IAEA
International Atomic Energy Agency

# Technical Safety Review (TSR) Service Guidelines

## Reference Report for Requesting Parties and IAEA Technical Teams

Vienna, November 2019

IAEA Services Series 41

# IAEA SAFETY STANDARDS AND 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. 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.

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Security related publications are issued in the **IAEA Nuclear Security Series**.

The **IAEA Nuclear Energy Series** comprises informational publications to encourage and assist research on, and the development and practical application of, nuclear energy for peaceful purposes. It includes reports and guides on the status of and advances in technology, and on experience, good practices and practical examples in the areas of nuclear power, the nuclear fuel cycle, radioactive waste management and decommissioning.

# TECHNICAL SAFETY REVIEW SERVICES GUIDELINES

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IAEA SERVICES SERIES No. 41

# TECHNICAL SAFETY REVIEW SERVICES GUIDELINES

## REFERENCE REPORT FOR REQUESTING PARTIES AND IAEA TECHNICAL TEAMS

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2019

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## FOREWORD

The IAEA works with its Member States and multiple partners worldwide to provide for the protection of people and the environment from harmful effects of ionizing radiation. The strategic approach to achieving such an objective involves continual improvement in four areas: national and international safety infrastructure; the establishment and global acceptance of IAEA safety standards; the integrated approach to provide for the application of the safety standards; and strengthening of the global network of knowledge and experience.

The IAEA's Technical Safety Review (TSR) peer review service supports the enhancement of nuclear safety for nuclear power plants and is based entirely on the IAEA safety standards. The service addresses the needs of Member States at most stages of development and implementation of a nuclear power programme, including the conceptual design, pre-licensing and licensing phases, nuclear power plant construction, operation and plant modifications including periodic safety reviews and lifetime extension. The TSR peer review service encompasses six technical subject areas: accident management, design safety, national safety requirements, generic reactor safety, periodic safety review and probabilistic safety assessment.

The TSR peer review service provides assistance to regulatory bodies, plant operating organizations, vendors and technical support organizations in their technical evaluations as well as in the development of national safety requirements. After a formal request to the IAEA, the TSR peer review service is prepared and provides a tailored, independent evaluation of the safety documentation submitted to the IAEA. A major outcome is recommendations to enhance nuclear safety in areas that may need improvements to adhere to the IAEA safety standards.

The IAEA officer responsible for this publication was C. Spitzer of the Division of Nuclear Installation Safety.

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**CONTENTS**

# 1. INTRODUCTION

One of the International Atomic Energy Agency (IAEA)'s peer review services is the Technical Safety Review (TSR). The TSR:

- Provides a tailored, independent evaluation of the safety assessment and design safety documentation and makes recommendations for enhancements and improvements to nuclear safety;
- Assists regulatory bodies, plant operating organizations, vendors and technical support organizations in their technical evaluations as well as in the development of their national safety requirements;
- Supports the enhancement of nuclear safety for nuclear power plants (NPPs) based exclusively on the IAEA safety standards;
- Addresses the needs of Member States (MS) at most stages of development and implementation of the nuclear power programme, including conceptual design, various pre-licensing as well as licensing stages, NPP construction, operation and plant modifications, including periodic safety reviews and lifetime extension;
- Encompasses six technical subject areas, including design safety, generic reactor safety, national safety requirements, probabilistic safety assessment, accident management and periodic safety review.

## 1.1 BACKGROUND

Since 1988, the IAEA has been providing safety review services in six technical subject areas (design safety, generic reactor safety, national safety requirements, probabilistic safety assessment, accident management, and periodic safety review) to support Member States in the application of the IAEA safety standards. The services in the six technical subject areas had different names over the years, but the objectives of the services remained the same.

These safety reviews were conducted using the following guidelines:

- IAEA Design Safety Review Services;
- Procedures for conducting independent peer reviews of probabilistic safety assessments;
- Review of accident management programmes in nuclear power plants.

These updated TSR guidelines were developed with the objective of providing a consolidated basis for the services provided by the IAEA to Member States and they aim to streamline, harmonize and formalize the process of conducting TSRs. These updated guidelines build on the previous guideline documents and reflect feedback and experience from Member States and experts who have been involved in the implementation of TSRs.

## 1.2 USE OF THE TSR GUIDELINES

These guidelines have been prepared to provide a basic structure and common approach to the terms of reference across the various technical subject areas covered by a TSR peer review – and they provide guidance on how to prepare for and conduct a TSR peer review service, and are addressed to:

- The Member State and/or organization requesting the TSR peer review (the Requesting Party);
- The technical team members of the TSR peer review.

TSRs address specific technical or regulatory aspects to assess whether they are consistent with the IAEA safety standards. Although the specific technical content of each of the six TSR technical subject areas is different, the review process follows the same structure for all reviews.

The specific technical subject areas for review are presented in Section 4 and cover:

DS – Design Safety;
GRS – Generic Reactor Safety;
SR – National Safety Requirements;
PSA – Probabilistic Safety Assessment;
AM – Accident Management;
PSR – Periodic Safety Review.

It is important to note that a TSR is flexible in scope. The technical subject areas included in the scope of the TSR can be tailored at the request of the Requesting Party. The actual scope of the TSR is defined in the terms of reference, which are normally agreed upon at least 3 months before the initiation of the service.

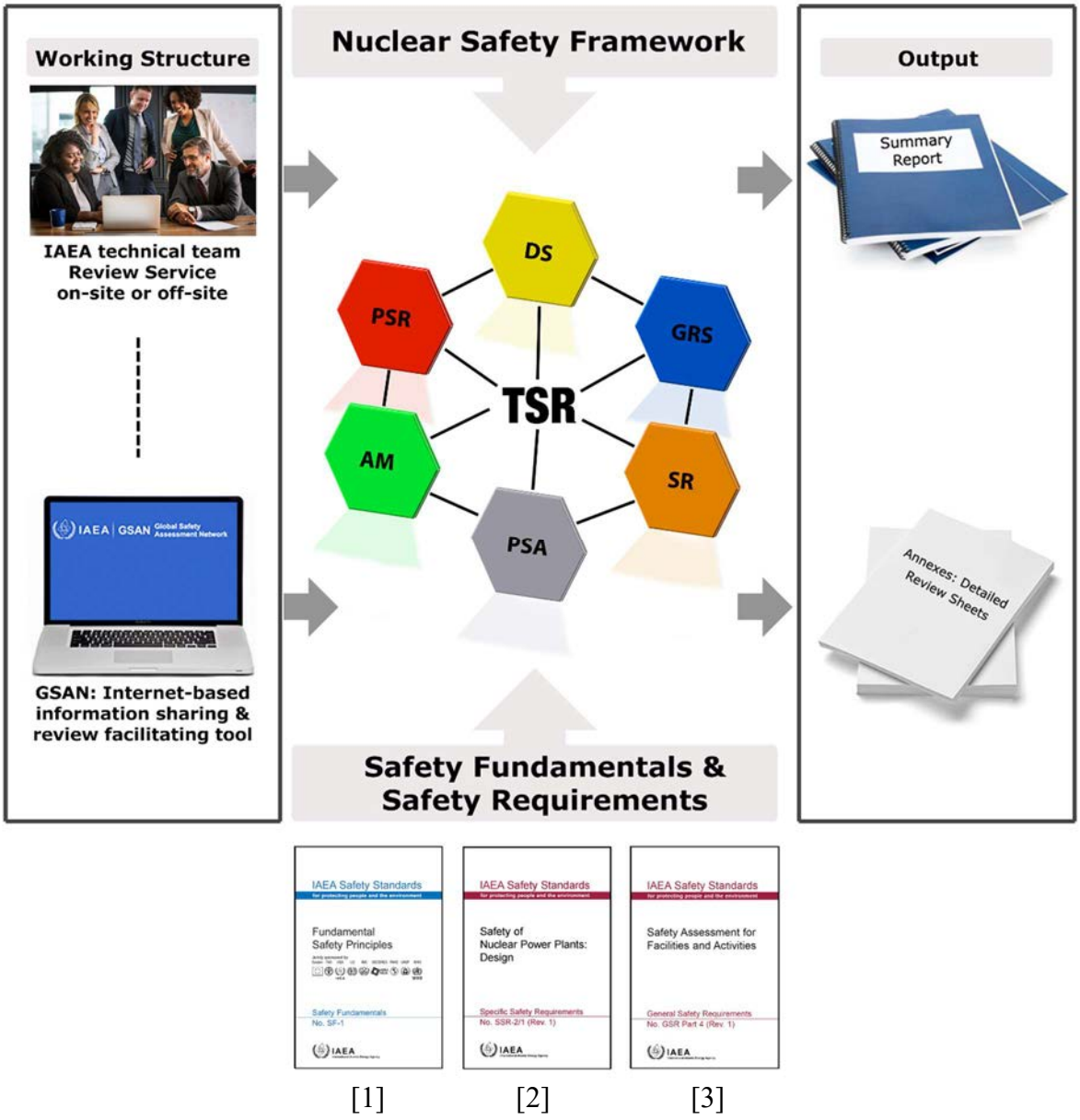
Further specific information for each TSR technical subject area, such as the templates for the terms of reference and the specific review sheet format, are available online at https://nucleus.iaea.org/sites/gsan/services/Pages/default.aspx and are maintained as living documents to address the feedback and lessons learned during the implementation of TSRs.

## 1.3 OBJECTIVES OF THE TSR PEER REVIEW

The key objectives of the TSR peer review are to:

- Provide the Requesting Party with an objective review of the documentation presented to the technical team with respect to the IAEA safety standards;
- Provide the Requesting Party with recommendations in those areas needing improvements to be consistent with the IAEA safety standards;
- Contribute towards harmonization of safety assessment standards worldwide;
- Promote the use of the IAEA safety standards worldwide;
- Promote opportunities for the IAEA to identify areas where IAEA safety standards could be further strengthened.

The general structure of a TSR peer review is presented in Fig. 1.




[1] [2] [3]

*FIG.1. General structure of a TSR peer review service.*

# 2. METHODOLOGY FOR TECHNICAL SAFETY REVIEWS

## 2.1 INITIATING A TSR PEER REVIEW

### 2.1.1 Member State request for a TSR

Generally, a TSR peer review is requested by an organization via its national nuclear safety regulatory authority or other relevant organization designated at national level to manage the interactions with the IAEA. A request for a TSR is transmitted to the IAEA Deputy Director General, Head of the Department of Nuclear Safety and Security, 6-12 months before the Kick-off Meeting.

The following information is to be included in the request for a TSR peer review service:

- The name of the Requesting Party;
- The proposed period of the TSR;
- The proposed scope of the TSR, if already available;
- A point of contact (name, telephone, e-mail address, etc.).

### 2.1.2 IAEA initial response

Upon receipt of a formal request for the TSR, the initial preparation starts at the IAEA Headquarters. The IAEA project manager and the Technical Team Leader are assigned according to the TSR peer review that has been requested. Their initial duties are to:

- Establish contact with the Requesting Party;
- Identify and coordinate with the IAEA division/sections that need to be involved;
- Develop the draft terms of reference;
- Arrange the Preparatory Meeting;
- Start looking for the appropriate and available external experts to be recruited.

At the same time, it is expected that the Requesting Party will nominate a liaison officer for further correspondence.

## 2.2 PREPARATORY PHASE

### 2.2.1 Terms of Reference and Safety Standards

Upon receiving the request from the Requesting Party, the IAEA provides, through the Safety Assessment Section (SAS), a tailored TSR peer review to address the specific needs of the Member State at most stages of development and deployment of nuclear power programmes.

The essential technical and administrative aspects of each review are laid out in the terms of reference that are submitted for consideration and agreement to the Requesting Party. In particular, all activities related to the implementation of the TSR are conducted in English and all documentation needs to be provided in English.

#### *2.2.1.1 Objective and scope of the TSR peer review*

The objective of a specific TSR is established and agreed by the IAEA and the Requesting Party. Selected IAEA Safety Requirements publications in force on the date of submission of the safety documentation to be reviewed to the IAEA serve as the basis for the review. Selected IAEA Safety Guides can be considered as supporting information only for purposes of clarification of the requirements used as the basis for the TSR.

#### *2.2.1.2 Limitations*

The volume of the safety documentation included in the review as well as the schedule will impact the level of detail of the observations identified in the review. However, these observations are beneficial for the Requesting Party to improve the quality of the safety documentation and to ultimately enhance nuclear safety aspects based on the IAEA safety standards.

It should be noted that a TSR does not constitute any kind of design certification or licensing activity as this is not a function of the IAEA; rather, it is the responsibility of the Member States.

The quality of the English version of the safety documentation could impact the results of the TSR.

The review is based on the safety documentation as delivered by the Requesting Party in accordance with the schedule. No request for additional information will be made by the IAEA.

The contents and wording of any press releases or publications by the Requesting Party related to the work performed under a TSR need to be agreed by all Parties.

#### *2.2.1.3 Safety Standards*

The IAEA safety standards are exclusively used as review criteria in the TSR peer review as defined in Section 2.2.1.1. The set of IAEA safety standards used for each TSR is specified in the terms of reference and depends on the scope and complexity of the requested TSR.

The TSR peer review is based exclusively on the IAEA safety standards in force at the time of the request.

An example list of IAEA safety standards that might form the basis for the TSR peer review is included in Appendix I.

#### *2.2.1.4 Technical team*

IAEA staff along with a select list of external experts, conduct the TSR against a selected set of applicable IAEA Safety Standards.

IAEA staff are assigned as Technical Officers (TOs) for each specific area to be reviewed, in accordance with their technical expertise. The TOs are responsible for ensuring that the reviews evaluate the relevant application of the IAEA safety standards in a consistent manner.

In addition to the TOs assigned, the IAEA utilizes a wide range of IAEA external experts for the TSR peer review. These experts, coming from a variety of Member States, have a thorough understanding of the IAEA safety standards, as well as the knowledge, methods and approaches

required to perform the requested review. Based on their expertise, the external experts are responsible for reviewing the assigned parts of the safety documentation providing impartial and clear observations and recommendations. Before the start of the TSR service, the external experts agree on the schedule for delivery of the safety documentation review, and their participation in the Kick-off Meeting, in the Discussion Meeting and possibly the Exit Meeting.

A safety officer is responsible for ensuring technical consistency in the approach during the review, that the deliverables represent a comprehensive review and all crosscutting aspects are identified in a consistent manner. This safety officer acts as the Technical Team Leader.

Each TSR is managed from the IAEA's Headquarters in Vienna. In addition to the Technical Team Leader, the TSR peer review service is managed by another safety officer acting as the IAEA project manager. The project manager is responsible for cooperating with the other IAEA divisions/sections that need to be involved, setting up the work plan and project structure, arranging contracts with IAEA contracted experts, organizing the review and deliverables, and for other financial and managerial aspects of the project.

Collectively, the IAEA project manager, the TOs and their direct supervisors, and the external experts form the IAEA technical team led by the IAEA Technical Team Leader.

If the TSR peer review is implemented as part of a Technical Cooperation Project, the assigned Technical Cooperation Programme Management Officer will support the implementation for financial and administrative arrangements.

#### *2.2.1.5 Deliverables*

The first deliverable of a TSR peer review service is the draft TSR Report. The report consists of an executive summary and the review sheets. Each review sheet identifies and describes the observations made, lists the related IAEA safety standards and provides a recommendation. Appendix II contains a template for a review sheet.

A recommendation is a proposal for changes, e. g. what further evaluations, analysis, explanations, clarifications, modifications, considerations, supplements, etc. might be needed to adhere to the IAEA Fundamental Safety Principles and Safety Requirements publications.

Recommendations are formulated on the basis of the following criteria:

- Recommendations are based on IAEA Safety Requirements publications, and the basis (i.e. the relevant requirement) for the recommendation should be clearly documented in the final TSR Report.
- Recommendations are proposed where aspects relative to the IAEA safety requirements are missing, incomplete, or inadequately implemented. For the respective reviewer’s assessment, Safety Guides are used but not as basis for the recommendation.
- Recommendations need to be specific, realistic and designed to result in tangible enhancements to nuclear safety through the safety documentation. To allow for a clear formulation of the recommendations, Safety Guides can be considered as supporting information only for purposes of clarification of the requirements used as the basis for the review.

- Recommendations need to be formulated in a succinct and self-explanatory manner. They clearly specify the responsible party and use “should”- language (for example, “the Requesting Party should do…”).

Within each review sheet, section 3 (Requesting Party response) is allocated for the Requesting Party to respond to the observation identified. Section 4 (Resolution by the IAEA technical team) provides feedback to the Requesting Party’s response based on the results of the Exit Meetings between the IAEA and the Requesting Party.

The final deliverable of a TSR peer review service is the final TSR Report. The final TSR Report consists of an executive summary, and the review sheets which identify the specific observations made, the related IAEA safety standards, and a final recommendation of how the observation could be resolved.

If there are any aspects important to the international community with respect to nuclear safety, the Requesting Party will consider requests from the IAEA to distribute the appropriate part of the final TSR Report.

#### *2.2.1.6 Schedule*

A project schedule is included in the terms of reference. The schedule takes into account the IAEA existing commitments, the duration of the administrative processes, such us external experts recruitment, meeting organization and travel arrangements as well as the time needed for performing the review depending on the scope and complexity of the requested TSR peer review.

### 2.2.2 Preparatory Meeting

Once the liaison officer from the Requesting Party has been nominated, the project manager arranges for the Preparatory Meeting led by the Technical Team Leader. Depending on the type of TSR requested, the Preparatory Meeting can be held at IAEA Headquarters or in the Requesting Party’s Member State.

During the Preparatory Meeting, the terms of reference, including the following main aspects, are presented:

- The main features of the requested TSR peer review are presented to the Requesting Party to establish a common understanding of what is expected from the TSR;
- Objectives of the review and deliverables;
- Preparation needed from both the IAEA and the Requesting Party;
- Provision of the technical documentation to be reviewed;
- Logistical arrangements;
- Financial arrangements;
- Dates of the TSR implementation and the schedule.

Further, the exact scope of the TSR, e.g. chapters of the preliminary safety analysis report, accident management programme, probabilistic safety assessment, is discussed and agreed.

The most important part of this Preparatory Meeting is the definition of the scope of the TSR peer review. It is essential that the Requesting Party has a clear understanding of what the TSR will cover and what the results of the peer review will be. A clearly defined and agreed scope will also determine the key skills and experience required from the external experts for implementation of the TSR.

For a TSR peer review a standard agreement can also be provided by the IAEA detailing the responsibilities of each party and including the terms of reference as an appendix. The standard agreement needs to be signed by the Requesting Party and the IAEA.

Following the agreement on the scope, the Requesting Party sends an official request letter to the IAEA agreeing to the scope and indicating how the financial arrangements for the TSR will be addressed.

TSR peer review can be financed via extra-budgetary contributions or, upon concurrence with the Department of Technical Cooperation, recipient countries could use Technical Cooperation funds.

As the final step before formally starting the TSR, the IAEA responds to the Requesting Party, accepting the financial arrangements and agreeing to conduct the TSR.

### 2.2.3 Selection, composition and recruitment of the technical team

Depending on the TSR peer review requested, the size of the IAEA technical team (see Section 2.2.1.4) and the duration of the review will vary.

The recruitment of external experts starts as soon as possible after the dates and the scope of the TSR have been determined. Generally, external experts need to have a minimum of ten years of work experience in the relevant nuclear field. In addition, external experts also need to have some general skills and abilities, including:

- Good communication skills;
- Good oral and written English;
- Good report-writing skills;
- The ability and willingness to work in a team.

The external experts will not include members from the host country, or experts who might have conflicts of interest.

It is the responsibility of the IAEA TOs to provide contacts data of potential external experts to the project manager to check their availability and willingness to participate in the TSR. The external experts are then recruited and cleared for service in accordance with IAEA procedures and established agreements. Given the specific technical nature of all TSRs, it is anticipated that the recruited external experts will mostly come from the private sector.

Using the agreed scope and provisional schedule developed during the Preparatory Meeting, the Technical Team Leader, in coordination with the TOs, assigns specific tasks to each technical team member. The external experts are requested to confirm that they accept participation in the TSR and that they agree with the assigned tasks by formally accepting the contract offered by the IAEA. An IAEA Confidentiality Agreement needs to be signed by all external experts.

## 2.3 IMPLEMENTATION OF THE TSR PEER REVIEW

### 2.3.1 Duration

The implementation of a TSR can take 3 to 9 months, depending on the Requesting Party's needs and selected topics.

### 2.3.2 Kick-Off Meeting

A Kick-off Meeting is generally organized at the IAEA's Headquarters in Vienna for the initiation of a TSR. In specific cases, the location of the Kick-off Meeting can be in the Requesting Party's Member State. During the Kick-off Meeting, the Technical Team Leader and the TOs meet with the assigned external experts to present the scope of the review and the review process, and to discuss the assignment of work, the schedule for performing the review as well as the expected deliverables.

### 2.3.3 The review by external experts

Following the Kick-off Meeting, the external experts perform their review mainly at their home locations. For certain technical subject areas, the review process might require walkdowns and clarification of specific aspects (e.g. human reliability context, area-related aspects). In this case, separate meetings could be organized in the Requesting Party's Member State at the beginning of the review process (for practical reasons, this meeting could be scheduled to take place back-to-back with the Kick-off Meeting). Results of this review are also identified in the review sheets that are provided to each respective TO. It should be noted that while the technical team members are assigned specific chapters to be reviewed, it is understood that few chapters can be considered to be stand-alone, i.e. in addition to their assigned chapters, the technical team members will have to consider information provided in other chapters as well.

The observations and recommendations made by the external experts during the review process are to be solely based on the evaluation of the documentation provided by the Requesting Party (e.g. the preliminary safety analysis report, probabilistic safety assessment reports including electronic models, accident management programmes) against the agreed set of IAEA safety standards. No requests for additional information will be made by the reviewers or the IAEA. The external experts are not authorized to use or reference any other standards or regulations during the review and in the review sheets.

A review sheet example (for a TSR-DS) is provided in Appendix II. Hereafter, the five distinct sections of the review sheet are explained in more detail (See Fig. 2 to Fig. 6) referring to the corresponding step in the review process and with a brief description of the content to be provided.

During the review by the external experts, the first two sections of the review sheet are filled in by the external experts, as follows:

| 1. TOPIC REVIEWED<br><br>• *This is the main aspect for which the review sheet is developed* |
|---|
| Safety Documentation Reviewed:<br><br>• *The exact chapter/section of the documentation provided for review that has been evaluated by the reviewer* |
| Review Area:<br><br>• *The area of concern (e.g. safety classification, application of the defence in depth, etc.)* |
| Observation Title:<br><br>• *A short statement summarizing the reviewer's observation* |

*FIG.2. Description of the topic reviewed – section 1 of the review sheet.*

| 2. OBSERVATIONS/REVIEW RESULTS<br><br>• *This is the section were all the information needed to identify and understand the aspect being evaluated will be included* |
|---|
| *2.1* DESCRIPTION *(a succinct description of the observation)*<br><br>2.1.1 Statement in the Safety Documentation<br>• *Quotes of the statements made in the documentation provided for review (this information should be accurate and factual, not an interpretation)*<br><br>2.1.2 Assessment by Reviewer<br>• *The reviewer's assessment describing the nature of the aspect being evaluated, the criteria used to judge it and the impact of the aspect on the documentation provided for review)* |
| 2.2 REFERENCE TO IAEA SAFETY STANDARDS<br><br>• *The exact title of the IAEA safety standard as well as its applicable requirements/paragraphs for the topic being reviewed should be provided in this section* |
| 2.3 RECOMMENDATION<br><br>• *Clearly formulated recommendations on ways to adhere to the IAEA safety standards*. |

*FIG.3. Description of the review results – section 2 of the review sheet.*

It is expected that before discussing the review sheets with the other IAEA technical team members, the assigned external expert(s) and the relevant TO have deliberated and coordinated the content of the review sheets.

### 2.3.4 Discussion Meeting

Following delivery of the review sheets, the Technical Team Leader and the TOs meet with the external experts for the Discussion Meeting in Vienna. Each TO and associated external expert briefly explain to the rest of the IAEA technical team the observations and the recommendations they made, and discuss and agree on addressing any differences in approaches.

The main objectives of the Discussion Meeting are to:

- Ensure a consistent approach;
- Ensure consistency among recommendations;
- Resolve any questions;
- Capture any cross-cutting aspects.

The draft review sheets, possibly revised after the Discussion Meeting, can be sent to the Requesting Party only for information, if required.

### 2.3.5 Preparation of the Draft TSR Report

After the Discussion Meeting, the Technical Team Leader prepares the draft TSR Report with the support and input from all the TOs. The review sheets constitute an appendix to the draft TSR Report.

The draft TSR Report is then delivered to the Requesting Party for comments.

### 2.3.6 Requesting Party's comments to the Draft TSR Report

The Requesting Party is given an opportunity to respond to each observation via comments, if needed. Those responses are included in section 3 of the review sheets as follows:

| 3 | REQUESTING PARTY'S RESPONSE |
|---|---|
| 3.1<br>3.2 | • *This section of the review sheet is reserved for the Requesting Party to provide, if necessary, comments on the specific observations made by the IAEA technical team. The Requesting Party's comments should refer to the documentation that was provided for review and not to additional documents the Requesting Party might have that were not part of the review.* |

*FIG.4. Description of the Requesting Party's response – section 3 of the review sheet.*

The main objectives of the Requesting Party's comments are to:

- Assure that all facts are accurately captured;
- Assure that the content of the review sheets is clear to them;
- Respond to the review observations, if necessary.

Once all Requesting Party's comments were included in the review sheets annexed to the draft TSR Report, the report should be sent to the IAEA Technical Team Leader.

In general, the Technical Team Leader distributes the review sheets with the Requesting Party's response to the relevant technical team members for them to complete section 4 of the review sheets as follows:

| 4 | RESOLUTION BY THE IAEA TECHNICAL TEAM |
|---|---|
| 4.1<br>4.2 | • *This section of the review sheet is reserved for the respective technical team members to evaluate the comments received from the Requesting Party and provide the resolution of the comments. The evaluation of the comments will be done solely based on the documentation originally provided for review and not considering any additional documents mentioned by the Requesting Party.* |

*FIG.5. Description of resolution by the IAEA technical team – section 4 of the review sheet.*

Within this implementation step, the IAEA Technical Team Leader proposes the final recommendations taking into account any resolution of the IAEA technical team.

### 2.3.7 Exit Meeting

A joint Exit Meeting between representatives of the IAEA technical team and the representatives of the Requesting Party is organized, usually in the Member State of the Requesting Party, to discuss the outcomes of the TSR based on the review sheets.

The main objectives of the joint Exit Meeting are to:

- Answer any questions that may arise from observations and/or recommendations in the draft TSR Report;
- Discuss and resolve any possibly remaining open issues from the review sheets.

The results of the discussions during the Exit Meeting are documented and used by the IAEA in the finalization of the TSR Report.

### 2.3.8 Preparation and delivery of the Final TSR Report

Following the Exit Meeting, the IAEA Technical Team Leader works on the draft TSR Report. At this step, the final section of the review sheet is completed as follows:

| 5 | FINAL RECOMMENDATION |
|---|---|
| | - *The final recommendation might be different from the original recommendation if the comments (referring to the documentation submitted for review) from the Requesting Party are sufficient to clarify the topic, or it might be the same as the original recommendation if the review sheet receives no comments or the comments are not sufficient to clarify the topic in accordance with the IAEA safety standards.* |

*FIG.6. Description of the final recommendation – section 5 of the review sheet.*

The final IAEA TSR Report is then provided to the Requesting Party, in general through the IAEA's official channels.

The IAEA restricts initial distribution of the final TSR Report to in-house users based on the need to know principle and to the Requesting Party involved. The report is automatically derestricted after 90 days unless the Requesting Party indicates otherwise in writing.

## 2.4 TSR RESULTS

The results of a TSR peer review presented in the final TSR Report at the end of the review process are summarized and formulated as recommendations to the Requesting Party.

**The summary** describes the scope of the review, the basis for the review, the composition of the technical team and the review process. The summary also identifies positive aspects observed during the review and the most important areas where supplementing information or modification is needed to adhere to the IAEA safety standards.

**Recommendations** are formulated as defined in Section 2.2.1.5 (*Deliverables)* of this publication.

## 2.5 FOLLOW-UP TSR

Based on the recommendations in the final TSR Report, the Requesting Party is expected to prepare an action plan to address those aspects that generated the recommendations. The progress of implementing the action plan can then be verified during a follow-up TSR (upon request from the Requesting Party).

The objective of the follow-up TSR is to review the progress of implementation of recommendations or other review observations from the original TSR as captured in the action plan.

As the original review, the follow-up TSR needs to be formally requested by the Requesting Party through the established official channels. It is normally requested 18-24 months after receiving the final report of the initial TSR peer review.

The follow-up TSR will have the same structure as the original TSR and will result in a final report documenting the extent to which the initial recommendations were addressed.

## 2.6 SUMMARY OF THE TSR PROCESS

The following five phases comprise a TSR peer review process and are identified in Fig. 7.

- Initiating a TSR peer review, see Section 2.1;
- Preparatory phase, see Section 2.2;
- Implementation of the TSR peer review, see Section 2.3;
- TSR results, see Section 2.4;
- Follow-up TSR, see Section 2.5.

## 2.7 FEEDBACK COLLECTION

At the end of a TSR peer review, the IAEA Technical Team Leader solicits feedback from the technical team members and the Requesting Party regarding the effectiveness of the TSR process, including whether the TSR objectives were attained. The feedback includes proposals for potential improvements to the TSR process and IAEA safety standards that were used as the basis for the review.

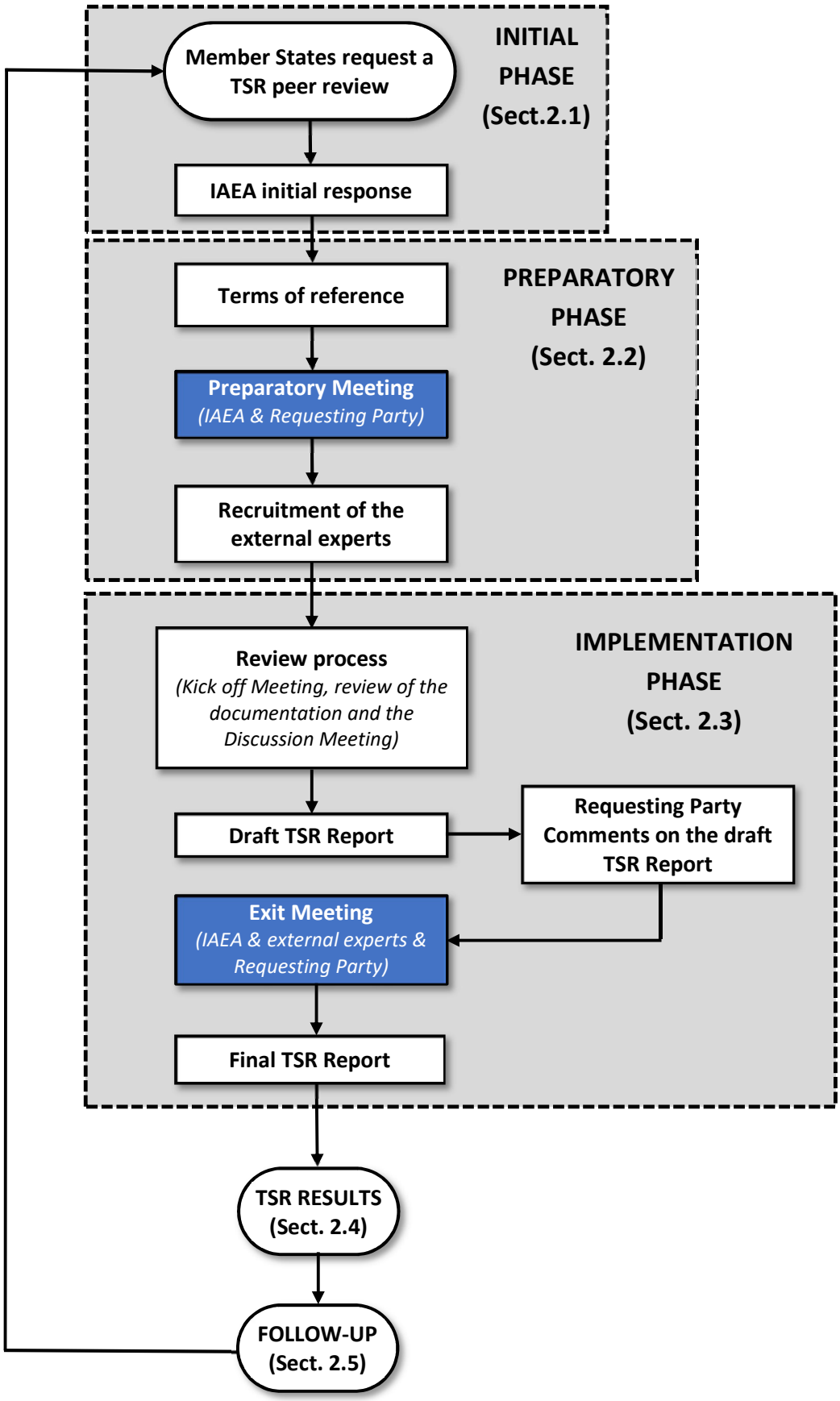



*FIG. 7. Summary of the TSR peer review process.*

# 3. SPECIFIC TECHNICAL SUBJECT AREAS FOR TSR

## 3.1 TSR-DESIGN SAFETY (DS)

The TSR-DS is conducted to review the safety of the specific design of an NPP against the Safety Requirements on Safety of Nuclear Power Plants: Design (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1)) [2], supported by the Safety Guides for NPP design. This review can be limited to specific technical areas.

***Objective***
The objective of the TSR-DS is to assist the Requesting Party to review the safety documentation for NPPs and to make recommendations in order to enhance safety.

***Deliverable***
The deliverable is a report that summarizes the observations of the review and includes, as appropriate, a set of recommendations to adhere to the IAEA safety standards.

## 3.2 TSR-GENERIC REACTOR SAFETY (GRS)

The TSR-GRS is performed on the safety documentation submitted to the IAEA. It provides an early evaluation of the safety documentation for a vendor's new NPP design against the IAEA safety standards at the level of the Fundamental Safety Principles (IAEA Safety Standards Series No. SF-1) [1] and the Safety Requirements on Safety Assessment for Facilities and Activities (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1)) [3] and on Safety of Nuclear Power Plants: Design (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1)) [2].

***Objective***
The objective of the TSR-GSR is to enable the Requesting Party to understand to which extent the safety case is addressing the requirements of the IAEA safety standards.

***Deliverable***
The deliverable is a report summarizing the extent to which the safety case addresses the IAEA requirements. It also includes, as appropriate, recommendations for improving the adherence of the safety documentation to the IAEA safety standards.

## 3.3 TSR-NATIONAL SAFETY REQUIREMENTS (SR)

The TSR-SR is conducted to review the national safety requirements for NPPs against the related IAEA safety standards at the level of the Fundamental Safety Principles (IAEA Safety Standards Series No. SF-1) [1], Safety Requirements on Safety of Nuclear Power Plants: Design (IAEA Safety Standards Series No. SSR-2/1 (Rev. 1)) [2], and the Safety Requirements on Safety Assessment for Facilities and Activities (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1)) [3]. The review can be limited to specific requirements of interest.

***Objective***
The objective of the TSR-SR is to assist the Requesting Party in the process of issuing or revising national safety requirements for NPPs to enhance safety.

***Deliverable***
The deliverable is a report that summarizes the observations of the review and includes, as appropriate, a set of recommendations to adhere to the IAEA safety standards.

## 3.4 TSR-PROBABILISTIC SAFETY ASSESSMENT (PSA)

The TSR-PSA is conducted to review the probabilistic safety assessment documentation submitted to the IAEA against the General Safety Requirements on Safety Assessment for Facilities and Activities (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1)) [3] supported by the Safety Guides on Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants (IAEA Safety Standards Series No. SSG-3) [4] and Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants (IAEA Safety Standards Series No. SSG-4) [5].

***Objective***
The objective of the TSR-PSA is to assist in the review of the technological and methodological aspects modelled in the probabilistic safety assessment, as well as probabilistic safety assessment applications to enhance safety.

***Deliverable***
The deliverable is a report that summarizes the observations of the review and includes, if needed, a set of recommendations to improve the adherence of the probabilistic safety assessment documentation to the IAEA safety standards.

## 3.5 TSR-ACCIDENT MANAGEMENT (AM)

The TSR-AM is conducted to review Accident management arrangements against the IAEA General Safety Requirements on Safety Assessment for Facilities and Activities (IAEA Safety Standards Series No. GSR Part 4 (Rev. 1) [3]) supported by the Safety Guide on Accident Management Programmes for Nuclear Power Plants (IAEA Safety Standards Series No. SSG-54) [6].

***Objective***
The objective of the TSR-AM is to assist in the development and implementation of an accident management to enhance safety.

***Deliverable***
The deliverable is a report summarizing the review observations and, as appropriate, recommendations to improve the adherence of the accident management to the IAEA safety standards.

## 3.6 TSR-PERIODIC SAFETY REVIEW (PSR)

The TSR-PSR is conducted to review the periodic safety review programme against the IAEA General Safety Requirements on Safety Assessment for Facilities and Activities (IAEA Safety Standards Series No. GSR Part 4) and Specific Safety Requirements on Safety of Nuclear Power Plants: Commissioning and Operation (IAEA Safety Standards Series No. SSR-2/2 (Rev. 1)) [7] supported by the Safety Guide on Periodic Safety Review of Nuclear Power Plants (IAEA Safety Standards Series No. SSG-25) [8].

***Objective***

The objective of the TSR-PSR is to assist the Requesting Party in establishing and implementing periodic safety review programmes consistent with the IAEA safety standards to enhance safety throughout the operating lifetime of the NPP.

***Deliverable***

The deliverable is a report that summarizes the observations of the review and includes, as appropriate, a set of recommendations to adhere to the IAEA safety standards.

# 4. SUPPLEMENTAL GUIDANCE FOR TSR IN COUNTRIES EMBARKING ON A NUCLEAR POWER PROGRAMME

The TSR peer reviews are conducted in support of Member States during most lifetime stages of conceptual design, detailed design, pre-licensing and licensing stages, NPP construction, commissioning and operation stages, including periodic safety reviews and lifetime extension.

The TSR peer reviews have been developed to assist plant operating organizations, technical support organizations and regulatory bodies in their technical evaluations as well as in the development of requirements and in enhancing nuclear safety for NPPs based on IAEA safety standards.

The different technical subject areas of TSR address the needs of countries embarking on new nuclear power programmes. The review of the preliminary and/or final safety analysis reports will be of benefit to all stakeholders in new and existing nuclear power programmes. Advice regarding the optimal timing for requesting the TSR on the specific technical subject areas is provided below consistent with the IAEA's milestone approach (see NG-G-3.1 (Rev. 1)) [9], by phase. In **Phase 1**, a TSR peer review service is not usually requested.

**Phase 2**

For programmes in Phase 2 (e.g. before being ready to invite bids), the TSR service can be requested for providing support related to the review of generic reactor safety (TSR-GRS) or national safety requirements (TSR-SR).

**Phase 3**

In Phase 3 (e.g. before being ready to commission and operate the first NPP), the TSR service can be requested for providing support related to the review of generic reactor safety (TSR-GRS), design safety (TSR-DS), national safety requirements (TSR-SR), probabilistic safety assessment (TSR-PSA) and accident management (TSR-AM).

## APPENDIX I

This Appendix references the IAEA Fundamental Safety Principles and a sample list of IAEA Safety Requirements publications that might be used as review criteria, depending on the subject areas to be reviewed. It also includes an example list of IAEA Safety Guides that could be considered as supporting information.

**Safety Fundamentals:**

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, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006).

**General Safety Requirements:**

INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, IAEA Safety Standards Series No. GSR Part 2, IAEA, Vienna (2016).

INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4 (Rev. 1), IAEA, Vienna (2016).

EUROPEAN COMMISSION, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANIZATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, WORLD HEALTH ORGANIZATION, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).

**Specific Safety Requirements:**

INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Design, IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), IAEA, Vienna (2016).

INTERNATIONAL ATOMIC ENERGY AGENCY, Site Evaluation for Nuclear Installations, IAEA Safety Standards Series No. SSR-1, IAEA, Vienna (2019).

INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Commissioning and Operation, IAEA Safety Standards Series No. SSR-2/2 (Rev. 1), IAEA, Vienna (2016).

**Safety Guides:**


INTERNATIONAL ATOMIC ENERGY AGENCY, External Human Induced Events in Site Evaluation for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-3.1, IAEA, Vienna (2002).

INTERNATIONAL ATOMIC ENERGY AGENCY, Dispersion of Radioactive Material in Air and Water and Consideration of Population Distribution in Site Evaluation for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-3.2, IAEA, Vienna (2002).

INTERNATIONAL ATOMIC ENERGY AGENCY, Seismic Hazards in Site Evaluation for Nuclear Installations, IAEA Safety Standards Series No. SSG-9, IAEA, Vienna (2010).

INTERNATIONAL ATOMIC ENERGY AGENCY, Geotechnical Aspects of Site Evaluation and Foundations for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-3.6, IAEA, Vienna (2005).

INTERNATIONAL ATOMIC ENERGY AGENCY, WORLD METEOROLOGICAL ORGANIZATION, Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations, IAEA Safety Standards Series No. SSG-18, IAEA, Vienna (2011).

INTERNATIONAL ATOMIC ENERGY AGENCY, Volcanic Hazards in Site Evaluation for Nuclear Installations, IAEA Safety Standards Series No. SSG-21, IAEA, Vienna (2012).

INTERNATIONAL ATOMIC ENERGY AGENCY, Site Survey and Site Selection for Nuclear Installations, IAEA Safety Standards Series No. SSG-35, IAEA, Vienna (2015).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of the Reactor Core for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-52, IAEA, Vienna (in preparation).

INTERNATIONAL ATOMIC ENERGY AGENCY, Core Management and Fuel Handling for Nuclear Power Plants Safety Guide, IAEA Safety Standards Series No. NS-G-2.5, IAEA, Vienna (2002).

INTERNATIONAL ATOMIC ENERGY AGENCY, Operational Limits and Conditions and Operating Procedures for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.2, IAEA, Vienna (2000).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Instrumentation and Control Systems for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-39, IAEA, Vienna (2016).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of the Reactor Coolant System and Associated Systems in Nuclear Power Plants, IAEA Safety Standards Series No. SSG-56, IAEA, Vienna (in preparation).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Reactor Containment and Associated Systems for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-53, IAEA, Vienna (in preparation).

INTERNATIONAL ATOMIC ENERGY AGENCY, Application of the Management System for Facilities and Activities, IAEA Safety Standards Series No. GS-G-3.1, IAEA, Vienna (2006).

INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for Nuclear Installations, IAEA Safety Standards Series No. GS-G-3.5, IAEA, Vienna (2009).

INTERNATIONAL ATOMIC ENERGY AGENCY, Deterministic Safety Analysis for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-2 (Rev. 1), IAEA, Vienna (2019).

INTERNATIONAL ATOMIC ENERGY AGENCY, Commissioning for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-28, IAEA, Vienna (2014).

INTERNATIONAL ATOMIC ENERGY AGENCY, Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.6, IAEA, Vienna (2002).

INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Classification of Structures, Systems and Components in Nuclear Power Plants, IAEA Safety Standards Series No. SSG-30, IAEA, Vienna (2014).

INTERNATIONAL ATOMIC ENERGY AGENCY, Ageing Management for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.12, IAEA, Vienna (2009).

INTERNATIONAL ATOMIC ENERGY AGENCY, The Operating Organization for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.4, IAEA, Vienna (2001).

INTERNATIONAL ATOMIC ENERGY AGENCY, Conduct of Operations at Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.14, IAEA, Vienna (2008).

INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection Aspects of Design for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-1.13, IAEA, Vienna (2005).

INTERNATIONAL ATOMIC ENERGY AGENCY, External Events Excluding Earthquakes in the Design of Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-1.5, IAEA, Vienna (2003).

INTERNATIONAL ATOMIC ENERGY AGENCY, Seismic Design and Qualification for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-1.6, IAEA, Vienna (2003).

INTERNATIONAL ATOMIC ENERGY AGENCY, Protection against Internal Hazards other than Fires and Explosions in the Design of Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-1.11, IAEA, Vienna (2004).

INTERNATIONAL ATOMIC ENERGY AGENCY, Recruitment, Qualification and Training of Personnel for Nuclear Power Plants, IAEA Safety Standards Series No. NS-G-2.8, IAEA, Vienna (2002).

INTERNATIONAL ATOMIC ENERGY AGENCY, Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-3, IAEA, Vienna (2010).

INTERNATIONAL ATOMIC ENERGY AGENCY, Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-4, IAEA, Vienna (2010).

INTERNATIONAL ATOMIC ENERGY AGENCY, Format and Content of the Safety Analysis Report for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-61, IAEA, Vienna (in preparation).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Electrical Power Systems for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-34, IAEA, Vienna (2016).

INTERNATIONAL ATOMIC ENERGY AGENCY, Electric Grid Reliability and Interface with Nuclear Power Plants, Nuclear Energy Series No. NG-T-3.8, IAEA, Vienna (2012).

INTERNATIONAL ATOMIC ENERGY AGENCY, Criticality Safety in the Handling of Fissile Material, IAEA Safety Standards Series No. SSG-27, IAEA, Vienna (2014).

INTERNATIONAL ATOMIC ENERGY AGENCY, Periodic Safety Review for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-25, IAEA, Vienna (2013).

INTERNATIONAL ATOMIC ENERGY AGENCY, Human Factors Engineering in Nuclear Power Plants, IAEA Safety Standards Series No. SSG-51, IAEA, Vienna (2019).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Auxiliary Systems and Supporting Systems for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-62, IAEA, Vienna (in preparation).

INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Fuel Handling and Storage Systems for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-63, IAEA, Vienna (in preparation).

INTERNATIONAL ATOMIC ENERGY AGENCY, Accident Management Programmes for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-54, IAEA, Vienna (2019).

## APPENDIX II

This appendix provides a sample review sheet for a TSR-DS peer review service.

**Sample review sheet**

| Review sheet |
|---|
| 1 TOPIC REVIEWED |
| PSAR Chapter Reviewed: |
| Review Area: |
| Observation Title: |
| 2 OBSERVATIONS/REVIEW RESULTS |
| 2.1 DESCRIPTION<br>2.1.1 Statement in PSAR<br>2.1.2 Assessment by Reviewer |
| 2.2 REFERENCE TO IAEA SAFETY STANDARDS |
| 2.3 RECOMMENDATION |
| 3 REQUESTING PARTY'S RESPONSE |
| 3.1<br>3.2 |
| 4 RESOLUTION BY THE IAEA TECHNICAL TEAM |
| 4.1<br>4.2 |
| 5 FINAL RECOMMENDATION |
| |

## 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, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Design, IAEA Safety Standards Series No. SSR-2/1 (Rev. 1), IAEA, Vienna (2016).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4 (Rev. 1), IAEA, Vienna (2016).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-3, IAEA, Vienna (2010).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-4, IAEA, Vienna (2010).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Accident Management Programmes for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-54, IAEA, Vienna (2019).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Commissioning and Operation, IAEA Safety Standards Series No. SSR-2/2 (Rev. 1), IAEA, Vienna (2016).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Periodic Safety Review for Nuclear Power Plants, IAEA Safety Standards Series No. SSG-25, IAEA, Vienna (2013).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Milestones in the Development of a National Infrastructure for Nuclear Power, Nuclear Energy Series No. NG-G-3.1 (Rev. 1), IAEA, Vienna (2015).

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