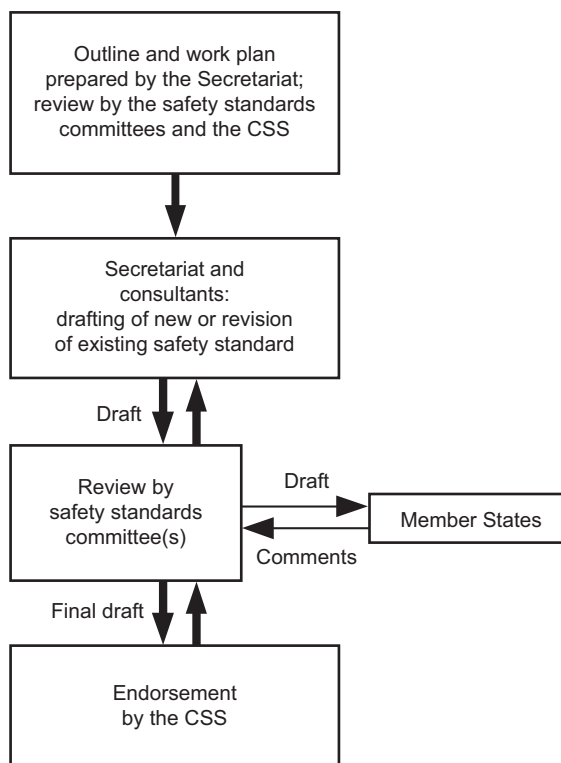


FIG. 2. The process for developing a new safety standard or revising an existing standard.

the Commission on Safety Standards is appointed by the Director General and includes senior governmental officials having responsibility for establishing national standards.

A management system has been established for the processes of planning, developing, reviewing, revising and establishing the IAEA safety standards. It articulates the mandate of the IAEA, the vision for the future application of the safety standards, policies and strategies, and corresponding functions and responsibilities.

INTERACTION WITH OTHER INTERNATIONAL ORGANIZATIONS

The findings of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the recommendations of international

expert bodies, notably the International Commission on Radiological Protection (ICRP), are taken into account in developing the IAEA safety standards. Some safety standards are developed in cooperation with other bodies in the United Nations system or other specialized agencies, including the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme, the International Labour Organization, the OECD Nuclear Energy Agency, the Pan American Health Organization and the World Health Organization.

INTERPRETATION OF THE TEXT

Safety related terms are to be understood as defined in the IAEA Safety Glossary (see <http://www-ns.iaea.org/standards/safety-glossary.htm>). Otherwise, words are used with the spellings and meanings assigned to them in the latest edition of The Concise Oxford Dictionary. For Safety Guides, the English version of the text is the authoritative version.

The background and context of each standard in the IAEA Safety Standards Series and its objective, scope and structure are explained in Section 1, Introduction, of each publication.

Material for which there is no appropriate place in the body text (e.g. material that is subsidiary to or separate from the body text, is included in support of statements in the body text, or describes methods of calculation, procedures or limits and conditions) may be presented in appendices or annexes.

An appendix, if included, is considered to form an integral part of the safety standard. Material in an appendix has the same status as the body text, and the IAEA assumes authorship of it. Annexes and footnotes to the main text, if included, are used to provide practical examples or additional information or explanation. Annexes and footnotes are not integral parts of the main text. Annex material published by the IAEA is not necessarily issued under its authorship; material under other authorship may be presented in annexes to the safety standards. Extraneous material presented in annexes is excerpted and adapted as necessary to be generally useful.

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1. INTRODUCTION

BACKGROUND

1.1. IAEA Safety Standards Series No. SSR-2/2 (Rev. 1), Safety of Nuclear Power Plants: Commissioning and Operation [1]; IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [2]; IAEA Safety Standards Series No. SSR-4, Safety of Nuclear Fuel Cycle Facilities [3]; IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [4]; and IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), Governmental, Legal and Regulatory Framework for Safety [5] establish safety requirements — based on IAEA Safety Standards Series No. SF-1, Fundamental Safety Principles [6] — for the provision of feedback on operating experience. International conventions such as the Convention on Nuclear Safety [7] (in Article 19) and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [8] (in Article 9) also emphasize the importance of providing feedback on operating experience. These safety standards and conventions stress the importance of establishing programmes to collect and analyse relevant operating experience and of acting on the results.

1.2. In 1989, the IAEA issued IAEA Safety Series No. 93, Systems for Reporting Unusual Events in Nuclear Power Plants¹. That Safety Guide presented a recommended scheme for the management of safety related operating experience in nuclear power plants that was based on available national practice at the time. In 2006, the IAEA issued another Safety Guide as IAEA Safety Standards Series No. NS-G-2.11, A System for the Feedback of Experience from Events in Nuclear Installations². NS-G-2.11 superseded and constituted an update and extension of IAEA Safety Series No. 93.

1.3. This publication is a revision of NS-G-2.11 and supersedes it. This revised Safety Guide updates the recommendations on meeting the obligations, principles and requirements established in international conventions, the Fundamental Safety Principles (SF-1 [6]) and the applicable Safety Requirements publications (Refs [1–5]). This Safety Guide also extends the scope to cover the provision of

¹ INTERNATIONAL ATOMIC ENERGY AGENCY, Systems for Reporting Unusual Events in Nuclear Power Plants, IAEA Safety Series No. 93, IAEA, Vienna (1989).

² 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).

feedback on operating experience throughout the lifetime of nuclear installations, from design to decommissioning, and provides additional guidance on analysing and reporting operating experience, including good practices.

OBJECTIVE

1.4. The objective of this Safety Guide is to provide recommendations for establishing, implementing, assessing and continuously improving an operating experience programme for nuclear installations to prevent or minimize the risk of future events³ by learning from events that have already occurred at the installation or elsewhere.

1.5. This Safety Guide is primarily aimed at operating organizations and regulatory bodies responsible for nuclear installations and describes their roles and responsibilities in the overall operating experience programme. However, this Safety Guide is also of relevance to other organizations involved in the design, construction, commissioning, operation and decommissioning of nuclear installations, including technical support organizations, vendor companies (e.g. designers, engineering contractors, manufacturers), research establishments and universities providing research and safety related services in support of a nuclear facility.

SCOPE

1.6. This Safety Guide is applicable to all types of nuclear installation that are part of the nuclear fuel cycle, except facilities for the mining or processing of uranium ores or thorium ores and disposal facilities for radioactive waste. The types of nuclear installation to which this Safety Guide applies include nuclear power plants, research reactors (including subcritical and critical assemblies) and adjoining radioisotope production facilities, storage facilities for spent fuel, facilities for the enrichment of uranium, nuclear fuel fabrication facilities,

³ In this Safety Guide, an ‘event’ is as defined in the IAEA Safety Glossary [9]: “any occurrence unintended by the *operator*, including operating error, equipment *failure* or other mishap, and deliberate action on the part of others, the consequences or potential consequences of which are not negligible from the point of view of *protection and safety*.” This definition includes initiating events, accident precursors, near misses, accidents (all as defined in the IAEA Safety Glossary [9]), as well as unauthorized acts. Operating experience includes, but is not limited to, experience from such events.

conversion facilities, facilities for the reprocessing of spent fuel, facilities for the predisposal management of radioactive waste arising from nuclear fuel cycle facilities, and nuclear fuel cycle related research and development facilities.

1.7. This Safety Guide is applicable to the design, construction, commissioning, operation and decommissioning stages in the lifetime of nuclear installations.

1.8. This Safety Guide does not address the arrangements for the notification and sharing of information established under the Convention on Early Notification of a Nuclear Accident and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency [10], which place specific obligations relating to a nuclear or radiological emergency on the States Parties to the conventions and on the IAEA. IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency [11], further addresses the requirements on notification and assistance relating to a nuclear or radiological emergency.

1.9. This Safety Guide does not address operating experience relating to nuclear security, although many of the recommendations in this Safety Guide would be relevant. The main reason that nuclear security related operating experience is not addressed is that some information in the operating experience programme may be subject to confidentiality requirements for security or other reasons established under the Amendment to the Convention on the Physical Protection of Nuclear Material [12]. Guidance on information security is outside the scope of this Safety Guide; such guidance is provided in the IAEA Nuclear Security Series Nos 13, 20 and 23-G [13–15].

STRUCTURE

1.10. Section 2 provides recommendations on the operating experience programme to be established and implemented in the operating organization. Section 3 provides recommendations on the operating experience programme for the regulatory body. Additional detailed guidance is provided in the Appendix. Descriptions of the operating experience systems operated by the IAEA are given in the Annex.

2. OPERATING EXPERIENCE FEEDBACK IN OPERATING ORGANIZATIONS

GENERAL

2.1. All organizations with responsibilities for safety should foster mutual understanding and respect through honest and open communication on operating experience as part of a strong safety culture (as indicated by Requirement 12 of GSR Part 2 [4]). This communication should include reporting any deficiencies with potential adverse effects on safety even if they are not covered by formal reporting requirements.

2.2. All organizations with responsibilities for safety should implement or participate in an effective operating experience programme. A graded approach should be applied so that the participation in such a programme is commensurate with the safety significance of the activities at the installation and with the role of the organization.

2.3. Requirement 24 of SSR-2/2 (Rev. 1) [1] states that **“The operating organization shall establish an operating experience programme to learn from events at the plant”**. Paragraph 5.27 of SSR-2/2 (Rev. 1) [1] states further that “[the operating organization] shall obtain and evaluate available information on relevant operating experience at other nuclear installations to draw and incorporate lessons for its own operations”. Similar requirements apply to research reactors (Requirement 88 and para. 7.126 of SSR-3 [2]) and to nuclear fuel cycle facilities (Requirement 73 and para. 9.133 of SSR-4 [3]). Operating experience from other industries with stringent safety requirements (e.g. chemical plants, air or sea transport) should be used, as far as such information can be obtained with commensurate effort.

2.4. An effective operating experience programme should include the following main elements:

- (a) Identification and reporting of internal operating experience;
- (b) Collection of external operating experience⁴;

⁴ In the context of this Safety Guide, ‘external operating experience’ is experience from outside the installation, whether from within the same State or from another State, from installations that use similar technologies or from those that use different technologies.

- (c) Screening of operating experience, including immediate review of events of specific interest;
- (d) Investigation and in-depth analysis of relevant operating experience;
- (e) Trending and review for timely recognition of developing issues;
- (f) Management of corrective actions resulting from investigation and analysis of operating experience, including approval, implementation, tracking and evaluation of their effectiveness;
- (g) Use, dissemination and exchange of operating experience, including through national and international reporting systems;
- (h) Review of the effectiveness of the operating experience programme;
- (i) Maintenance of a storage, retrieval and documentation system for operating experience.

A schematic diagram of a typical operating experience programme containing the recommended elements is shown in Fig. 1.

2.5. The organizational framework for an operating experience programme will depend on the operating organization's structure. An operating organization with a single nuclear installation should perform all functions of the operating experience programme for that installation. An operating organization that has multiple installations may judge it appropriate to centralize some of the operating experience functions⁵.

2.6. The exchange of experience with national and international systems for the gathering of feedback on operating experience may be supported by external organizations (e.g. there may be industry organizations or other national organizations through which reporting might be routed).

THE MANAGEMENT SYSTEM AND THE ROLE OF MANAGEMENT

2.7. Principle 3 of the Fundamental Safety Principles [6] states that “**Effective leadership and management for safety must be established and sustained in**

⁵ Such centralized functions typically include:

- (a) Coordination of and support for the handling of internal operating experience to ensure compliance with the organization's processes;
- (b) Screening and analysis of external operating experience and dissemination among the relevant installations;
- (c) Training of personnel on the operating experience programme;
- (d) Independent investigation of significant events, as necessary.