




OPERATIONAL SAFETY REVIEW TEAM (OSART)

Nuclear Safety and Security Programme

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Foreword

One of the best known IAEA's safety review services is the Operational Safety Review Team (OSART) programme.

Established in 1982, the OSART programme has provided advice and assistance to nuclear power plants and their corporate functions of Member States through over 200 missions.

The purpose of the programme is to enhance the safety of nuclear power plants during commissioning and operation. Operators' strong commitment to address issues identified in OSART missions illustrates just how effective OSART are in supporting Member States' work to enhance safety performance.

It has also been greatly valued for the opportunity it provides for mutual learning and sharing of knowledge and experience — such as good practices and lessons learned — among team members, who are drawn from different Member States and host plant personnel. The programme can also support transparency and public confidence in nuclear safety.

The OSART programme has been a cornerstone of the IAEA's efforts to improve the safety of nuclear installations worldwide. Moreover, it has made great contributions to the IAEA safety standards programme and to assisting Member States in developing and improving their own self-assessment programmes.

It is desirable that the objectives and significance of the OSART programme are well understood globally. All Member States are encouraged to continue to use this service, and in particular those that have not hosted a mission in recent years, to continuously improve their nuclear safety.

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Background

Conservative design, careful manufacturing and sound construction are all prerequisites for the safe operation of nuclear power plants. However, the safety of the plant also depends on: effective management policies, procedures, processes and practices; the competence of commissioning and operating personnel; comprehensive instructions; and adequate resources. Finally, a workforce with a positive and conscientious attitude in discharging their safety responsibilities, is also important for safe operations. The OSART programme considers these and other aspects in assessing a facility's operational safety performance. The areas to be assessed during an OSART review, are agreed between the IAEA and the host organization during the OSART Preparatory Meeting.

The lessons learned from the 2011 accident at the Fukushima Daiichi nuclear power plant led Member States to request such missions more frequently, and the IAEA has strengthened the focus on areas such as accident management and safety culture during its OSART missions.

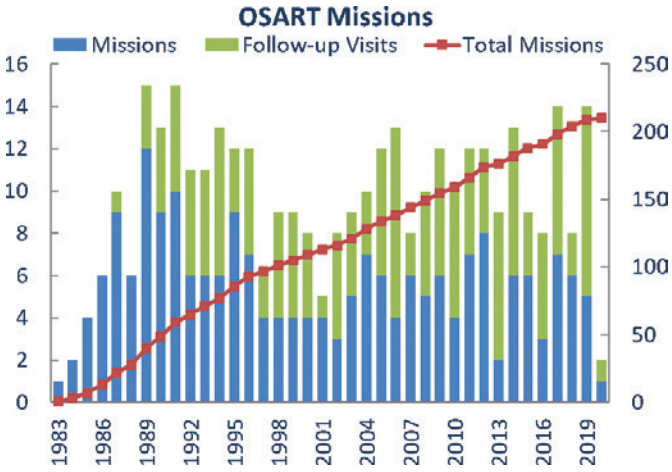
During the mission, a team of international experts conducts in-depth reviews of operational safety performance. They review the factors affecting the management of safety and the performance of personnel. The focus of these OSART missions is on identifying gaps between plant operations and the requirements outlined in the IAEA Safety Standards.

While OSART reviews have a strong technical focus, the expert reviewers also identify safety culture and organizational issues.

History

The IAEA created the Operational Safety Review Team (OSART) programme in 1982 soon after the 1979 accident at the Three Mile Island nuclear power plant, at a time when several nuclear power plants were beginning operation and the industry was recognizing the importance of achieving high standards of operational safety and reliability. The first OSART mission was conducted in August 1983 at the Kori nuclear power plant in the Republic of Korea. As of December 2020, the IAEA had conducted 210 OSART missions at 118 nuclear power plants in 37 Member States (see Fig. 1).

FIG. 1. The number of OSART Missions and Follow-up visits.



In 1989, follow-up visits became a standard feature of the OSART programme, and as of December 2020, 151 such missions had been held. The follow-up visits review improvements in operational safety which have taken place in response to the findings from the initial mission.

200th OSART mission in Almaraz Nuclear Power Plant, Spain

Table 1 shows the number of OSART missions and OSART follow up missions from 1983 to 2020.

Table 1. The number of OSART missions and OSART follow up missions

Member State	Type of mission	No. of missions	No. of follow-up visits	Year of mission
Armenia	O	1	1	2011
Argentina	O	1	1	1997
Belarus	P	1	0	2019
Belgium	O	2	2	2007, 2010
Brazil	O, T	7	5	1985, 1989, 1992, 2002, 2003, 2005, 2011, 2012
Bulgaria	O, P, S, E	7	5	1990, 1990, 1991, 1991, 1995, 1999, 2012
Canada	O, T	5	3	1987, 1990, 2004, 2015, 2016
China	O, P, T	13	10	1989, 1990, 1991, 1993, 1996, 1997, 2001, 2004,2005, 2009, 2012, 2017, 2019
Czech Republic	O, P, T, E	11	7	1989, 1990, 1991, 1995, 1996, 2000, 2001, 2001, 2011, 2012, 2013
Finland	O, P	6	1	1986, 1990, 2007, 2017, 2018
France	O, P	31	26	1985, 1988, 1992, 1992, 1993, 1994, 1995, 1996, 1998, 1998,1999, 2000, 2002, 2003, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2014, 2015, 2016, 2017, 2019
Germany	O	6	3	1986, 1987, 1987, 1991, 2004, 2007
Hungary	O, P	3	3	1988, 2001, 2014
India	O	1	1	2012
Iran, Republic of	O	1	—	2018
Italy	O, P	2	1	1987, 1988
Japan	O	6	5	1988, 1992, 1995, 2004, 2009, 2015
Kazakhstan	O	1	—	1998
Korea, Republic of	O	6	3	1983, 1986, 1989, 1994, 1997, 2007
Lithuania	O	2	2	1995, 2006
Mexico	O, P	5	2	1986, 1987, 1987, 1997, 2012
Netherlands	O	4	4	1986, 1987, 2005, 2014
Pakistan	O, P, T	6	2	1985, 1989, 1996, 1999, 2004, 2015
Philippines	P	2	—	1984, 1985
Poland	P	1	—	1989
Romania	O, P	4	5	1990, 1993, 2005, 2016, 2019
Russian Federation	O, P, S	11	9	1989, 1991, 1991, 1993, 2005, 2008, 2011, 2014, 2015, 2017, 2018, 2019
Slovakia	O, P, S, T	6	5	1990, 1991, 1993, 1996, 1997, 2006, 2010
Slovenia	O	4	4	1984, 1993, 2003, 2017
South Africa	O, T	4	2	1989, 1989, 1991, 2011
Spain	O	6	4	1987, 1990, 1998, 2002, 2009, 2018
Sweden	O	7	7	1986, 1988, 1989, 1991, 2008, 2009, 2010
Switzerland	O	5	5	1994, 1995, 1999, 2000, 2012
Ukraine	O, S, T, E	14	9	1988, 1994, 1994, 1995, 1995, 1995, 1996, 2003, 2004, 2006, 2007, 2008, 2009
United Arab Emirates	P	1	—	2017
United Kingdom	O, P	5	5	1989, 1992, 1994, 2015, 2017, 2019
United States of America	O	9	7	1987, 1989, 1992, 2000, 2005, 2008, 2011, 2014, 2017, 2019

O — operational safety review mission; P — pre-operational safety review mission; S — safety review mission (design and operations); T — technical exchange mission; E — expert mission to former Soviet type reactors.

Objectives

Key objectives of the OSART programme are:

- To provide the host country's regulatory authority, plant or utility management and governmental authorities with an objective and independent assessment of the status of NPP operational safety, using the IAEA safety standards as the base line;
- To provide the host plant with recommendations in areas where alignment with the IAEA safety standards needs to be improved;
- To provide the host plant with suggestions that would enable the host to improve or expand policies or programmes in order to make the performance more effective;
- To provide the host plant with an opportunity to self-assess its practices against the IAEA safety standards and identify areas for improvement;
- To identify good practices and share these with the international nuclear industry to facilitate their application in other nuclear power plants;
- To broaden the experience and knowledge and enhance the management skills of experts and observers from Member States and IAEA staff taking part in OSART missions;
- To enable IAEA staff to identify areas in which the IAEA safety standards need to be strengthened.

The OSART programme also plays a role in recognising the host plant's processes for identifying safety-related issues and for taking actions to improve alignment with the standards.

OSART mission at Taishan Nuclear Power Joint Venture Company Limited, China Guangdong Nuclear Power Group, China

Mission types, scopes and relevant services

There are three types of OSART missions: OSART missions, Pre-OSART missions and Corporate OSART missions.

OSART missions to plants in operation

OSART missions can be conducted at any time after a plant begins commercial operation. They are usually not held during the first year of operation, or before completion of the first refuelling outage for light water reactors. Missions to plants in operation, focus on the performance of management processes and plant personnel in achieving safe operation using the IAEA Safety Standards as the basis for the assessment.

Pre-OSART missions to plants undertaking commissioning

Pre-Operational Safety Review Team (Pre-OSART) missions are conducted during the commissioning phase. The missions aim to assist the utility in achieving high standards of commissioning and readiness for safe operations. Pre-OSART missions are ideally conducted three to six months before the first fuel load, after plant processes and procedures affecting safety have been established, plant staff recruited and trained, and some systems have moved to a pre-operational or full operational state. This allows the review to focus on the state of the plant's preparations for initial fuel load, reactor start-up and operation.

Corporate OSART missions

Corporate OSART missions can be conducted at utilities that own or operate nuclear power plant and possibly conventional plant sites and other business areas. Corporate OSART missions review the utility's centralized functions that affect operational safety aspects of its nuclear power plants. They are performed on a case-by-case basis, taking into consideration specific corporate organizational structures.

The scope of each type of OSART missions is agreed between the IAEA and the host organization.

OSART missions and Pre-OSART missions can include any of the following 15 review areas:

1. Leadership and management for safety
2. Training and qualification
3. Operations
4. Maintenance
5. Technical support
6. Operating experience feedback
7. Radiation protection
8. Chemistry
9. Emergency preparedness and response
10. Accident management
11. Human-technology-organization interaction
12. Long term operation
13. Commissioning
14. Transitional period from operation to decommissioning
15. Use of PSA for plant operational safety improvements

Areas 1 to 11 are standard areas at an operational plant, with the addition of area 12 for plants for which an extension of the operating lifetime is planned. Area 13 is included in Pre-OSART missions. Area 14 is for plants who are going to transition from operations to decommissioning and area 15 can be added for plants that seek a more detailed review of the probabilistic safety analysis applications.

Corporate OSART mission at Rosenergoatom Joint- Stock Company, Smolensk Nuclear Power Plant, Russian Federation

Corporate OSART mission can include any of the following 15 review areas:

1. Corporate management
2. Corporate independent oversight
3. Corporate support to provide human resources
4. Corporate communications
5. Corporate procurement
6. Corporate support to maintenance
7. Corporate technical support
8. Corporate support to operating experience feedback
9. Corporate support to radiation protection
10. Corporate support to chemistry
11. Corporate support to emergency preparedness and response
12. Corporate support to accident management
13. Corporate support to long term operation
14. Corporate support to commissioning
15. Corporate support to transition from operation to decommissioning

Independent Safety Culture Assessment (ISCA)

The safety culture traits are reviewed within the framework of a standard OSART mission as part of area 11 or area 1. For more detailed assessment of safety culture, the IAEA offers the Independent Safety Culture Assessment (ISCA), which can be requested either as part of an OSART mission or as a stand-alone service.

An ISCA provides the requesting organization a window into its safety culture characteristics, shared values and basic assumptions. The review aims to further develop and strengthen the organization's culture.

By exploring the connection between OSART findings and safety culture findings, facilities can identify and systematically address systemic challenges to safety performance.

Transparency and accountability

The OSART programme is designed to promote transparency and accountability, which are attributes that promote nuclear safety and public confidence in nuclear energy. The OSART Guidelines are public, as are the IAEA Safety Standards on which the service is based on.

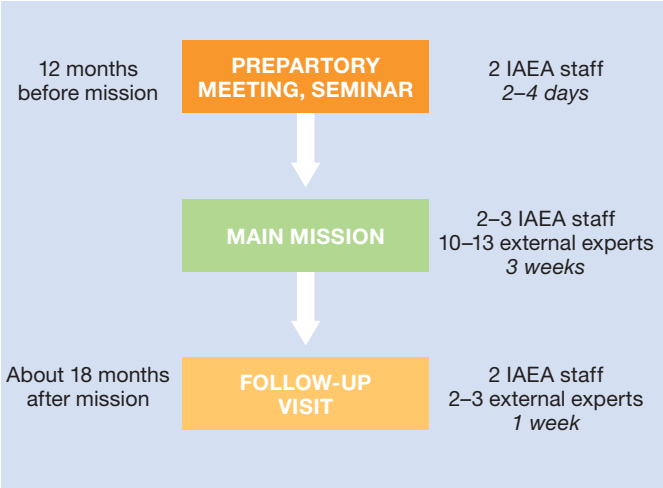
At the request of the host plant, press releases are sometimes issued at the end of OSART and OSART follow-up missions.

Sequence of events

The OSART process comprises the preparatory meeting, the main mission and the follow-up visit.

The preparatory meeting enables the host organization to begin the planning for the mission one year before the OSART mission. The follow-up visit is usually held about 18 months after the main mission (see Fig. 2).

FIG. 2. Overview of the OSART programme.



Preparing for an OSART mission

A Member State requests an OSART service for a specific nuclear power plant in a letter transmitted to the IAEA Deputy Director General and Head of the Department of Nuclear Safety and Security 18–24 months before the envisioned mission.

OSART Preparatory meeting

An IAEA Team Leader (TL) will liaise with the utility and regulatory authorities. The TL arranges a preparatory meeting with the plant management to familiarize them with the OSART methodology and to discuss any arrangements that need to be implemented prior to the mission. The preparatory meeting is held at the plant about one year before the start of the OSART mission and lasts three days.

Other organizations involved, such as regulatory authorities, are welcome to attend the meeting.

OSART training at Kola Nuclear Power Plant, Russian Federation

The meeting agenda includes discussions on the exact scope of the review, the plant's preparations, arrangements for reporting mission results and any intended involvement of the media.

The meeting includes a seminar for the plant counterparts, (including field visits) to highlight the OSART methodology and the various techniques to be used during the mission and in the plant's self-assessment.

Plant preparations

To prepare for the mission, the plant will prepare an Advance Information Package (AIP) and conduct a self-assessment. It will also designate plant counterparts, a host plant peer (HPP) and organize logistical support. The utility, the nuclear power plant or the regulatory authority has to formally confirm its commitment to finance the review. Resources from the IAEA Technical Cooperation Fund can be used for reviews in eligible countries.

Plant counterparts and host plant peer (HPP)

The plant is requested to designate a plant counterpart for each review areas and a host plant peer (HPP). Counterparts, often senior plant officials, serve as contact persons for reviewers and provide any needed coordination with specialist staff. The HPP is usually also a senior plant staff member with good overall knowledge of plant programmes, practices and staff. HPPs act as liaison officer between the plant and the IAEA team. They participate in team meetings and activities during the mission and advise the team when needed. In case of misunderstandings or issues needing further clarification, the HPP finds the responsible plant staff to enable further dialogue to occur.

Advance information package (AIP)

To enable an OSART team to perform effectively and efficiently while on-site, the nuclear power plant prepares an advance information package (AIP) and sends it to the OSART team at least one month prior to the mission. The package highlights the plant organizational structures, current operational practices, the plant staff approach to operational safety, key operational features and safety performance indicators and the general design.

The AIP may also include the results of any operational safety self- assessment.

Composition of the review team

The OSART team comprises a Team Leader (TL) and a Deputy Team Leader (DTL), who are IAEA staff, and up to 16 external reviewers and up to 3 observers from other plants which plan to host an OSART mission in the future. The TL and DTL are responsible for the overall conduct of the mission. They coordinate and liaise with the host utility, the host plant and the regulatory authority, and they train and guide the teams to help ensure coherent and consistent reviews.

OSART review team at KRSKO Nuclear Power Plant, Slovenia

Experts are recruited on the basis of their technical skills in the area they will review, their evaluation skills and their knowledge of English, which is the working language during OSART reviews. IAEA staff members who have experience in the nuclear industry as well as demonstrated evaluation skills sometimes participate as reviewers.

A couple of months before the OSART mission, an interactive training tool is distributed to reviewers so that they can learn the OSART methodology.

Carrying out the review

Standard OSART review schedule

The standard OSART schedule (see Table 2) shows the activities of the team during the three weeks of the mission.

The first day is used for plant access formalities and induction training. In addition, the TL and DTL conduct refreshers training for the team on the OSART programme, the mission schedule, review and evaluation skills, and their expectations of team members. The training also highlights factors unique to the mission and the nuclear power plant and enables the reviewers to begin working together as a team.

On the second day, an entrance meeting with senior plant management, representatives from the nuclear safety regulatory authority and other concerned authorities is held in the morning. The experts then join their plant counterparts. In the afternoon, a plant tour is carried out in several groups, with the aim of covering as many premises as possible and identifying any areas for further investigation.

From the third day to the end of the second week reviewers conduct individual interviews, make observations and discussions with plant counterparts. At daily meetings, all team members share notes and exchange information on facts or concerns identified. Through discussion, the team develops a consensus on emerging issues.

The team leader informs the plant manager daily on the progress made. Opportunities for improvement and areas of outstanding performance are discussed as they emerge. The last days of the mission are reserved for closing any open topics, completing technical notes and discussing them with the plant counterparts. Additionally, each team member drafts a summary of their review area for the technical notes and for an oral presentation at the exit meeting.

Table 2. Overview of OSART site activities

	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Travel	Travel	Team training Plant training	Entrance meeting Plant tour	Review and daily meeting with the counterparts and team		
Week 2			Review and daily meeting with the counterparts and team				
Week 3	Start draft technical notes		Finish draft technical notes	Team consensus on findings	Finalize technical notes; discuss with plant counterparts Preparation for exit meeting speech	Exit meeting Departure	

The OSART review methodology

The OSART team assess performance based on their reviews of documentation, interviews and observations (see Fig. 3). They use several sources of information, including:

a. Plant documents

Information of general interest to the whole team, including the results of the plant's self-assessment if any, are included in the AIP. In addition, each expert may decide to review additional, area-specific documents.

b. Interviews

Interviews with plant personnel are open discussions conducted to:

- Seek answers to questions and concerns that follow the documentation review;
- Assess plant staff understanding of their duties and responsibilities, competence, professionalism and commitment to nuclear safety;
- Provide an opportunity for all important information to be exchanged between reviewers and counterparts.

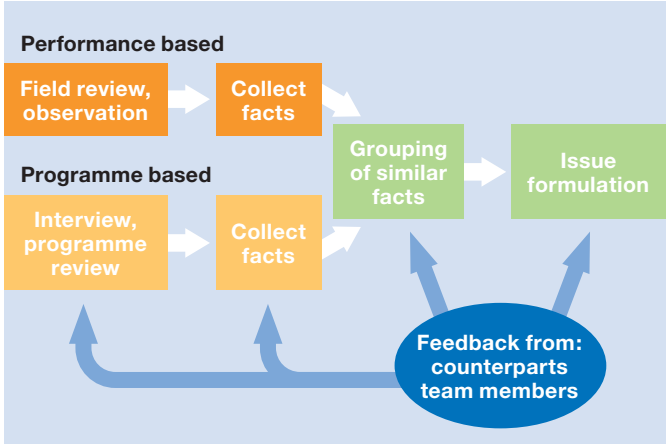
c. Direct observation

Direct observation of operational activities is an important part of the review process. The observation of activities should include nuclear and industrial safety practices, use of procedures, use of quality control measures, supervision and management and the control of work.

More than half of the review period is generally spent in the field, observing activities and the environment in which they are conducted.

Plant counterparts are essential to verify that the experts' observations are correct. They also help experts to ensure that they correctly understand the written material, which might have been translated, and that the practices observed are representative.

FIG. 3. OSART Review Methodology.



Evaluation criteria

The evaluation criteria for the OSART's team observations and analysis is based on the relevant IAEA safety standards (listed at the end of this brochure). The OSART review provides an objective comparison of the observed plant safety performance with the IAEA safety standards and may result in a recommendation (highlights what improvements in operational safety should be made), suggestion (highlights an opportunity for further improving safety), or good practice (an outstanding and proven programme, activity or equipment), in accordance to the OSART guidelines.

Reporting the results

While on the site, the OSART members record their observations and conclusions. These are discussed in detail with the plant counterparts and combined into Technical Notes, which are shared with the host plant as a preliminary report of the mission results. They form the basis for the TL's preparation of the OSART Report, which is an official IAEA report that summarizes the team's observations and conclusions and lists all recommendations, suggestions and good practices identified by the team.

Before the report is finalized, the host plant and regulatory authority are invited to provide comments. The final report is submitted through official channels to the Member State that requested the OSART mission. Initially, the report is distributed only to the IAEA, host utility and regulatory authority. After 90 days, this restriction is lifted, unless the host country requests otherwise.. Many host countries and host plants post the OSART reports on their web sites to ensure transparency. Main conclusions of derestricted reports are available on the IAEA website – these can be found through the Peer Review and Advisory Services Calendar.

Follow-up visits

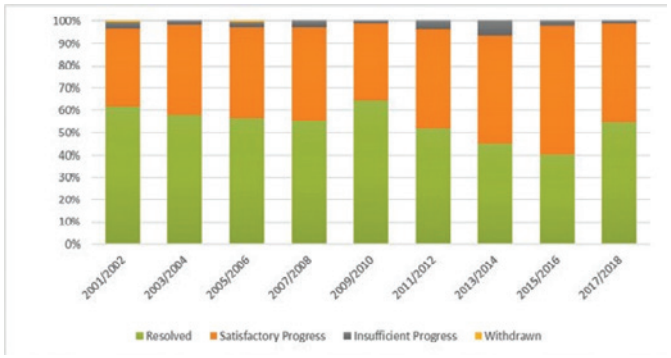
Approximately 18 months after the OSART mission, a follow-up visit takes place. During this visit, a group of three to five team members evaluates the progress made in resolving the issues raised by the OSART team. They do so by interviewing personnel, reviewing documentation and conducting field visits. The status of the plant response to each recommendation and suggestion is included in the final mission report. The results of follow-up visits are reported in a similar manner to the original OSART missions.

Exit meeting of Corporate OSART mission at Rosenergoatom Joint-Stock Company, Russian Federation

Corporate OSART mission at Rosenergotom Joint Stock Company, Russian Federation

An analysis of the 93 OSART follow-up visits that were conducted between 2001 and 2018 shows that over 97% of the findings identified in the initial mission had been resolved or satisfactory progress had been made at the time of the follow-up. (see Fig. 4).

FIG. 4. OSART issue resolution at the follow-up visit.



Mission Results database, good practices

The OSART Mission Results (OSMIR) database contains the results of derestricted OSART missions and their follow-up visits from 1991 onwards. The continuously updated database provides information on OSART results for specific review areas and individual topics within those review areas. This database is shared on request with organizations and individuals in the nuclear industry to help strengthen nuclear safety performance.

OSART good practices and other materials are available on the IAEA website:

www.iaea.org/services/review-missions/operational-safety-review-team-osart

Continuous improvement

The IAEA monitors the OSART programme to increase its usefulness and effectiveness by incorporating new features and eliminating outdated ones. At the end of each mission, the OSART members and host plants provide feedback on the OSART process.

Industry experts and others provide suggestions and opinions on the programme during IAEA technical meetings and other meetings. The OSART guidelines are regularly revised to reflect feedback and industry-wide progress in nuclear safety.

The information acquired through the programme is also used to update the OSART Highlights.

OSART reviewers at Almaraz Nuclear Power Plan, Spain

Series/number	Title
Safety Fundamental	
SF-1	Fundamental Safety Principles
Safety Requirements	
SSR-2/1 (Rev.1)	Safety of Nuclear Power Plants: Design
SSR-2/2 (Rev.1)	Safety of Nuclear Power Plants: Commissioning and Operation
GSR Part 2	Leadership and Management for Safety
GSR Part 3	Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards
GSR Part 4 (Rev.1)	Safety Assessment for Facilities and Activities
GSR Part 6	Decommissioning of Facilities
GSR Part 7	Preparedness and Response for a Nuclear or Radiological Emergency
Safety Guides	
NS-G-2.1	Fire Safety in the Operation of Nuclear Power Plants
NS-G-2.2	Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants
NS-G-2.3	Modifications to Nuclear Power Plants
NS-G-2.4	The Operating Organization for Nuclear Power Plants
NS-G-2.5	Core Management and Fuel Handling for Nuclear Power Plants Safety Standards
NS-G-2.6	Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants
NS-G-2.8	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants
NS-G-2.13	Evaluation of Seismic Safety for Existing Nuclear Installations
NS-G-2.14	Conduct of Operations at Nuclear Power Plants
GSG-1	Classification of Radioactive Waste
GSG-2	Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency
GS-G-2.1	Arrangements for Preparedness for a Nuclear or Radiological Emergency
GS-G-3.1	Application of the Management System for Facilities and Activities
GS-G-3.5	The Management System for Nuclear Installations
GS-G-4.1	Format and Content of the Safety Analysis Report for Nuclear Power Plants
GSG-7	Occupational Radiation Protection
GSG-11	Arrangements for the Termination of a Nuclear of Radiological Emergency
SSG-2 (Rev.1)	Deterministic Safety Analysis for Nuclear Power Plants
SSG-3	Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants
SSG-4	Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear
SSG-13	Chemistry Programme for Water Cooled Nuclear Power Plants
SSG-15	Storage of Spent Nuclear Fuel

Series/number	Title
Safety Guides	
SSG-25	Periodic Safety Review of Nuclear Power Plants
SSG-28	Commissioning for Nuclear Power Plants
SSG-38	Construction for Nuclear Installations
SSG-39	Design of Instrumentation and Control Systems for Nuclear Power Plants
SSG-40	Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors
SSG-47	Decommissioning of Nuclear Power Plants, Research Reactors and Other Nuclear Fuel Cycle Facilities
SSG-48	Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants
SSG-50	Operating Experience Feedback for Nuclear Installations
SSG-54	Accident Management Programmes for Nuclear Power Plants
RS-G-1.8	Environmental and Source Monitoring for Purposes of Radiation Protection
INSAG publications	
INSAG-12	Basic Safety Principles for Nuclear Power Plants, 75-INSAG-3 Rev.1
INSAG-15	Key Practical Issues in Strengthening Safety Culture
INSAG-25	A Framework for an Integrated Risk Informed Decision Making Process

*Above publications are currently referred from OSART Guidelines (Working Notes Outline). In addition to above, other IAEA Safety Standards, Safety Reports Series, IAEA Safety Glossary, EPR Series are also used for reviews, as necessary.

(Photos: IAEA)

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