



IAEA

International Atomic Energy Agency

Guidelines for the Peer Review of Operational Safety of Nuclear Fuel Cycle Facilities

Reference for IAEA Safety Evaluation
of Fuel Cycle Facilities
During Operation (SEDO)

Vienna, February 2024

IAEA Services Series 50

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GUIDELINES FOR THE PEER REVIEW
OF OPERATIONAL SAFETY
OF NUCLEAR FUEL CYCLE FACILITIES

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IAEA SERVICES SERIES No. 50

GUIDELINES FOR THE PEER REVIEW OF OPERATIONAL SAFETY OF NUCLEAR FUEL CYCLE FACILITIES

REFERENCE FOR IAEA SAFETY EVALUATION
OF FUEL CYCLE FACILITIES DURING OPERATION (SEDO)

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2024

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FOREWORD

The IAEA offers its Member States a wide array of review services, during which a team of experts reviews the actual practices in an organization, nuclear facility or activity against the IAEA safety standards and other IAEA publications. The IAEA's Safety Evaluation of Fuel Cycle Facilities During Operation (SEDO) is a review service available to Member States to enhance the safety of nuclear fuel cycle facilities during commissioning and operation.

The SEDO review service is based on the IAEA safety standards applicable to nuclear fuel cycle facilities during their commissioning or operation. These safety standards reflect the consensus of Member States on the safety of nuclear fuel cycle facilities. This publication is a set of guidelines for the SEDO review service.

The purpose of this publication is to provide information on the preparation, scoping, implementation, reporting and follow-up of SEDO review missions. It is mainly intended for members of the SEDO mission team but may also help the operating organization of a nuclear fuel cycle facility in preparing to host a SEDO mission.

The IAEA officers responsible for this publication were J. Rovny, L. Valiveti and A. Shokr of the Division of Nuclear Installation Safety.

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Guidance and recommendations provided here in relation to identified good practices represent expert opinion but are not made on the basis of a consensus of all Member States.

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1. INTRODUCTION

1.1. BACKGROUND

The International Atomic Energy Agency (IAEA) supports Member States in enhancing the safety of nuclear facilities by providing a peer review service in many areas that affect safety. One of the IAEA's safety review services is the Safety Evaluation of Fuel Cycle Facilities During Operation (SEDO). The objectives of a SEDO mission are to assist the requesting Member State in enhancing the operational safety of its nuclear fuel cycle facilities (NFCFs) and promoting the continuous development of operational safety in all Member States operating NFCFs by disseminating information on good safety practices.

The first SEDO mission was organized in 2007 using draft guidelines based on the IAEA safety standards that were applicable at the time. This publication presents the current SEDO organizational process and review guidelines, in line with the scope and structure of IAEA Safety Standards Series No. SSR-4, Safety of Nuclear Fuel Cycle Facilities [1].

1.2. OBJECTIVE

The purpose of this publication is to provide guidance on the preparation, scoping, implementation, reporting and follow-up of safety reviews of NFCFs during their commissioning and operation. As such, it is intended principally for use by the team members of SEDO missions but may also serve as guidance to Member States hosting a SEDO mission.

1.3. SCOPE

The SEDO peer review service is mainly focused on the fulfilment of the safety requirements established in SSR-4 [1] for the operation of NFCFs.

A SEDO mission is suitable for NFCFs that conduct the following activities:

- (a) Conversion and enrichment of uranium;
- (b) Reconversion and fabrication of nuclear fuels of all types;
- (c) Interim storage of fissile material and fertile material before and after irradiation;
- (d) Reprocessing of spent nuclear fuel and breeder materials from thermal reactors and fast reactors;
- (e) Associated waste conditioning, effluent treatment and interim storage of waste that allows for retrieval of the waste for later disposal;
- (f) Separation of radionuclides from irradiated thorium and uranium;
- (g) Related research and development.

The review service was developed to cover the following 13 areas:

- (1) Operating organization and facility management;
- (2) Training and qualification;
- (3) Operations;
- (4) Maintenance, periodic testing and inspection;
- (5) Modifications;
- (6) Nuclear criticality safety;

- (7) Radiation protection programme;
- (8) Radioactive waste and effluent management;
- (9) Fire, chemical and industrial safety;
- (10) Ageing management;
- (11) Emergency preparedness and response;
- (12) Commissioning;
- (13) Preparation for decommissioning.

SEDO is a flexible service. Given the variety of NFCF types and processes, the areas to be reviewed and the importance of the work relative to each area need to be defined on a case-by-case basis for tailor-made SEDO missions.

Certain specific requirements, such as Requirement 71 (Operational accident management programme) of SSR-4 [1], are not presented as a contained review area, but addressed within the other review areas.

The specific guidelines for each of the 13 areas are intended to help the experts conduct the review in the light of personal experience and in accordance with the IAEA safety standards. The guidelines are not exhaustive, nor are they intended to limit the review. It is expected that — based on advance information, including the results of a self-assessment, where applicable, and the results of the first part of the review — the experts will use their judgment to decide on review areas that will need more in-depth evaluation.

1.4. STRUCTURE

This publication consists of three sections and three Annexes. Section 2 presents guidance on the preparation, conduct and follow-up of a SEDO mission. Section 3 presents detailed guidelines on each of the 13 review areas covered in a SEDO mission. The guidance is provided in a structured way so that the experts developing a plan and programme for a specific review can cover selected areas to the necessary depth, consistent with the scope and objectives of the review.

Annexes I to III provide additional information and templates for mission preparation, conduct and reporting.

2. PREPARATION, CONDUCT, REPORTING AND FOLLOW-UP OF A SEDO MISSION

2.1. INITIATION OF THE MISSION

Any IAEA Member State may request a SEDO mission to be performed at an NFCF. The request can be initiated by the regulatory body or by the operating organization of the NFCF and includes the following information:

- (a) Identification of the NFCF;
- (b) Proposed period of the SEDO mission;
- (c) Proposed scope of the SEDO mission, if already known;
- (d) A contact person in the host country.

On receipt of a request for a SEDO mission from a Member State, an IAEA liaison officer will be assigned to establish the communication channel between the IAEA, the operator of the facility and the regulatory body and to arrange a preparatory meeting. In addition, a SEDO mission team leader will be appointed.

2.2. PREPARATORY MEETING

The preparatory meeting, usually attended by the SEDO mission team leader and IAEA liaison officer, is generally held at the facility site approximately 12 months prior to the mission, to allow the facility management, the counterparts and the other organizations involved, including the national regulatory body, to participate. The meeting covers the following topics:

- (a) Main features of the SEDO mission;
- (b) Exact scope and objectives of the review, reflecting the needs of the host organization;
- (c) Preparation for the review by the facility management;
- (d) Review methods to be used;
- (e) Type, format and content of the advance information package (AIP);
- (f) Selection of the size and members of the mission team;
- (g) Logistical support needed;
- (h) Financial arrangements.

The meeting also includes a brief walkdown of the facility.

Following the meeting, the IAEA will convene a mission team and the facility management will designate one contact person for each of the 13 review areas in Section 1.3 to serve as the counterpart of the mission team member assigned to the same review area.

2.3. ADVANCE INFORMATION PACKAGE

The AIP addresses the major SEDO objectives as defined in these guidelines. It provides the reviewers with the evidence of fulfilling the requirements or specifications, practices and performance that have been documented by the facility. The completeness and clarity of the information contained in is the AIP essential for the quality of the review.

The AIP may contain the following background information on the operating organization and the facility:

- (a) Facility history and current operating status, organization and layout;
- (b) Facility main functions and major process and safety systems, the relationship between the operating organization and the facility, if applicable;
- (c) Recent regulatory findings;
- (d) Recent technical publications, press releases and information given to the public;
- (e) Operating events with the International Nuclear and Radiological Event Scale (INES) classification;
- (f) Facility performance data, recently initiated or planned major site initiatives;
- (g) Administrative and logistics support arrangements for the review;
- (h) Information (typically not more than ten pages per area) specific to each review area as defined in Section 3.

In preparing for a SEDO mission, the facility management conducts a thorough self-assessment of the facility operational safety in light of the IAEA safety standards. The results of the self-

assessment are included in the AIP in sufficient detail for the IAEA team members to understand any challenges or issues that the facility has been facing. While the methodology chosen to conduct the self-assessment is not specified, the results of the self-assessment need to contain the following key components:

- (1) For each review area, a description of how each individual expectation, as described in Section 3, is met.
- (2) Specific gaps where performance or programmes do not fully meet IAEA safety standards.
- (3) Where a gap is identified, an explanation of what corrective actions are being taken or planned to address the gap, for instance budget commitments, improved staffing, document or procedures preparation, increased or modified training, or equipment purchases.

The contents of the AIP cover all essential NFCF operational safety information in a concise manner. All descriptions in the package are written in English, as this is the SEDO working language. The standard structure and content of an AIP is provided in Annex I.

2.4. MISSION TEAM

The mission team is composed of a team leader, who is always an IAEA staff member, an assistant team leader and up to twelve experts. The team composition consists of external consultants (usually from other NFCFs, other nuclear facilities, regulatory bodies or technical support organizations) and of IAEA staff. Preference is given to reviewers with NFCF experience, particularly from similar facilities.

Diverse mission team members are selected to ensure that a variety of national approaches to operational safety are represented. Each expert invariably has, in addition to their particular area of expertise, knowledge of their country's approaches in other relevant areas. Coupling this knowledge with the IAEA safety standards in the nuclear safety area allows the best international practices to be identified as a major outcome of the review mission.

The mission team members, after being appointed, review all the information available in the AIP relevant to their review areas or modules. It is recommended that the mission team members start the AIP review six to eight weeks before the SEDO mission.

The IAEA ensures that the national host of the mission identifies and communicates to the IAEA and the mission team members, all the information that may be needed to grant facility access. This information and any forms that need to be completed prior to arrival on site are provided to team members in sufficient time to allow for their completion in advance.

The team leader maintains contact with the host during this period to confirm that all arrangements are progressing as planned (e.g., accommodation, access to facility site, AIP, logistical support).

2.5. CONDUCT OF THE MISSION

The duration of a SEDO mission is typically one to two weeks, depending on the scope of the mission and facility type. The following activities are performed during the main SEDO mission:

- (a) Briefing of mission team;
- (b) Entrance meeting;
- (c) Review of facility documents;
- (d) Interviews with facility personnel;
- (e) Facility walkdown;
- (f) Observation of activities;
- (g) Daily meetings of the mission team;
- (h) Drafting of mission report;
- (i) Exit meeting.

Further information on these activities is provided below.

2.5.1. Briefing of mission team

Upon arrival of the mission team, the team leader conducts a short briefing during which the scope, objectives and mission-specific instructions are reiterated to the mission team. It is also an opportunity for mission team members to clarify any information received prior to the mission.

2.5.2. Entrance meeting

The mission itself is opened by an entrance meeting attended by mission team members, facility management, representatives of the regulatory body and other concerned authorities. During the entrance meeting, mission team members are introduced to their counterparts. In addition, essential organizational matters such as needs of the mission team, the method of communicating and reporting review results, and the detailed work schedule, are discussed and finalized. Before the review activities are commenced, the facility provides any necessary training (e.g. a safety briefing) to the mission team, tailored to the activities expected to be undertaken as part of the mission. This training may be organized as part of the entrance meeting or may be conducted separately.

2.5.3. Review of facility documents

Facility documents which are of general interest to the whole mission team or are relevant for several review areas, are made available to the team members as part of the AIP prior to the mission. Further and more specific documentation is usually made available during the mission. Review of this documentation provides one means of acquiring the information needed to develop the safety review findings.

2.5.4. Interviews with facility personnel

Interviews with facility personnel are used by the mission team to:

- (a) Gather additional information not covered by documentation;
- (b) Provide answers to questions arising out of the documentation review;
- (c) Assess facility personnel's understanding of their duties and responsibilities;
- (d) Assess facility personnel's competence, professionalism and commitment to nuclear safety;
- (e) Provide the opportunity for all important information to be exchanged between reviewers and counterparts.

Interviews are conducted as open discussions with the aim to better understand facility operations and should not be perceived as an audit or inspection by the mission team.

2.5.5. Facility walkdown

Facility walkdown is intended for the mission team to get familiar with the general layout of the site and facility. It provides an opportunity for the mission team to collect data or information about general housekeeping, condition of facility structures, systems, and components (SSCs) and facility personnel adherence to rules and good practices. The walkdown also includes any laboratories and other support facilities on the site. Generally, the facility walkdown is organized during one of the first two days of the mission.

2.5.6. Observation of activities

The observation of work and activities includes safety practices, use of procedures, drawings and instructions, quality control measures in use, use of human error prevention tools, management's supervision of activities, and shift turnovers.

Direct observations can be supplemented by technical discussions with facility personnel. Discussions with facility personnel are used to collect further information not covered by the available documentation, to clarify questions associated with the work observed, to assess staff understanding of the operating organization's policies and programmes and to collect further inputs to the overall review findings and conclusions.

2.5.7. Daily meetings of the mission team

Each working day of the mission, the team leader calls a meeting where the experts summarize their observations and concerns identified during the day, including perceived facility strengths and weaknesses. This creates an opportunity for other team members to exchange their views, further strengthening the base of the evaluation.

Team meetings make a vital contribution to the success of the review process and are the principal mission management and feedback tool to achieve the following:

- (a) To ensure the mission plan is being followed;
- (b) To identify emerging issues;
- (c) To modify the mission plan as necessary;
- (d) To manage the interface between the mission team and the facility's personnel;
- (e) To monitor mission progress.

2.5.8. Drafting of mission report

Before the final draft of the mission report is completed, each team member meets with their counterpart to preview the findings, recommendations and suggestions to identify and correct potential errors of facts. Further information regarding the reporting of a SEDO mission is provided in Section 2.6.

2.5.9. Exit meeting

Before the mission team leaves the facility site, an exit meeting is conducted. The exit meeting is attended by the whole mission team and by the facility senior management team. The mission team communicates to the facility management the main mission findings, mainly the

recommendations, suggestions, and good practices. An executive summary report is provided to the operating organization during the exit meeting. Further steps and follow-up actions with respect to the mission report and mission follow-up may also be discussed.

2.6. MISSION REPORT

The SEDO mission is documented in a mission report. While the main inputs to the mission report are prepared by mission team members during the conduct of the mission, the report is finalized at the conclusion of the mission. The finalization is organized by the team leader.

The mission results focus on the safety of the facility being reviewed during operation and whether the applicable IAEA safety requirements of SSR-4 [1] are being met. This may result in a recommendation, suggestion, or a good practice, which are defined as follows:

Recommendation

A recommendation is advice on what improvements in operational safety are needed in order to fulfil the IAEA safety requirements for the evaluated activity or programme. A recommendation is specific, realistic, and designed to result in tangible improvement. It is based on proven, good international performances and addresses the root causes rather than the symptoms of the identified concern. A recommendation does not specify methods for satisfying the safety requirements.

Suggestion

A suggestion is advice on an opportunity for safety improvement not directly related to conformance with the IAEA safety requirements. It is primarily intended to improve performance, to indicate useful expansions of existing programmes, and may point out possible superior alternatives to ongoing work for achieving best practice level. In general, it is intended to encourage the facility management and personnel to consider ways and means of enhancing safety performance, thereby promoting best international practices.

Good practice

A good practice is an outstanding and proven programme, activity or equipment in use by the facility that contributes directly or indirectly to operational safety and sustained good performance. A good practice goes beyond merely meeting requirements or expectations. It is considered superior enough to other practices to be brought to the attention of similar NCFs for their consideration.

The SEDO mission report is an official IAEA publication that summarizes the team's main observations and conclusions, including work completed, and all recommendations, suggestions, and good practices. Before the report is finalized, the facility and concerned regulatory authorities are given the opportunity to provide comments. This report is submitted through official channels to the host country. The typical format of the SEDO mission report is presented in Annex II.

2.7. FOLLOW-UP MISSION

The purpose of the SEDO follow-up mission is to determine the status of implementation of all recommendations, suggestions and good practices as presented in the SEDO report and to

assess whether adequate actions have been taken by the concerned authorities to address the identified findings regarding the safety of the facility. The responsibility for responding to the formal conclusions and recommendations of the SEDO report rests with the host country.

In general, the follow-up mission consists of a visit to the facility at an appropriate date (usually between six and twenty four months) after the review. At least one of the experts that participated in the original SEDO mission participates in the follow-up mission. The follow-up mission follows the same procedures as the main SEDO mission, but its scope is reduced to only the areas where issues were previously identified.

The operating organization develops an action plan to implement the corrective actions agreed after considering the SEDO mission report. Reports stating the progress status of the implementation of recommendations are prepared and submitted to the follow-up mission team. The follow-up mission team examines the progress achieved in addressing the issues raised.

The follow-up mission team leader is informed of any responses to the main mission team's conclusions and recommendations, and any follow-up action initiated by the host country or operating organization. This provides feedback to those involved in reviewing the NFCF to assess the effectiveness of their reviews.

Following the follow-up mission, the team leader ensures that a follow-up mission report is prepared in accordance with the standard IAEA format. The follow-up mission report describes the status of implementation of the recommendations and suggestions in the main SEDO mission report. If a significant number of issues show insufficient progress, the team leader may propose to the host organization that an invitation be issued for another follow-up mission.

3. REVIEW AREAS AND GUIDELINES

3.1. REVIEW OF THE OPERATING ORGANIZATION AND FACILITY MANAGEMENT

3.1.1. Objective

The objective is to provide a basis for evaluation of management, organization, and administration of the operating organization. The review aims to verify that a management system, giving safety matters the highest priority, is established and implemented. Activities related to safety are performed in accordance with written procedures and controlled by adequate management arrangements.

References: Requirements 2, 3, 4, 6 of SSR-4 [1]; IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [2].

3.1.2. Guidelines

1. The mission team verifies that:
 - (a) A management system has been established, and is being effectively implemented and continuously improved;

- (b) The management system includes all the elements of management so that processes and activities important to safety are established and conducted coherently with other requirements, including those relating to leadership, human performance, security, quality, protection of health and protection of the environment;
 - (c) The management system integrates both radiation-related as well as non-radiation-related aspects of safety;
 - (d) The management system implements the safety policy;
 - (e) The management system applies to all parties conducting activities important for safety, including contractors, and establishes appropriate quality assurance (QA) arrangements;
 - (f) A graded approach is applied to the development and implementation of the management system;
 - (g) The management system has been reviewed and is subject to approval by appropriate levels of management in the operating organization, and, where required, by the regulatory body;
 - (h) There is evidence that the effectiveness of the management system is periodically assessed through audits and reviews (arranged by the operating organization);
 - (i) The management system includes provisions for ensuring effective communication and clear assignment of responsibilities, in which accountabilities are unambiguously assigned to individuals within the operating organization and to suppliers, to ensure that processes and activities important to safety are controlled and performed in a manner that ensures the safety objectives are achieved;
 - (j) Individuals are assigned responsibility for coordinating the development, application and maintenance of the management system, but with senior management accountability.
2. The mission team confirms, by reviewing documents and interviewing staff, that the operating organization functions (e.g. management system, oversight, technical support, communication) are developed and that the company objectives are known and shared by the personnel of the facility.
 3. The mission team checks that the communications between management and staff are effective in both directions.
 4. The mission team confirms that the operating organization management is informed of the safety related performance, conducts audits or inspections, and develops improvement action plans.
 5. The mission team verifies that activities related to the following topics are subject to controls established in written procedures:
 - (a) Nuclear criticality safety;
 - (b) Facility modifications;
 - (c) Organizational changes;
 - (d) Handling of nuclear material;
 - (e) Maintenance, periodic testing and inspections including authorization, performance, and verification of tests and repairs;
 - (f) Preparation of safety related documents such as operating procedures and records.
 6. By examining documentation and interviewing the staff of the operating organization, the mission team identifies whether:

- (a) A safety committee or an advisory group exists to review safety aspects of the operation of the facility;
 - (b) The safety committee includes members who are independent of operations management;
 - (c) The safety committee is composed of members who are adequately qualified and experienced to provide appropriate advice in all safety areas applicable to the facility;
 - (d) The functions, responsibilities and composition of the safety committee are documented and include provisions to ensure that relevant aspects of facility modifications, operating procedures, limits and conditions, organizational structure, significant events and safety assessment are subject to review by the safety committee.
7. By examining documentation, observing work and interviewing the staff of the operating organization, the mission team determines whether:
- (a) A clear safety policy, giving utmost priority to safety and promoting a strong safety culture, is established and implemented by the operating organization;
 - (b) The safety policy stipulates clearly the leadership role of the highest level of management in safety matters;
 - (c) The safety policy is clearly communicated through the organization and all staff are aware of their responsibilities for ensuring safety;
 - (d) Processes and activities related to safety are controlled by documented management procedures and arrangements, and these are followed, reviewed and reinforced;
 - (e) Adequate and appropriate resources are devoted to safety;
 - (f) Individuals are encouraged to have a questioning attitude towards matters affecting safety and are not afraid to communicate their concerns on safety matters and suggestions for improvement with line managers and others.
8. The mission team reviews the organization chart and confirms that the structure of the operating organization and the functions, roles and responsibilities of its personnel are established and documented.
9. The mission team confirms, by examining documents and interviewing managers, that there exists a clear understanding of the division of responsibilities and authority between all units of the operating organization and relevant external organizations providing services.
10. The mission team confirms that responsibilities for nuclear safety are clearly defined and that there are clear lines of authority established to deal with this matter.
11. The mission team checks that independent verification of safety-related activities is in place. 'Independent' means that the verifications are performed by personnel (or under their responsibility) related to a specific hierarchy line which is not subordinated to the acting entities (e.g., operation, maintenance, purchase, engineering). The mission team confirms that the conclusions of the verifications are reported to the management of the operating organization.
12. The mission team checks that the management programme has a consistent and systematic application of planning schedules, procedures, reviews, and audits supported

by appropriate resources. The mission team checks that the overall planning and scheduling function provides an integrated view and consistent instructions to these functions and gives the relevant priority to safety.

13. The mission team checks that a mechanism exists for staff to report safety concerns to the facility management.
14. The mission team checks that managers, on a periodic basis, observe the conduct of work in the facility and in particular, work on safety related systems. The mission team verifies whether managers demonstrate their commitment to safety by being involved in the work activities.
15. The mission team verifies that when services are provided from outside the operating organization, responsibilities are allocated within the organization for specifying, supervising, controlling and monitoring those services. The mission team checks that the operating organization retains the overall responsibility for safety.
16. The mission team verifies that, in the selection of contractors, their QA programmes are considered, and their capability to provide either items or services or both is evaluated, in accordance with the specifications of the procurement documents and the past performance of the contractor.
17. The mission team reviews the operating organization's human performance programme (if any) and responsibilities. The mission team checks whether tools to prevent human errors are part of the training programmes and are implemented in practice (e.g. peer checks, questioning attitude, self-verification, three-way communication).
18. The mission team checks that the responsibilities, authority, structures, and organizational independence of the QA unit are clearly defined and that appropriate resources are available.
19. The mission team checks that general QA policy is defined and followed among the different entities of the operating organization.
20. The mission team checks that identified deviations and non-conformities are traced and documented, that they give rise to appropriate corrective action plans, and that the corrective action plans are traced and implemented.
21. By performing facility walkdowns, observing work and interviewing the staff of the operating organization, the mission team determines whether:
 - (a) Managers take into account attitude to safety when selecting or promoting staff;
 - (b) Managers are aware of how the safety of their facility compares with others;
 - (c) Managers are aware of the trends of safety performance indicators and reasons;
 - (d) Production needs interfere with training activities;
 - (e) Training programmes address safety culture;
 - (f) The general state of the facility (e.g., tidiness, leaks, logbooks, records) is satisfactory;
 - (g) A system for bringing safety concerns to higher managers is in place;
 - (h) Managers participate in personnel trainings where safety policy is explained;
 - (i) Managers give attention to the physical working environment of their staff.

22. By reviewing records and examining relevant procedures, the mission team confirms whether:
 - (a) A programme to learn from events at the facility and events at other nuclear installations is established and implemented in a systematic way;
 - (b) Events with safety significance are identified, investigated, documented, analysed and, as appropriate, reported to the regulatory body;
 - (c) Corrective measures identified are implemented, and lessons learned are used to review and update relevant operating procedures and training programmes.
23. The mission team checks that personnel responsible for operating experience feedback are suitably qualified and have adequate experience and training to carry out this task effectively.
24. The mission team reviews the root cause investigation process and methodology in use. The mission team checks that personnel are qualified to analyse human failure related events.
25. The mission team confirms that the effectiveness of the operating experience feedback programme is regularly assessed using established criteria.
26. The mission team reviews the internal and external reporting criteria and confirms that the reporting threshold is low enough to consider all relevant input information. The mission team confirms that precursors and near misses are reported.
27. The mission team checks whether recent facility events were shared with the external nuclear community.
28. The mission team determines how external operating experience is shared with the facility and reviews the screening criteria (for selection of events or information to be shared) to ensure they are sufficiently broad. The mission team checks how well important external operating experience feedback is reviewed for applicability at the facility and that any appropriate actions are taken in a timely manner.

3.2. REVIEW OF TRAINING AND QUALIFICATION

3.2.1. Objective

The objective is to provide a basis for evaluating training programmes and personnel qualification at an NCF. The review verifies that programmes for personnel training and retraining are established and are adequate for the activities conducted in the given facility.

References: Requirement 58 of SSR-4 [1].

3.2.2. Guidelines

1. The mission team verifies that:
 - (a) Programmes for personnel training and retraining are established and effectively implemented;
 - (b) The necessary qualifications and competences are clearly defined to ensure that personnel performing safety related functions are capable of performing their duties safely;

- (c) Specific training and drills for operating personnel, internal and external firefighters, and other personnel relevant for emergency response are provided relevant to their assigned response functions in the event of a fire or explosion at the facility.
2. By examining the training programme, the mission team determines whether:
 - (a) The programme describes organization and administration of the training and qualification activities;
 - (b) The programme includes the necessary qualifications of instructors;
 - (c) The programme includes provisions for periodic assessment of the competence of personnel and for refresher training on a regular basis (including for personnel who have had extended absences from their authorized duties);
 - (d) The programme includes a description of training materials and defines the content of those materials;
 - (e) The operating personnel, including technical support personnel, are given suitable training in radiation protection before the start of their duties;
 - (f) The training includes normal operation as well as accident management of the facility;
 - (g) The scope of training on radiological and non-radiological hazards is commensurate with the potential hazard posed by the given NCF;
 - (h) The training promotes behaviour and attitudes supporting strong safety culture.
3. The mission team verifies that the training programmes, training materials, the training itself and training outcomes (including those for retraining) are documented and subject to review and audit in accordance with the established management system. The mission team evaluates how well goals and objectives are used to monitor and improve the training programmes.
4. The mission team confirms that the training programme is upgraded in light of performance deficiencies observed at the workplace and discovered through event analysis.
5. The mission team checks personnel training records to ensure that the amount of training actually provided to various personnel groups is commensurate with that needed for maintaining the knowledge and ability to safely perform their tasks.
6. The mission team evaluates the training and qualification of instructors. It checks whether an assessment of the instructors by the trainees is performed and taken into consideration.
7. The mission team confirms that the principle of optimization of protection and criticality safety, where appropriate, are included in the training programme for the workshops and laboratories.
8. The mission team evaluates how practical training is developed and conducted. The elements of this training include simulator training (if relevant), and on-the-job training.
9. The mission team confirms that an adequate programme has been implemented to ensure that the qualifications of the facility operators and shift supervisors are up to date, that they are verified initially and periodically, and that the operators are formally authorized before being allowed to perform shift duties.

10. For uranium conversion, uranium enrichment and fuel fabrication facilities, the mission team verifies that:
 - (a) Operators are given training in the safe handling and processing of large quantities of UF₆ and other hazardous chemicals.
 - (b) Adequate training is given to all site personnel to take appropriate action in the event of the release of UF₆ or other hazardous chemicals.
11. For mixed oxide fuel fabrication facilities and reprocessing facilities, the mission team verifies that the training includes special training in glovebox operations, including actions to be taken if contamination occurs.
12. For nuclear fuel cycle research and development facilities, the mission team verifies that both researchers and operators are qualified and trained to handle radioactive material and to conduct tests and experiments.
13. The mission team evaluates continuing training programmes for developing and maintaining managers' and supervisors' technical knowledge, management and supervisory skills and knowledge on the facility administration.
14. The mission team evaluates, through interviews, the extent to which key managers provide input and participate in the initial and continuing training programme in job related technical areas. The mission team also determines how the managers refresh their own knowledge.
15. The mission team evaluates the adequacy of the structured training courses provided to managers with emergency response duties, in the areas of emergency preparedness and response, coordinated participation in drills, and maintenance of technical qualifications necessary to cope with the assigned emergency response duty.

3.3. REVIEW OF OPERATIONS

3.3.1. Objective

The objective is to provide a basis for evaluating the adequacy of the operating organization, management of operational safety, and the facility operations.

References: paras 9.1 – 9.8 and Requirements 55, 56, 57, 59, 63, 64 of SSR-4 [1].

3.3.2. Guidelines

1. The mission team verifies that:
 - (a) A clearly defined management structure for the facility is available;
 - (b) Functions and responsibilities are clearly specified in writing and understood by relevant personnel;
 - (c) Adequate management structure is put in place to ensure nuclear safety, protection against radiological and chemical hazards, and safe on-site transport;
 - (d) Adequate resources are available for all functions relating to the safe operation.
2. By examining documentation and through interviews with the staff of the operating organization, the mission team verifies that:

- (a) Operating personnel are familiar with the management structure of the operating organization;
 - (b) Operating personnel are aware of and understand their own roles and responsibilities in ensuring safety during operation;
 - (c) The managers of the operating organization show commitment to highest standards of safety and take the responsibility for all activities conducted within their scope of supervision.
3. By examining documentation and through interviews with the managers of the operating organization, the mission team verifies that:
 - (a) There is a clear understanding of the division of responsibilities and authority between all units of the facility organization, and between such units and other parts of the operating organization and relevant external organizations providing services;
 - (b) The management is provided with sufficient authority and resources to enable it to fulfil its duties effectively.
4. The mission team verifies that the management of the operating organization has established, and clearly and effectively communicated to the operating personnel, the management expectations and standards concerning safety.
5. The mission team determines whether personal responsibility and accountability are stimulated by adequate delegation of responsibility and whether personnel are encouraged to suggest improvements to safety.
6. The mission team verifies that there is an adequate system for tracking tasks, actions, and commitments (including to the regulator) and for reviewing their implementation.
7. The mission team determines that a comprehensive set of operational limits and conditions has been developed for the facility which may either be a part of the safety analysis or be incorporated into a separate document, which contains:
 - (a) Safety limits on important process variables which provide adequate protection of the integrity of the physical barriers against radiation and the uncontrolled release of radioactive material;
 - (b) Safety system settings for those variables and parameters that, if not controlled, could result in safety limits being exceeded;
 - (c) Limits and conditions for safe operation to provide acceptable margins between normal operating values and safety system settings. This includes limits on operating parameters and minimum operable equipment, actions to be taken by operating personnel to avoid the need for actuation of safety systems and for authorizing the transfer of hazardous materials (radioactive, fissile or chemically reactive) between various buildings at the site;
 - (d) Periodic testing and surveillance specifications stating the necessary frequency and scope of tests of all items important to safety to ensure compliance with approved operational limits and conditions;
 - (e) Administrative controls such as:
 - (i) Organizational structure and responsibilities;
 - (ii) Minimal staffing needs;
 - (iii) Review and audit needs;

- (iv) Procedures to ensure limits are not exceeded;
- (v) Actions to be taken following a violation of operational limits and conditions;
- (vi) Reports and records needs.

8. The mission team verifies that the existing operational limits and conditions:
 - (a) Were derived from the facility safety analysis and constitute a comprehensive envelope for the safe operation to protect the staff, the public, and the environment;
 - (b) Are presented by clear statements of their objectives, applicability, specification and justification;
 - (c) Have been reviewed and approved by the regulatory body, if so required.
9. The mission team verifies that the operating organization reviews regularly the approved operational limits and conditions in order to make revisions arising out of operational experience.
10. The mission team verifies that the operational limits and conditions include provisions to be taken if a safety limit, safety system setting or limiting condition for safe operation is not satisfied.
11. The mission team confirms that the shift supervisor and operators have a clear understanding of their responsibilities with regard to actions, reporting and documenting related to non-conformities of operational limits and conditions.
12. The mission team determines whether any safety limits, safety system settings or limiting conditions for safe operation have been violated during the facility operation and, if so, which actions were taken, including investigation of the cause.
13. The mission team determines the controls established by the operating organization to ensure compliance with the approved operational limits and conditions and to facilitate the verification that the operation is conducted in compliance with them.
14. The mission team verifies that:
 - (a) Adequate operating procedures have been developed and are available for normal operation, anticipated operational occurrences and accident conditions, and cover all safety related operations that may be conducted in the facility;
 - (b) Adequate operating procedures have been developed by the operating personnel in cooperation with the designer and manufacturer, if needed;
 - (c) Operating procedures are consistent with operating limits and conditions;
 - (d) Operating procedures are periodically reviewed and updated.
15. The mission team determines whether personnel involved in operation are adequately trained in the procedures and their use, including for accident management conditions.
16. The mission team confirms that the procedures and operating instructions can be easily located and are understandable to the operators. The mission team confirms that there are adequate mechanisms in place for the operating staff to report document mistakes or potential improvement in operating procedures.

17. The mission team verifies that changes to operating procedures are made through existing internal procedures in accordance with facility management system and that changes are made known to operating personnel.
18. The mission team verifies that all safety related activities which may be conducted in the facility are adequately analysed, assessed, and controlled to ensure protection against ionizing radiation and associated toxic chemical hazards.
19. Through a walkdown of the facility including workplace observations and through interviews with the staff of the operating organization, the mission team verifies that:
 - (a) Personal protective equipment is provided to personnel as needed;
 - (b) Operating personnel understand the purpose of the personal protective equipment, are familiar with its use and follow the procedures for its correct use.
20. The mission team verifies whether, in case of a conduct of a non-routine operation or test that is not covered by existing operating procedures, the following steps are implemented:
 - (a) A specific safety review is carried out;
 - (b) A special procedure is developed and made subject to approval, in accordance with the established procedures for modifications;
 - (c) Additional training of relevant personnel in these procedures is provided.
21. By examining documentation and through interviews with the operating personnel, the mission team identifies whether a mechanism is established by which operators can report operational errors and safety deficiencies and suggest improvements.
22. Through a walkdown of the facility, the mission team assesses the administrative control of the following:
 - (a) Fire protection measures;
 - (b) Material conditions and general housekeeping (e.g., leaks, corrosion spots, loose parts or damaged insulation), including identification, reporting and timely correction;
 - (c) Labelling of equipment;
 - (d) Industrial safety practices (e.g., lighting and accessibility of premises, temporary storage areas).
23. By examining logbooks, checklists, and other appropriate records, the mission team confirms that the operating organization has made arrangements for generating and controlling the reports and records and that these are generated and retained in line with the existing management system.
24. The mission team checks that minimum staffing levels are defined to ensure safety of the facility in operational states and under accident conditions.
25. The mission team ensures that staffing levels provide adequate redundancy and diversity of the skills needed in emergency situations. The mission team determines what additional support is available to cope with unexpected or multiple events.

26. The mission team confirms that operators are attentive and responsive to facility parameters and conditions and that they are given clear direction by the shift supervisors or team leaders to perform assigned tasks.
27. The mission team checks that procedures for the transfer of radioactive material between units are defined and enforced. It also checks that system and component status changes are documented.
28. The mission team checks that all relevant facility areas are covered by scheduled walkdowns within specified intervals and that a system for documenting problems exists. The mission team checks that special arrangements are made for areas that cannot be entered during operation.
29. The mission team determines the effectiveness of shift turnover in transferring and documenting all important information about the facility status, work in progress and events during the shift.
30. The mission team observes shift briefings to determine how well the shift supervisor communicates expectations and objectives for each of the shift's activities.
31. The mission team checks that reliable communications equipment is available to support process area and facility activities during all modes of operation. The team also confirms that the communication system adequately supports all notifications under the on-site emergency plan.
32. The mission team check that the levels of lighting, noise, and temperature are adequate and that the instrumentation and warnings are unobstructed, clearly readable and understandable to the staff.
33. The mission team verifies that the following technical support is established and available, as necessary:
 - (a) Radiochemical and chemical analytical services;
 - (b) Utilities supply;
 - (c) On-site transportation;
 - (d) Decontamination.
34. The mission team determines the availability, appropriateness, and adequacy of the laboratory instruments' user instructions, through discussion and observation. The team also checks that laboratory staff are familiar with their contents.
35. By reviewing the functions of the analytical services and through a walkdown of the laboratories, the mission team identifies whether:
 - (a) Equipment to adequately collect and analyse radioactive and toxic chemical samples is provided;
 - (b) Calibration standards, sources and procedures are available for calibration and maintenance of laboratory equipment;
 - (c) The analytical equipment is properly calibrated according to established schedule, and the status of analytical equipment and instruments is properly recorded and maintained through logbooks and labels;
 - (d) Redundancy is provided to ensure timely analytical services.

3.4. REVIEW OF MAINTENANCE, PERIODIC TESTING AND INSPECTION

3.4.1. Objective

The objective is to provide a basis for evaluation of programmes for maintenance, periodic testing, and inspection.

References: Requirement 65 of SSR-4 [1].

3.4.2. Guidelines

1. The mission team verifies that programmes for maintenance, periodic testing, and inspection:
 - (a) Are established and effectively implemented;
 - (b) Include the applicability, the frequency of periodic testing and surveillance, and criteria for acceptability;
 - (c) Clearly define mechanism for authorization of maintenance and periodic testing.
2. By examining documentation and, if possible, by observing works, mission team verifies that:
 - (a) There are written procedures for maintenance, periodic testing, and inspection of all items important to safety;
 - (b) The procedures are based on the safety analysis and manufacturers' recommendations;
 - (c) The procedures specify the measures to be taken in the event of any changes from the normal configuration of the facility;
 - (d) A system of work authorization (or equivalent) is used including appropriate step-by-step procedures to be followed before and after the conduct of work in accordance with management system;
 - (e) The procedures include provisions for the restoration of the normal configuration on the completion of the activity.
3. The mission team verifies that there is good coordination among the various maintenance groups (e.g. mechanical, electrical, instrumentation and control, civil) and an effective interface with the operating group, the radiation protection personnel, technical support and other facility groups.
4. The mission team checks that contractors involved in maintenance and/or modification work are subject to the same criteria as the facility staff. This applies to setting goals and objectives, organizational structures, professional competence and qualification of all involved personnel, measurement of performance and evaluation and correction of findings.
5. The mission team checks, through interviews and observation of work activities, that the knowledge, skill, experience level and proficiency of maintenance workers and contractors are appropriate for their assignments.
6. The mission team checks that adequate training facilities, with necessary mock-ups, are available and used to support training for complex or major maintenance tasks.

7. The mission team checks that proper tools, equipment and consumable supplies are available to support work. The team also checks that contaminated tools are adequately marked and segregated.
8. The mission team determines that measuring and test equipment used for periodic testing is:
 - (a) Calibrated against relevant standards at recommended intervals;
 - (b) Subject to controlled use;
 - (c) Tagged and removed from service when out of tolerance.
9. The mission team checks that lifting, rigging, scaffolding, transport and electrical equipment are identified, in conformance with national standards and requirements on industrial safety, periodically inspected, and stored appropriately (coordinate with review area 9 addressing industrial safety) and are in good working condition when made available for use.
10. The mission team checks that corrective work is timely implemented and that incomplete work is properly and actively managed.
11. The mission team checks that procedures and work instructions used to perform maintenance activities are technically accurate, easy to understand, and contain clear acceptance criteria. The team also checks that temporary changes to procedures are sufficiently controlled, including appropriate review and approval, and are promptly incorporated into permanent revisions when appropriate, limiting the number of temporary procedures and their lifetime.
12. Through examination of records, the mission team verifies that the results of maintenance and periodic testing are assessed by properly qualified personnel in order to verify compliance with operational limits and conditions.
13. The mission team determines whether:
 - (a) The operating organization assesses the results of maintenance, periodic testing and inspection;
 - (b) The frequency of maintenance, periodic testing, and inspection of individual items important to safety is adjusted on the basis of experience so as to ensure adequate reliability;
 - (c) The operating organization incorporates the feedback from maintenance, periodic testing, and inspection for continuous improvement.
14. The mission team confirms that appropriate reviews and analyses are conducted, and corrective actions are taken when testing results do not meet acceptance criteria. The teams also confirms that documentation of periodic testing results is accurate, complete, easily retrievable and accessible to other departments.
15. If the frequency and extent of periodic testing is modified due to experience feedback, the mission team checks whether such modifications were properly approved by management and by the competent authorities.
16. The mission team checks that work authorization procedures are established, and that they clearly define the responsibilities and authorities related to equipment isolation, post maintenance testing and system restoration to service.

17. The mission team confirms that analysis of possible consequences is conducted before a piece of equipment is placed out of service and that the reliability of redundant safety equipment is verified before any safety related component is isolated.
18. The mission team confirms that shift personnel are aware of all systems and components out of service at any time and there are appropriate means to control the configuration of the facility.
19. The mission team determines whether adequate provisions exist for the following:
 - (a) Transferring responsibilities for the work permits from shift to shift;
 - (b) Controlling the work of more than one group on a system or component;
 - (c) Locking, tagging or otherwise securing isolation points to ensure safety;
 - (d) Identifying out of service systems and components by appropriate signs and tags both in the process area and in the control room.
20. The mission team verifies that actions to minimize the risks associated with maintenance during shutdown (between campaigns) are taken.

3.5. REVIEW OF MODIFICATIONS

3.5.1. Objective

The objective is to provide a basis for evaluation of the operational control of modifications. The review verifies that an adequate procedure for control of modifications is in place and that safety impact of modifications is systematically assessed and taken into account in the relevant documentation of the facility.

References: Requirement 61 of SSR-4 [1].

3.5.2. Guidelines

1. The mission team verifies that:
 - (a) The operating organization takes the overall responsibility for modifications prepared and implemented during operation including those where external vendors and subcontractors are involved;
 - (b) The proposals for modifications are classified using adequate criteria for the categorization, in accordance with a graded approach;
 - (c) The modifications with safety impact are assessed against the original design basis of the facility.
2. The mission team determines that a procedure for control of modifications exists, that it has been implemented, and that it includes (as appropriate):
 - (a) A description of the proposed modification;
 - (b) Justification for the modification, such as ageing, backfitting or upgrading;
 - (c) Categorization of the modification in accordance with a graded approach;
 - (d) Internal organization, arrangements associated with the modification and specific responsibilities;
 - (e) Design requirements and criteria;
 - (f) A safety assessment that supports the modification;

- (g) Specifications of the manufacturing processes;
 - (h) Instructions for proper installation and commissioning;
 - (i) Testing and inspection requirements of the completed modification;
 - (j) Review of operational and emergency procedures and operational limits and conditions;
 - (k) Requirements for updating documentation, including the safety analysis;
 - (l) Requirements for training and qualification.
3. When examining the documentation for a selected modification (or modifications) implemented in the past, the mission team identifies whether:
 - (a) The management system was applied to all stages of the modification project;
 - (b) The proposed modification was reviewed by operation personnel and by the safety committee in accordance with the internal procedure;
 - (c) Personnel involved in implementing the proposed modification were suitably trained, qualified, and experienced for the task;
 - (d) All facility documents affected by the modification were updated as necessary;
 - (e) Appropriate commissioning was carried out, and the results were recorded and assessed (if applicable);
 - (f) In accordance with national requirements, the regulatory body was informed of the modification in advance.
 4. The mission team checks that the safety of modifications is demonstrated by a specific nuclear criticality safety analysis where applicable. The team also checks that both operating and maintenance personnel, as well as the nuclear criticality specialist, are involved in reviewing the documentation for the modification(s).
 5. The mission team checks that an appropriate commissioning programme is carried out after implementation of the modification(s). The teams confirms that facility personnel are involved in developing the commissioning programme, even in cases when a contractor or contractors implemented the modification(s).
 6. The mission team checks that a procedure is in place for identifying, controlling and managing organizational changes which may affect safety and that this procedure is systematically applied, monitored and reviewed.
 7. The mission team verifies whether, during the implementation of modifications, the radiation exposure of the workers involved is kept as low as reasonably achievable (i.e. ALARA principle).
 8. When examining the documentation and records on temporary modifications, the mission team verifies whether:
 - (a) Temporary modifications are subject to the same level of safety review and justification as permanent modifications;
 - (b) Temporary modifications are limited in time and number;
 - (c) Temporary modifications are clearly identified and labelled;
 - (d) The operating personnel is aware of and understand the consequences of the temporary modification(s) for the operation and safety of the facility.
 9. For sites with multiple nuclear facilities, the mission team verifies whether the proposed modifications are assessed also for their potential impact on the neighbouring facility or facilities on the site.

3.6. REVIEW OF NUCLEAR CRITICALITY SAFETY

3.6.1. Objective

The objective is to provide a basis for evaluating the adequacy of the nuclear criticality safety programme. The review verifies that activities are carried out in accordance with the criticality safety programme; that nuclear criticality safety evaluations appropriately describe the process, identify normal and credible abnormal conditions, identify the nuclear criticality safety parameters being controlled and limits established thereof, and demonstrate the assurance of subcriticality under normal and all credible abnormal conditions.

References: Requirement 66 of SSR-4 [1].

3.6.2. Guidelines

1. The mission team verifies that:
 - (a) A nuclear criticality safety programme commensurable with the potential for an accidental criticality in the facility, is established and effectively implemented;
 - (b) The operating organization has appointed qualified nuclear criticality safety staff who are knowledgeable about the physics of nuclear criticality and the associated safety standards, codes and best practices, and who are familiar with the facility design and operations;
 - (c) Nuclear criticality safety evaluations are established and appropriately describe the process, identify normal and credible abnormal conditions, identify the nuclear criticality safety parameters being controlled and limits established thereof, and demonstrate the assurance of subcriticality under normal and all credible abnormal conditions;
 - (d) An adequate nuclear criticality safety training programme for nuclear criticality safety staff, operators and management has been appropriately established and implemented;
 - (e) Engineered and administrative controls for ensuring nuclear criticality safety are consistent with the nuclear criticality safety evaluation, are physically in place, and are properly implemented.
2. In reviewing the relevant procedures and records, the mission team verifies whether measures for identification and inspection of potential accumulation of fissionable materials are established and followed, in accordance with the nuclear criticality safety evaluation, where appropriate.
3. In examining the procedures for implementation of modifications and the records of modifications, the mission team verifies that plant modifications (e.g. to the process or equipment) potentially impacting nuclear criticality safety are reviewed by qualified nuclear criticality safety staff.
4. The mission team verifies that all operations involving fissionable material have been evaluated by nuclear criticality safety staff and that nuclear criticality safety evaluations have been established as appropriate.
5. The mission team verifies that the list of processes involving nuclear criticality limitations is established in the operating limits and conditions (or in an equivalent

document). The team also verifies that the limitations are suitably labelled at the workstations, as appropriate.

6. The mission team verifies that written procedures are in place for preventing nuclear criticality during emptying and wet cleaning of process equipment and cylinders used for fissionable material, as applicable.
7. The mission team verifies that a minimum margin of subcriticality (i.e., administrative margin) has been established, appropriately justified, and documented.
8. The mission team verifies that computer codes used to perform nuclear criticality safety calculations are verified and validated and that verification was performed before first use and after all changes that could impact the performance of the computer code (e.g., changes in hardware, software, or operating system).
9. The mission team verifies that preference is given to engineered criticality controls over administrative criticality controls and to passive engineered criticality controls over active engineered criticality controls.
10. The mission team verifies that nuclear criticality safety evaluations demonstrate compliance with the double contingency principle¹ where practicable, as appropriate.
11. The mission team verifies that the procedures pertinent to nuclear criticality safety specify all nuclear criticality safety controls and parameters that are intended to be controlled and identify their associated limits.
12. The mission team verifies that deviations from procedures, control degradations and failures, and changes in process conditions that affect nuclear criticality safety are reported to the management, entered into the corrective action programme as appropriate, and investigated promptly, and that actions are taken to prevent recurrence.
13. The mission team verifies that nuclear criticality safety staff are given the resources to perform the necessary assessments and calculations for which they are responsible.
14. The mission team verifies that nuclear criticality safety staff have adequate competence in criticality safety and operating experience and are independent of operations, and that their decisions with respect to criticality safety are documented.
15. By examining records from training and through interviews with the staff of the operating organization, the mission team identifies whether operators and other personnel involved in conduct of operations:
 - (a) Are aware of relevant nuclear criticality safety hazards;
 - (b) Understand the conditions that might cause a nuclear criticality accident;
 - (c) Are trained in relevant emergency response procedures in case of criticality accident alarm system initiation.

¹ A principle applied, for example, in the design of processes for nuclear fuel cycle facilities, such that the design for a process must include sufficient safety features that a criticality accident would not be possible unless at least two unlikely and independent changes in process conditions were to occur concurrently [3].

16. The mission team verifies that nuclear criticality safety staff are closely involved in development of the content of the nuclear criticality safety training and of the periodic refresher training given to facility personnel.
17. The mission team verifies that nuclear criticality safety training covers the following:
 - (a) The main principles of criticality physics;
 - (b) Nuclear criticality safety parameters (e.g., mass, geometry) and common methods of limiting the risk of criticality accidents;
 - (c) Examples of unfavourable geometry containers and a discussion of the control of unfavourable geometry containers as appropriate;
 - (d) The potential effects of criticality on exposed personnel;
 - (e) Emergency response procedures;
 - (f) Examples of criticality events, with the lessons that can be learned from them;
 - (g) The necessary strict adherence to procedures.
18. For facilities that process fissionable materials of different enrichments, the mission team verifies that the nuclear criticality safety evaluation provides adequate provisions to exclude unwanted mixing or confusion of different enrichments.
19. The mission team verifies that a criticality accident alarm system has been established and appropriately maintained, and that the location of the system detectors provides adequate coverage of areas in which fissionable material is handled, used, or stored. The team also verifies that the corresponding audible alarms are located at each place where staff could be present and exposed to radiation from a criticality event. For areas in which noise levels may impede personnel's ability to hear audible alarms, the team verifies that visual alarms are provided.
20. The mission team verifies that the criticality accident alarm system is regularly tested and that deviations are corrected in a timely manner.
21. The mission team verifies that emergency response procedures and criticality evacuation paths are established. The team also checks that these procedures are regularly tested by drills and that any issues identified are corrected in a timely manner.
22. The mission team verifies that a nuclear criticality safety audit programme that addresses all areas subject to criticality hazards has been established and that it is implemented with appropriate frequency.

3.7. REVIEW OF THE RADIATION PROTECTION PROGRAMME

3.7.1. Objective

The objective is to provide a basis for evaluation of the radiation protection programme, procedures, and practices. The review verifies that an adequate radiation protection programme is established and implemented.

References: Requirement 67 of SSR-4 [1], IAEA Safety Standards Series No. GSR Part 3 Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards [4].

3.7.2. Guidelines

1. By examining the radiation protection programme and through interviews with the staff, the mission team identifies whether:
 - (a) The radiation protection programme demonstrates the overall responsibility of the operating organization for radiation safety and includes the establishment within the operating organization of radiation protection personnel, and the appointment of one or more qualified radiation protection officers who are technically competent in radiation protection matters and knowledgeable about the radiological aspects of the design, operation, and hazards of the facility;
 - (b) The advice and concerns of radiation protection personnel are taken into consideration by the levels of management within the operating organization with the authority to establish and enforce operational procedures;
 - (c) Dose limits and dose constraints for occupational exposure (for both internal and external exposure) associated with the relevant category of all facility states (for operational states and accident conditions) are set, consistent with the regulatory requirements;
 - (d) The chemical form of releases and the kinetics of the exposure pathway were considered when determining the reference levels for radiation dose rates.

2. By performing facility walkdowns, and through observation of work and interviews with the staff of the operating organization, the mission team determines whether:
 - (a) Areas occupied by workers are classified (controlled areas and supervised areas) in accordance with foreseeable levels of dose rates, surface contamination and airborne contamination;
 - (b) Control of the access to and exit from radiological areas is established and maintained;
 - (c) Radiation protection personal protective equipment and dosimeters are properly worn and used;
 - (d) Workplace radiological monitoring is established and performed in accordance with area classification;
 - (e) Shielding and other measures for protection and safety, including access control, are provided as appropriate for restricting radiation exposure;
 - (f) Fixed and mobile equipment is provided to detect surface contamination on people, equipment, products and other objects to verify the effective confinement of radioactive material;
 - (g) Facilities are provided for the decontamination of operating personnel and equipment.

3. By reviewing records and examining relevant procedures, the mission team confirms whether:
 - (a) Adequate training in radiation protection practices is provided to operating personnel and contractors;
 - (b) The operating organization verifies (by means of surveillance, inspections and audits), that the radiation protection programme is correctly implemented and that its objectives are met;
 - (c) Work in radiologically controlled areas (RCAs) is authorized in accordance with appropriate procedures (work permits) including for non-routine operations;
 - (d) Annual dose reports are submitted to the regulatory body;

- (e) The operating organization has made arrangements for generating and controlling records containing radiation protection data, including personnel monitoring data;
 - (f) The radiation protection programme is reviewed on a regular basis and is updated as necessary;
 - (g) Radiation protection officers are involved in preparing operating and maintenance procedures;
 - (h) Facility modifications are planned, reviewed, supervised, and implemented from the perspective of avoiding unnecessary radiation exposure and keeping unavoidable exposure in conformance with the principle of optimization of protection.
4. The mission team checks that personnel are knowledgeable about current work practices and facility procedures. The team also evaluates workers' (including contractors') understanding of the reasons for contamination control measures and the importance of full compliance with the facility procedures.
 5. The mission team verifies that the frequency of refresher radiation protection training is appropriate. The team also confirms by spot checks that radiation protection personnel have successfully completed the most recent training or are scheduled to attend such training.
 6. The mission team checks that work permits are prepared and cleared (from a radiation protection perspective) only by individuals who have been fully trained in the facility's radiation work authorization procedure and have been authorized by line management and/or by a radiation protection manager.
 7. The mission team reviews the procedures for movement and transfer of tools, equipment, and materials out of RCAs and verifies that the flow of tools, equipment and materials across the RCA boundary is minimized.
 8. The mission team checks that individual work sites are marked with actual radiological conditions.
 9. The mission team checks whether special shielding and low radiation 'waiting areas' are provided, where appropriate.
 10. The mission team determines whether the facility and workplace monitoring procedures adequately reflect radiological conditions (including internal exposure hazards) in an accurate and timely manner. The teams also checks that the workplace monitoring procedure is comprehensive enough to identify changes in radiological conditions in controlled or supervised areas.
 11. The mission team evaluates how the spread of contamination is minimized at the facility. The team verifies that access to areas where contamination levels might lead to high doses to workers is restricted, and that the level of control applied is commensurate with the hazard.
 12. If applicable, the mission team confirms that close attention is paid to the confinement of fine radioactive powders and aqueous solutions containing thorium, plutonium, enriched uranium, or other radioactive concentrates.

13. The mission team checks that the procedure for the control and monitoring of airborne contamination is compatible with the design to maintain airflow from clean to contaminated areas. For facilities where significant concentrations of airborne activity are anticipated, the team checks that appropriate internal dosimetry is available, including the use of whole body counters, where relevant.
14. The mission team reviews the types and quantity of protective clothing and respiratory protective equipment available and ensures that they are appropriate for the hazards that are anticipated.
15. The mission team ensures that respiratory protection devices are available to minimize the internal exposure of personnel when engineered measures cannot be employed. The team also checks that a documented programme of training, quantitative fit testing, and confirmatory monitoring, exists where appropriate, including formal training and procedures on the selection, issue, cleaning, and repair of respiratory protection devices.
16. The mission team checks that a programme of air sampling and airborne exposure tracking over time is employed and that such a programme includes timely air sampling and evaluation that is coordinated with the worker's presence in the area.
17. The mission team observes how personnel contamination monitoring is performed and assesses the adequacy of the locations selected for personnel contamination monitoring.
18. The mission team checks that a procedure of effective response to the detection of personnel contamination is in place, including recording, decontamination, cause investigation, prompt corrective action and exposure assessment.
19. The mission team verifies that adequate procedures and schedules are in place to ensure that the equipment and devices used to obtain radiological measurements and doses are calibrated, maintained and used in such a way that results are accurately determined.
20. The mission team checks whether an appropriate system exists to control radiological conditions in hot laboratories, hot cell areas and workshops, if applicable.
21. The mission team identifies what specific arrangements or provisions are undertaken to reduce individual and collective doses for each work group, including contractors.
22. By examining the procedures for cleaning and decontamination of areas and equipment and through interviews with the staff of the operating organization, the mission team determines whether:
 - (a) Resources exist for prompt investigations following unusually high contamination readings;
 - (b) Dedicated equipment, such as standby fans, temporary ventilation equipment, dynamic containments and mobile air samplers, are available for use in anticipated operational occurrences;
 - (c) The personnel are familiarized with the relevant procedures and equipment.
23. The mission team verifies whether adequate decontamination facilities for tools, parts and equipment are available and used to minimize radiation doses and exposure to contamination.

3.8. REVIEW OF RADIOACTIVE WASTE AND EFFLUENT MANAGEMENT

3.8.1. Objective

The objective is to verify that an appropriate programme for the management of radioactive waste and effluents is established and implemented. The review verifies that the facility is operated so as to control and minimize, as far as reasonably achievable, the generation of radioactive waste of all kinds in terms of both activity and volume.

References: Requirement 68 of SSR-4 [1], GSR Part 3 [4], IAEA Safety Standards Series No. GSR Part 5, Predisposal Management of Radioactive Waste [5].

3.8.2. Guidelines

1. By examining the programme for the management of radioactive waste, and by verifying its implementation, the mission team confirms whether:
 - (a) The facility is operated so as to control and minimize, as far as reasonably achievable, the generation of radioactive waste of all kinds in terms of both activity and volume;
 - (b) Facility organizational structure for radioactive waste management is established in accordance with facility management system and with safety policy;
 - (c) Control measures are applied in the following order: reduce waste generation, reuse items as originally intended, recycle materials, and consider disposal as waste;
 - (d) Site personnel are trained and participate in the efforts to keep the generation of radioactive waste to the minimum practicable;
 - (e) Generation of radioactive waste is reported periodically to the regulatory body in accordance with national requirements.

2. By reviewing records and examining relevant procedures, and through a walkdown of the facility, the mission team:
 - (a) Verifies how the radioactive waste management programme is implemented;
 - (b) Confirms the existence and implementation of procedures for collection, segregation, characterization, treatment, storage, handling, conditioning, monitoring and labelling of radioactive waste;
 - (c) Confirms the adequacy of records, including their retrievability;
 - (d) Verifies that materials are not taken into RCAs unnecessarily;
 - (e) Checks that radioactively uncontaminated solid waste is segregated from contaminated waste as far as practicable;
 - (f) Checks that uncontaminated solid waste is monitored before its release from RCAs to ensure that it is below the release limit (if any);
 - (g) Checks that volume and activity reduction techniques, including decontamination, compaction, and incineration or concentration, are used to achieve maximum volume and radioactivity reduction;
 - (h) Checks whether contaminated materials such as tools and equipment are decontaminated and re-used when beneficial;
 - (i) Checks the instructions for usage of labels, warning signs and tags for radioactive material and their use at the facility;
 - (j) Checks that physical (e.g., liquid, solid) and chemical (e.g., corrosive, flammable) composition of waste is taken into account for their conditioning.

3. The mission team verifies that recyclable material is used in place of disposable material where practical and that it is recycled.
4. The mission team checks that the fissile material content is taken into account in a sufficiently conservative way for conditioning and storage, to prevent nuclear criticality.
5. The mission team interviews workers involved in radioactive waste management to determine their knowledge of actions to take in accidents or emergencies.
6. By examining relevant procedures and verifying the records, the mission team confirms whether:
 - (a) A prospective radiological environmental impact assessment is kept updated, considering the operational experience and the information on the environmental conditions relevant for public exposure;
 - (b) Discharges of radioactive effluents and associated hazardous chemical effluents are authorized and conducted in accordance with regulations for the protection of the public and the environment (including fulfilment of dose limits and dose constraints);
 - (c) Facility specific discharge limits are defined and revised regularly based on operating experience;
 - (d) The scope and frequency of sampling and monitoring of discharges are established in accordance with the potential environmental impact of the waste and effluents and with a graded approach;
 - (e) Discharges are monitored at the point of discharge (source), and activity concentration in the environment is monitored, and the results are recorded in order to verify compliance with the applicable regulatory requirements;
 - (f) Deviations from the discharge limits, if any, are followed by the adequate corrective actions.
7. The mission team reviews the installed effluent monitoring systems, including their calibration and maintenance records.
8. The mission team reviews the analytical procedures used to sample and evaluate effluent releases, including sample collection and laboratory processing and nuclear analytical techniques, for accuracy and adequacy.
9. The mission team verifies that radiation protection measures, including clothes, shielding, permanence control and ventilation, are adequate in all facility areas occupied by operating personnel to ensure proper personnel protection, including from radioactive airborne effluents.
10. By reviewing the environmental monitoring programme and corresponding procedures, and by examining the relevant records, the mission team determines whether:
 - (a) Background conditions and data were established and collected before operation of the facility commenced;
 - (b) The radionuclides in the environment from both planned and unplanned releases are monitored and their environmental impact is assessed;
 - (c) Action levels and annual limits for effluents for the protection of the public and personnel are established;

- (d) Local and near field environmental monitoring stations are established and used to monitor the air, surface water, groundwater, soil, sediments, local food and biota in the food chain, as necessary;
 - (e) Records of environmental monitoring results are maintained, including records of planned discharges and unplanned releases, as well as results of audits and inspections;
 - (f) Results of the source and environmental monitoring programmes are reported regularly to the relevant authorities consistent with national regulations.
11. By examining documentation and through interviews with the staff of the operating organization, the mission team confirms whether:
- (a) Installed sampling and monitoring equipment is appropriate for the effluents and sources of direct irradiation being monitored;
 - (b) Personnel responsible for source monitoring and environmental monitoring understand the proper use of sampling techniques, monitoring equipment and analytical techniques in the laboratories;
 - (c) Personnel responsible for effluent monitoring and environmental monitoring have an understanding of measurements taken and are able to interpret the measured values.
12. The mission team evaluates the adequacy of the sampling techniques and sampling locations used.
13. The mission team reviews environmental monitoring results for trends and comparison with effluent monitoring results.
14. The mission team reviews past actions in this area with regard to reporting, mitigation and corrective action.

3.9. REVIEW OF FIRE, CHEMICAL AND INDUSTRIAL SAFETY

3.9.1. Objective

The objective is to provide a basis for evaluation of protection against fire and management of industrial and chemical safety. The review verifies that policies and arrangements are established and implemented so as to ensure protection against fire and explosion and to keep the risks associated with industrial and chemical hazards to workers and the public as low as reasonably achievable.

References: Requirements 69 and 70 of SSR-4 [1].

3.9.2. Guidelines

1. The review verifies that:
 - (a) The organizational structure has clear divisions of responsibilities and clear lines of communication concerning fire, chemical and industrial safety;
 - (b) The fire, chemical and industrial safety programmes are well understood and adhered to by the facility personnel, including contractors;

- (c) The operating organization, as appropriate, has access to the necessary safety expertise in order to minimize risks to the public, workforce and environment arising from fire, chemical and industrial safety hazards;
 - (d) Prior to the start of any non-routine work, a process is in place to evaluate health and safety risks from fire, chemical and industrial safety.
2. The mission team checks whether on-site firefighting resources are adequate for the foreseen events. If not, the team checks whether on-site capability is supplemented by assistance from a public firefighting organization.
 3. The mission team checks that the qualifications and experience of the on-site fire protection and support personnel are commensurate with facility hazards and with assigned responsibilities.
 4. The mission team confirms, through review of administrative procedures and interviews, that an on-shift fire brigade is available at all times to handle both a fire and a subsequent facility emergency, that personnel have the necessary qualifications, and that guidance is in place for corrective action related to any shortfall of personnel or equipment. If possible, the team arranges observation of a firefighting drill.
 5. The mission team confirms that the on- and off-site firefighting organizations have received the proper instructions and training (including related to radiation protection and nuclear criticality hazards), to interface and support the facility in all types of firefighting activities in a nuclear environment. The team confirms that responsibilities are clearly established and documented.
 6. The mission team reviews the inspection, surveillance and preventive maintenance programmes for the fire detection and suppression systems.
 7. The mission team checks that adequate measures are in place for the maintenance of fire barriers such as fire stops, fire damper doors, cable penetrations and controls, to ensure that barriers are kept in good condition and returned to normal service after maintenance or modifications.
 8. The mission team verifies that the areas (e.g., doors, passages, roads) leading to fire exits, stairs, evacuation routes and fire extinguishing equipment are clear and not blocked by any obstacles.
 9. The mission team checks that the control of flammable materials and ignition sources is in place to detect changes in fire loads and ignition sources and that fire detection and suppression systems are installed as necessary.
 10. The mission team confirms that the fire supply systems testing interval is defined and followed.
 11. The mission team confirms that portable firefighting equipment (e.g., fire extinguishers, protective clothing, portable breathing apparatus) is maintained in workable condition. The team checks that portable firefighting equipment is located in areas of high fire risk and is accessible, and that surveillance requirements are met.
 12. The mission team checks that fire protection drills involving all responsible personnel are regularly conducted at the facility.

13. The mission team checks if monitoring for flammable gases (e.g., hydrogen) is conducted to detect flammable gas concentrations in equipment, boxes, and rooms and to maintain their levels below the lower flammability limits in the air.
14. The mission team verifies that significant changes in fire loadings, ignition sources and process parameters (e.g., temperature, concentrations, pressure) are analysed by the safety committee and properly controlled.
15. The mission team verifies, if applicable, whether the properties of flammable liquids are monitored, including with respect to changes in properties as a result of their exposure to ionizing radiation. This is particularly important for reprocessing facilities (storage of spent extractants and organic liquids).
16. By reviewing the programme for controlling the risks associated with industrial and chemical hazards to workers and the public and by examining relevant procedures, the mission team confirms whether:
 - (a) The programme includes arrangements for the planning, implementation, monitoring and review of the relevant preventive and protective measures, and is compatible with the requirements for nuclear and radiation safety;
 - (b) All personnel, including workers, suppliers, contractors and visitors, are appropriately trained in order to provide them with the necessary knowledge and awareness of industrial and chemical safety and its interface with nuclear and radiation safety;
 - (c) The operating organization provides support, guidance and assistance for personnel in the area of industrial and chemical hazards.
17. The mission team verifies the implementation of the following practices with respect to chemical safety:
 - (a) Chemical containers are suitably labelled and appropriately stored (they are not allowed to accumulate in maintenance areas);
 - (b) The labels clearly identify the chemicals stored and their associated hazards;
 - (c) Safety protection sheets of chemicals exist in the pertinent work areas and can be easily and readily accessed by the operators and maintenance personnel;
 - (d) The stored quantity is limited to the necessary; any chemicals not needed for operation or maintenance are appropriately disposed;
 - (e) The use of chemicals conforms to the facility procedures.
18. The mission team confirms that the chemical safety technicians, operators, and maintenance staff are trained to recognize the hazards of using and/or handling chemically hazardous material.
19. The mission team verifies that personal protective equipment and facilities related to chemical safety, such as eyewash and showers, are available to the operating personnel and that instructions on their use are properly given.
20. The mission team verifies that a list of hazardous chemicals at the facility and safety information related to their storage, use, handling and recommended first aid responses to accidental exposure are accessible in all process areas where the chemicals are used.

21. The mission team verifies whether the compatibility of the chemicals used in the process and their mixtures are checked to avoid the release of hazardous gases, uncontrolled chemical reactions, or adverse corrosion activity.
22. The mission team confirms that the generation of a combination of non-radiological and radiological hazards, such as toxic or asphyxiating gases in conjunction with radiation and contamination, is minimized.
23. The mission team verifies that chemical safety matters arising from modifications, operation or maintenance are analysed by the safety committee and properly controlled.
24. The mission team checks that detectors are installed in areas with a significant chemical hazard (e.g., fluorine detectors around large quantities of UF₆ or HF) and that occupancy in these areas is controlled.
25. By examining the industrial safety programme (or equivalent) and related procedures and through observation of work, the mission team determines the inclusion and implementation of the following elements:
 - (a) Use of personal protective equipment;
 - (b) Availability of eye protection equipment, including eye wash facilities;
 - (c) Use of scaffolding and climbing equipment;
 - (d) Use of lifting equipment.
26. The mission team verifies that an adequate process is implemented for identification, reporting, investigation, and analysis of industrial safety related events and near misses.
27. The mission team checks that all industrial safety related events and significant industrial accidents and their root cause investigations are reviewed by the safety committee.
28. The mission team confirms that a root cause evaluation is done for events related to industrial safety and that the events are analysed for trends to determine whether preventive measures are necessary.
29. The mission team checks that the industrial safety training requirements for facility staff and contractors are adequate.
30. The mission team investigates, by inspecting selected areas and activities on the site and by interviewing appropriate individuals, whether the safety rules, procedures and instructions are being adhered to satisfactorily.
31. The mission team checks that industrial safety requirements are specified on work authorizations.
32. The mission team checks that the validation of safety equipment, such as breathing apparatus, is up to date.
33. The mission team confirms that the verification status of systems preventing overpressure (e.g., pressure release valves, membranes) is valid.

3.10. REVIEW OF AGEING MANAGEMENT

3.10.1. Objective

The objective is to provide a basis for evaluating the operating's organization approach to ageing management of items important to safety. The review verifies that an effective ageing management programme exists and is implemented.

References: Requirements 32 and 60 of SSR-4 [1]

3.10.2. Guidelines

1. The mission team verifies that an effective ageing management programme is established and implemented, including the following elements:
 - (a) Identification of SSCs for ageing management;
 - (b) Identification and understanding of ageing in SSCs;
 - (c) Minimization of ageing effects;
 - (d) Detection and monitoring of ageing effects and analysis of trends;
 - (e) Acceptance criteria, corrective actions and mitigation of ageing effects;
 - (f) Feedback from operating experience and other research and development results on ageing;
 - (g) Documentation of ageing management.
2. The mission team verifies whether the ageing management programme is coordinated with and consistent with other relevant programmes, including the programmes for in-service inspection, periodic safety review and maintenance.
3. The mission team confirms that the interfaces between the ageing management programme and the following technical areas are addressed and documented:
 - (a) Maintenance, periodic testing and inspection;
 - (b) Safety assessment;
 - (c) Periodic safety review;
 - (d) Equipment qualification;
 - (e) Configuration management;
 - (f) Lifetime extension.
4. The mission team checks that an appropriate strategy is in place to monitor the degradation of "static" SSCs (e.g., fixed shielding, structural components, containment) including those associated with nuclear criticality prevention (e.g. fixed absorbers, spacers).
5. The mission team confirms that maintenance policies address the replacement of obsolete and obsolescent parts.

3.11. REVIEW OF EMERGENCY PREPAREDNESS AND RESPONSE

3.11.1. Objective

The objective is to verify whether the existing emergency arrangements provide adequate capability for the operating organization to respond effectively to a nuclear or radiological

emergency, including in combination with other incidents or emergencies (e.g., a nuclear or radiological emergency initiated and/or affected by a conventional emergency, natural event, security event or national or global health crisis).

References: Requirement 72 of SSR-4 [1], IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency [6].

3.11.2. Guidelines

1. The mission team verifies that the NCF has an organizational structure with clearly assigned roles and responsibilities for managing an emergency response.
2. The mission team verifies that the emergency response organization includes the names and duties of individuals authorized to act as site response managers, the chain of command and communication, and a description of related facilities and procedures.
3. The mission team determines whether facility emergency arrangements are commensurate with the hazards identified and the potential consequences associated with the NCF and nearby nuclear facilities, if applicable, and whether they consider the associated non-radiological and chemical hazards, as part of a wide range of emergency scenarios, including:
 - (a) Nuclear criticality;
 - (b) Releases of hazardous materials (both radioactive material and chemicals);
 - (c) Fires, explosions and associated loss of services (e.g., electrical power supply and coolants);
 - (d) Nuclear security events which may trigger nuclear or radiological emergencies;
 - (e) Non-radiological hazards, radiological hazards, and their combinations.
4. The mission team verifies that a comprehensive and documented on-site emergency plan exists that:
 - (a) Covers all functions and activities to be implemented by the operating organization in the event of an emergency including the following elements:
 - (i) Coordination of response actions and communication arrangements with relevant authorities;
 - (ii) Arrangements for identification and declaration of an emergency, timely notification of response personnel, and activation of emergency response;
 - (iii) List of the off-site organizations to be notified, including the names of specific officials;
 - (iv) Provisions for assessment and prognosis of the situation and implementation of mitigatory actions, necessary protective actions and other response actions on the site;
 - (v) Arrangements for terminating an emergency, including prerequisites that need to be fulfilled;
 - (vi) Arrangements for protecting emergency workers and helpers in an emergency;
 - (vii) Arrangements for managing the medical response in an emergency.
 - (b) Defines the emergency classification system and associated emergency action levels;

- (c) Describes the NCF, including authorized nuclear material types present and their enrichment levels, chemicals and other hazardous substances present, and fission product inventory, if applicable;
 - (d) Describes the location of the facility including, as appropriate, surrounding population density, nearby industrial activity and access routes;
 - (e) Identifies the owner and/or the operator and states the objective of the on-site emergency plan;
 - (f) Describes emergency response facilities and equipment, including locations.
5. The mission team verifies that the on-site emergency plan is reviewed on a regular basis.
 6. The mission team verifies that procedures for implementing the on-site emergency plan exist and that they cover all the functions planned to be carried out in an emergency.
 7. For facilities processing UF₆, the mission team verifies that, in response to an emergency, immediate attention is given to the chemical toxicity of UF₆ and its reaction products.
 8. The mission team verifies that adequate logistical support and facilities are provided to enable emergency response functions to be performed in a timely and effective manner in an emergency.
 9. The mission team verifies that adequate resources are available and maintained in adequate conditions to support and implement the on-site emergency plan.
 10. The mission team verifies that:
 - (a) The emergency response organization is staffed with sufficient personnel who are selected, trained, qualified and assessed for their initial fitness and continuing fitness for their intended duties;
 - (b) Suitably qualified personnel are available with appropriate training to staff the various positions necessary to take mitigatory actions, protective actions and other response actions;
 - (c) The minimum shift group composition is sufficient to perform the immediate actions specified in the emergency procedures and in the on-site emergency plan in the event of an activation of the on-site emergency plan.
 11. By reviewing the training programme for emergency response and related records, the mission team verifies that:
 - (a) An established training programme ensures that response personnel possess the essential knowledge, skills and abilities needed for effective response under emergency conditions;
 - (b) Response personnel are trained periodically and familiar with the emergency procedures and the equipment provided;
 - (c) Training is provided on mitigation of chemical effects and the detection of over-exposure, as appropriate.
 12. The mission team verifies whether chemicals for neutralizing chemical hazards and for mitigating chemical effects are properly stored and available, as appropriate.
 13. The mission team verifies that arrangements have been made for providing useful, timely, factually correct, clear, and appropriate information to the public and to the news media in an emergency.

14. The mission team verifies that periodic, regular exercises are conducted to test the emergency arrangements at suitable intervals.
15. The mission team verifies that exercises are evaluated and that lessons identified are used to revise the established emergency arrangements.
16. The mission team verifies, for any past emergencies that have occurred, that suitable records are maintained for analysis of the emergency and the emergency response.
17. The mission team determines whether all pathways for radiation exposure, ingestion of radioactive materials and chemical exposure have been considered in the on-site emergency plan.

3.12. REVIEW OF COMMISSIONING

3.12.1. Objective

The objective is to verify whether the operating organization has established a commissioning programme and adequate provisions for its successful implementation.

References: Requirement 54 of SSR-4 [1].

3.12.2. Guidelines

1. By reviewing the commissioning programme, the mission team identifies whether the commissioning programme:
 - (a) Covers the full range of facility conditions considered in the design;
 - (b) Is subject to regulatory review and assessment;
 - (c) Defines the organization of and responsibilities for commissioning;
 - (d) Defines the commissioning stages, procedures and reports;
 - (e) Describes the methods of review and verification, the treatment of deficiencies and deviations;
 - (f) Defines the requirements for documentation.
2. The mission team verifies that all parties involved in construction of the facility, i.e., operating organization, manufacturers, suppliers, and constructors, are involved in the commissioning and that the interfaces and communication lines between the groups are clearly specified.
3. The mission team checks whether process for identification and addressing of non-conformities between the original design and the as built condition of the facility is established as part of the facility commissioning.
4. By reviewing the commissioning programme, the mission team verifies whether:
 - (a) Commissioning tests are arranged in functional groups;
 - (b) Commissioning is divided into 'cold commissioning' and 'hot commissioning' stages; more stages may be introduced if needed;
 - (c) Criteria for moving to the next stage are clearly specified;
 - (d) Requirements for qualification of personnel are specified.

5. The mission team verifies that the commissioning includes tests and activities to confirm the operational limits and conditions and the values of significant parameters. This includes setting of safety systems based on the results of the commissioning tests.
6. The mission team confirms that the commissioning test results of safety related systems are reviewed by the safety committee and by the regulatory body as applicable.
7. The mission team verifies whether commissioning procedures have been developed for all parts of the facility in line with the commissioning programme.
8. By reviewing selected commissioning test procedures, the mission team confirms that the procedures include:
 - (a) Purpose of the test;
 - (b) The safety precautions, prerequisites and provisions necessary during the test;
 - (c) The test procedure;
 - (d) Hold points defined for the notification and involvement of the safety committee, external bodies, manufacturers, or regulatory body, as applicable;
 - (e) Acceptance criteria;
 - (f) Provisions for resolving deviations, deficiencies or non-conformances discovered during the test;
 - (g) Documentation of test results.
9. The mission team checks that a process for updating the licensing documentation and for applying changes to safety measures or work practices as a result of commissioning is established.

3.13. REVIEW OF PREPARATION FOR DECOMMISSIONING

3.13.1. Objective

The objective is to verify whether the operating organization has prepared an adequate decommissioning plan and whether the activities assumed by the decommissioning plan during facility operation are being executed.

References: Requirement 74 of SSR-4 [1].

3.13.2. Guidelines

1. By reviewing the decommissioning plan, the mission team identifies whether:
 - (a) One or more approaches to decommissioning that are appropriate for the facility and are in compliance with regulatory requirements are evaluated in the decommissioning plan;
 - (b) All aspects of facility operation that are important in relation to decommissioning are considered in the decommissioning plan;
 - (c) The decommissioning plan takes into account the predisposal management of radioactive waste that will be generated during decommissioning;
 - (d) Staffing, training and qualification aspects are considered in the decommissioning plan;
 - (e) The decommissioning plan is reviewed regularly and updated accordingly.

2. The mission team verifies that the transitional period between facility shutdown and the beginning of decommissioning is described in the safety documentation of the facility. The team also checks that any implications for safety arising during this period are assessed.
3. The mission team confirms that radioactive material from the post-operational clean-up is assumed to be recovered and reused as far as reasonably achievable.
4. The mission team checks whether adequate measures are established to ensure criticality safety during the transitional period between permanent shutdown of the facility and the beginning of decommissioning, as well as during decommissioning operations.

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ANNEX I

STANDARD STRUCTURE AND CONTENT OF AN ADVANCE INFORMATION PACKAGE FOR A SEDO MISSION

The advance information package (AIP) is prepared by the operating organization hosting the Safety Evaluation of Fuel Cycle Facilities During Operation (SEDO) mission and is used to convey information relevant to the SEDO team members for the preparation of their review.

The AIP contains adequate information and data to understand the overall organizational structures, division of main responsibilities, and current operating practices. It makes use of existing documents, reports, procedures, and training materials to the extent possible. The package is in English, as this is the SEDO working language.

To the extent possible, the structure of the review areas in the AIP follows the structure of review areas as listed in Section 3 of this publication.

I-1. ADMINISTRATIVE INFORMATION

1. Contact points at the plant and list of counterparts;
2. Summary of site-specific radiological, industrial and fire safety rules, and emergency response provisions;
3. Summary of site-specific security rules;
4. Arrival logistics (airport, hotel, facility, transportation).

I-2. GENERAL INFORMATION

1. Facility description:
 - Overall site and facility description;
 - Schematic plan of the site;
 - Facility operating history;
 - Performance indicators;
 - Current organizational structure.
2. Design information:
 - Brief description of major processes and safety systems;
 - Key design parameters;
 - Brief description of facility major modifications completed or planned.
3. External organizations:
 - Brief description of the main functions, structures and interactions of external organizations liaising with the facility (e.g. operating organization headquarters, regulatory authorities, main suppliers and contractors, industry organizations).
4. Self-assessment:
 - For each review area, a description of how each individual area objective is met;
 - List of gaps identified through self-assessment where performance or programmes do not fully meet IAEA safety standards;
 - For each gap identified, an explanation of what corrective actions are being taken or planned to close the gap.

I-3. TECHNICAL INFORMATION

1. Outline of facility operating licence;
2. Safety performance indicators;
3. List of designations of organizational units (e.g. department, division, section, group) and positions (e.g. superintendent, manager, chief, head);
4. List, terms of reference and timetables of the most significant regular meetings at the facility.

I-4. REVIEW AREAS

1. Operating organization and facility management:
 - Organization and structure of the operating organization;
 - Management programme including management philosophy, management objectives and expectations, audits, and review;
 - Safety policy;
 - Safety committee;
 - Document management system;
 - Safety culture and human performance;
 - Overall approach to fire, chemical and industrial safety;
 - Quality assurance programme;
 - Operating experience feedback organization and management;
 - Reporting and review process of internal and external experience;
 - Corrective action programme;
 - Analysis of trends in events, including low-level events and near misses.
2. Training and qualification:
 - Organization of training functions;
 - Training programme including initial training and retraining;
 - List of major training procedures;
 - Overview of training facilities;
 - Qualifications needed for key plant positions;
 - Evaluation of training;
 - Training activities planned during the SEDO mission.
3. Operations:
 - Operating organization, shift structure and staffing levels;
 - Overall distribution of responsibility during normal operation and accident conditions, lines of command and communication;
 - Work request authorization, equipment isolation and tagging system, locking systems;
 - List of normal operating procedures;
 - List of accident management procedures;
 - Brief description of operating limits and conditions;
 - Overall approach to fire protection and prevention;
 - Schedule of facility walkdowns.

4. Maintenance, periodic testing, and inspection:
 - Maintenance organization;
 - Programme for corrective and preventive maintenance;
 - Evaluation of maintenance activities, including analysis of trends;
 - In-service inspection programme;
 - List of major maintenance procedures;
 - Work authorization programme.
5. Modifications:
 - System for control of modifications;
 - Plant modification philosophy, with a list of past and planned major modifications;
 - Temporary modification review process;
 - Assessment of modifications to organizational structure.
6. Nuclear criticality safety:
 - Nuclear criticality safety programme;
 - Nuclear criticality safety organization and staffing level;
 - Nuclear criticality safety training;
 - Schedule of criticality accident alarm system testing.
7. Radiation protection programme:
 - Radiation protection programme;
 - Radiation protection organization and staffing level;
 - Outline of applicable radiation protection regulations;
 - Radiation exposure and contamination control policy;
 - Radiation protection instrumentation and protective equipment;
 - List of radiation protection procedures;
 - Recent radiation protection report data regarding collective and individual dose statistics, contamination events;
 - Contamination monitoring and decontamination facilities;
 - Measures applied in emergency situations.
8. Radioactive waste and effluent management:
 - Radioactive waste and effluent management programme;
 - Waste streams including waste classes;
 - Periodic radioactive waste reports including statistics on waste generation;
 - List of main procedures for radioactive waste predisposal management;
 - Facility specific discharge limits;
 - Facility effluent monitoring system;
 - Environmental monitoring programme.
9. Fire, chemical and industrial safety:
 - Fire, chemical and industrial safety policies;
 - Organization and staffing level;
 - List of main chemically hazardous materials present on site;
 - Schedule of fire protection and chemical emergency drills;

- Use of personal protective equipment;
- Training on chemical hazards.

10. Ageing management:

- Ageing management programme;
- List of structures, systems and components (SSCs) with their safety classification;
- Degradation monitoring strategy;
- Ageing detection and examples of trends for selected SSCs.

11. Emergency preparedness and response:

- Organization of emergency preparedness and response;
- Classification of emergencies;
- Outline of on-site emergency plan and interfaces with off-site emergency response organizations;
- Emergency response facilities on-site and off-site;
- Emergency identification, notification and communication;
- Emergency response;
- Emergency training, drills and exercises.

12. Commissioning:

- Commissioning process;
- Organization and management of commissioning;
- List of main commissioning programmes;
- Control of plant configuration.

13. Preparation for decommissioning:

- Decommissioning plan;
- Control of plant configuration during preparation for decommissioning;
- Nuclear criticality safety during preparation for decommissioning;
- Training, qualification, and knowledge transfer from operation to decommissioning.

ANNEX II TYPICAL FORMAT OF A SEDO MISSION REPORT

II-1. BACKGROUND

- Description of the facility including its history;
- Summary of the preparatory meeting;
- Objectives and scope of the mission;
- Basis for the assessment and documents provided by the counterpart.

II-2. CONDUCT OF THE MISSION

- SEDO team;
- Description of the review method;
- Review criteria.

II-3. CONCLUSIONS AND RECOMMENDATIONS

Structured by review areas

APPENDIX: Issue pages

ANNEX I: Mission agenda

ANNEX II: List of mission participants

**ANNEX III
ISSUE PAGE FORMAT**

REVIEW AREA:
Issues:
Observations:
Basis and references:
Possible safety consequences:
Counterpart's view on the findings:
Recommendations:
Suggestions:
Good practices:

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