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CORR Guidelines

Preparing and Conducting Review Missions of Construction Project Readiness for Nuclear Power Plants

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CORR GUIDELINES

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IAEA SERVICES SERIES No. 24

CORR GUIDELINES

PREPARING AND CONDUCTING REVIEW MISSIONS OF CONSTRUCTION PROJECT READINESS FOR NUCLEAR POWER PLANTS

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 2013

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FOREWORD

The construction readiness review (CORR) mission for nuclear power plant projects has been established with the aim of conducting peer reviews of construction projects related to nuclear power plants.

Such a mission provides a detailed assessment of readiness for construction, construction progress, readiness for turnover, as well as recommendations for improvement.

Organizations in Member States, such as nuclear utilities, owners, regulators and technical support organizations, can benefit from such reviews.

A team of international experts with complementing specialities will conduct the CORR mission. The review is based on appropriate IAEA publications, such as IAEA Safety Standards Series Guides and IAEA Nuclear Energy Series publications, as well as on internationally recognized project and construction management guides. Mission findings are summarized in a mission report, which includes a list of recommendations, suggestions and identified good practices.

The review is not intended to be a regulatory inspection or an audit against international codes and standards. Rather, it is a peer review aimed at improving implementation processes and procedures through an exchange of technical experiences and practices at the working level. The mission is applicable at any stage of a nuclear power plant construction project, although two specific phases are targeted: (1) start of construction mission (Phase 1 mission) and (2) an in-progress mission (Phase 2 mission). Missions are initiated when official requests are submitted by Member States through the appropriate IAEA channels.

The IAEA officer responsible for this publication was J.H. Moore of the Division of Nuclear Power.

EDITORIAL NOTE

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1. INTRODUCTION

1.1. PURPOSE OF CONSTRUCTION READINESS REVIEW MISSION GUIDELINES

A *construction readiness review (CORR)* is an assessment of an NPP project's construction preparedness, based on *counterpart* requirements, interviews, analysis and observations. It can be held at various project stages. Specific review stages may be prior to start of major construction, major milestones, or as otherwise requested by the *counterpart*. The assessment includes a review of planning of major milestones, preparedness for subsequent phases, assessment of major risks and issues, and engineering and construction readiness.

These guidelines provide structure for a *CORR mission*. They are addressed principally to the *construction review team*, but also provide guidance to the mission *counterpart* in preparing for the mission. Publications referenced in these guidelines provide additional information.

These mission guidelines are designed to be applicable to both new construction and major refurbishments. *CORR missions* are desirable for new NPP construction projects (e.g. first-of-a-kind, first-in-a-country, first on a particular site etc.), and whenever a *counterpart* desires independent feedback on NPP project readiness to proceed to its construction phase. Subsequent projects (e.g. second or third unit, etc.) on a particular site constructed by an established project team might benefit from a *CORR mission* targeted at lessons learned from previous construction activities.

The guidelines are intended to assist *construction review team* and *counterpart* members in performing the review. They are not exhaustive and should not limit reviewer investigations, but rather should be considered as illustrative of typical requirements for successful construction projects for which such reviews are carried out. Reviewers will apply judgement and experience to decide what topics require more in-depth evaluation during the mission.

1.2. CONSTRUCTION READINESS REVIEW MISSION OBJECTIVES

CORR missions are comprehensive reviews directly addressing strategic and key elements associated with implementing NPP construction projects. They are conducted by a team of international experts with direct experience applicable to the areas of review. Judgements of compliance are made on the basis of IAEA publications (see references in this publication), and on the combined judgement of the international review team.

The review is neither a regulatory inspection nor is it an audit against national or international codes and standards. Rather, it is aimed at improving the implementation, procedures and practices being followed through an exchange of technical experience and practices (peer review).

Objectives of *Construction Readiness review missions* are to:

- Assess strategy, organization, leadership, management vision, goals, methods and processes;
- Identify project management, engineering, procurement, quality management, human resources, construction readiness, and construction completion assurance related issues or concerns related to the *project under review*;
- Identify *issues*, make observations, and identify *good practices* related to the *project under review*;

- Facilitate personal exchanges of experience.

To fulfil these objectives, the *CORR mission* aims to provide the *counterpart* with a mission report providing:

- The team's assessment of the state of construction readiness and processes related to the *project under review*;
- *Recommendations* and *suggestions* for improvement in areas where performance may appear to fall short of recognized international good practices;
- *Good practices* identified during the course of the review.

The process will provide *counterpart* experts, expert reviewers from Member States, and IAEA staff with opportunities to broaden their experience and knowledge. It will also provide key *counterpart* staff with an opportunity to discuss their practices with experts who have experience in the same field.

1.3. CONSTRUCTION READINESS REVIEW MISSION SCOPE

Construction Readiness review missions are focused on the *project under review*, and the *review basis and reference* documents agreed to be used. They address project construction readiness and associated aspects, unless there is a specific request from the *counterpart* to include additional items. Such additional items might include, (1) specific design issues and technologies (outside of design readiness), (2) project economic viability, (3) long term investment strategies related to the NPP fleet (4) portions of other IAEA review services, or others. Review missions typically do not discuss specific issues related to the choice of NPP provider, or specific contract terms and conditions.

Scope definition occurs during the mission's *preparatory phase* (see Section 2.2), and is based upon mutual agreement of the *construction readiness review team leader* and *counterpart*.

1.4. ORGANIZATION OF THIS DOCUMENT

Section 2 provides guidelines regarding overall *CORR mission* organization, from the preparatory phase to follow-up missions.

Section 3 provides guidelines regarding principles and techniques to be applied during the mission.

Appendix I provides suggested contents of an *advance information package* (AIP) to be prepared by the *counterpart*.

Appendix II provides a list of potential subjects for scope definition of a specific *CORR mission*. It is used as a discussion tool with the *counterpart*.

Appendix III provides a mission report template, including templates for *issue* sheets.

The above Appendixes are available in electronic form for preparation of specific mission reports by the *construction review team*.

2. ORGANIZATION OF THE CONSTRUCTION READINESS REVIEW MISSION

2.1. OVERVIEW OF THE CONSTRUCTION READINESS REVIEW (CORR) PROCESS

A *construction readiness review mission* is initiated based on a formal request through official IAEA channels from an organization of a Member State (e.g. nuclear utility, regulatory authority, technical support and design organization). Actions prior to this request are not the object of, and are not discussed in, this guideline.

A *construction readiness review mission* is typically performed at one or both of the NPP construction project phases shown in Table 1, with follow-ups as requested by the *counterpart*.

TABLE 1. TYPICAL CORR MISSION PHASES AND TIMING

Phase	Title	Description/Timing
1	Construction Readiness Review *Phase I Mission Review*	Prior to start of major construction activities (approx. 2 months prior). For new NPPs this would mean prior to first concrete pour.
2	Construction Progress. *Phase II Mission Review*	Done approx. at 30-50% construction stage (usually 2 months prior to first significant NPP system/area handover)

Construction review related activities are based upon:

- Documentation describing processes applicable to the *project under review* including, but not limited to, procedures and performance metrics in use or to be used during the construction phase, corrective action processes, and documentation demonstrating how they support the overall project;
- Interviews and discussions with *counterpart* staff and support organizations;
- Written procedures and methods associated with design, specification, procurement, warehousing, installation, verification, validation, and testing of the *project under review*;
- Written documentation related to qualification of personnel, as well as systems, structures, and components (SSCs) related to the *project under review*;
- Observations of planning, coordinating, and construction activities and associated oversight processes

The review focuses on performance in technical areas, related regulatory requirements, managerial aspects of policy implementation, control/coordination of related activities, continuous review and improvement of activities, as well as document control.

The principles and guidance for the CORR *mission* service are those outlined in IAEA publications and safety standards (see Refs [1] to [36]). In addition, other internationally accepted project management or construction guides or standards (e.g. PMBOK,

Construction Industry Institute PDRI, PRINCE2, GAPPS, INPO etc.; see Refs [37] to [102]) may also be considered at the *counterpart's* suggestion.

It is important to note that a CORR *mission* is a flexible service. The review areas, timing, and review depth, can be tailored according to a *counterpart's* request. *Counterparts* may request for example reviews at different times during the construction project, or a review towards the end of the construction project to assess completeness.

The *CORR* process is divided into three main phases, each with its own purpose and goals:

- Preparatory phase, which includes a formal meeting between IAEA staff members and *counterpart* staff, called the *preparatory meeting*;
- Review phase, which consists of a review mission;
- Follow-up phase, which may include an optional follow-up mission, which focuses on implementation of *recommendations* from the *review mission*.

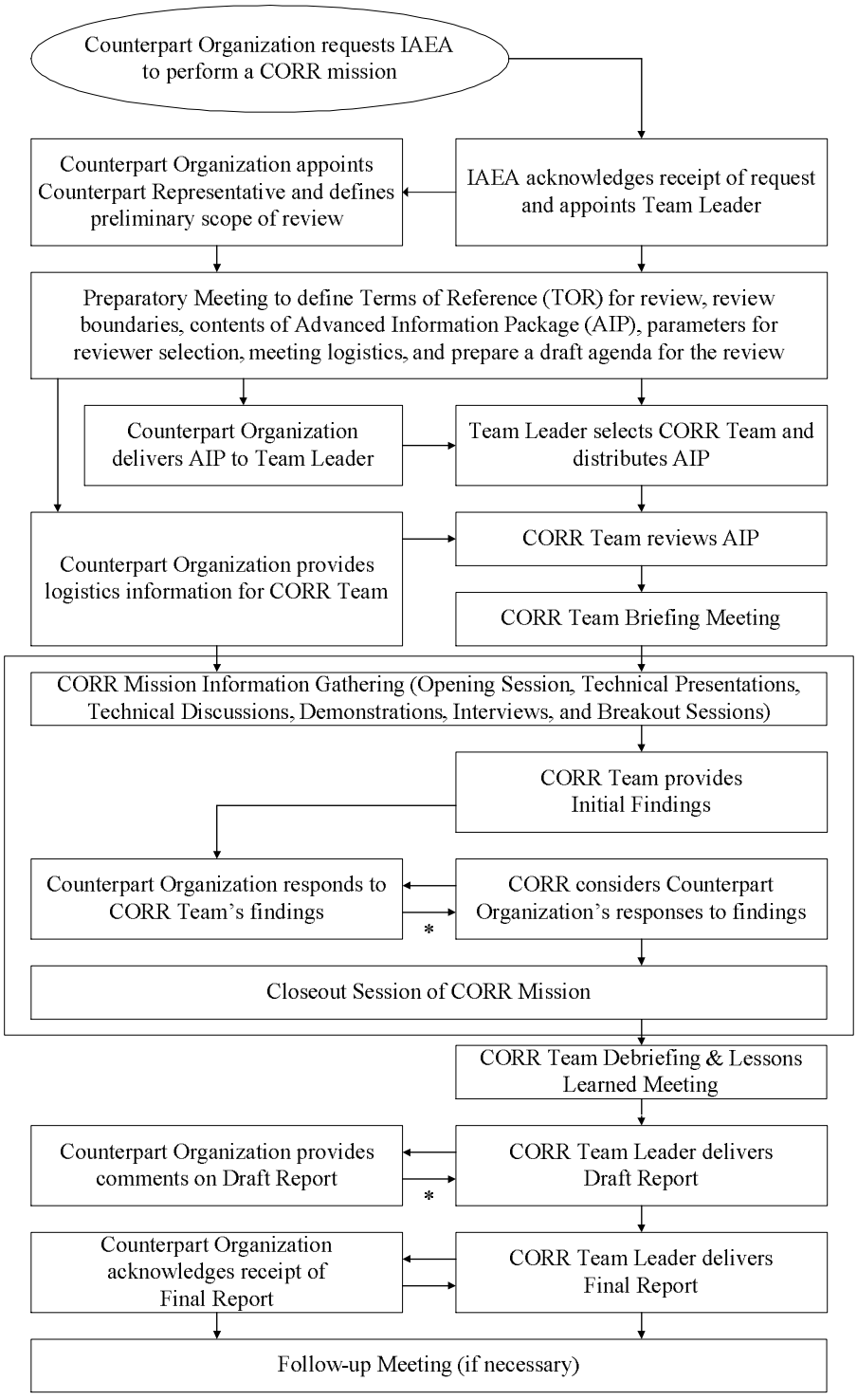
Figure 1 provides an overview of the various tasks associated with a CORR *mission*.

2.2. PREPARATORY PHASE AND PREPARATORY MEETING

Preparation is key for *CORR mission* success. The preparatory phase addresses the following topics (in approximate sequential order):

- Appointment of *construction review team leader*, and identification of *counterpart representative*;
- Clarification of mission objectives and scope;
- Selection of *construction review team*;
- Establishment of *review mission agenda;*
- Provision of advance documents to the *construction review team*, i.e. terms of reference and *advance information package*;
- Establishment of a *code of conduct* for adherence by the *construction review team*.
- Resolution of logistics issues (e.g. transportation, lodging, insurance, funding, fees, and meeting rooms) for the review mission;
- Establishment and signature of non-disclosure agreements;
- Establishment of measures to be taken to address language barriers (i.e. translation of review materials and/or translation services during the review mission).

Preparation should begin no later than six months prior to the review mission. This enables each participant (from the *construction review team* and the *counterpart*) to plan for specific activities and to conduct necessary research and study prior to the review mission.



* Resolution of the findings and of the draft report may require multiple cycles (target is a single review cycle).

FIG. 1. Overview of a Construction Readiness Review mission.

2.2.1. Appointment of construction review team leader

After a mission request for a *CORR mission* from a Member State has been received by the IAEA, the IAEA designates a staff member as *construction review team leader*. The *counterpart* nominates a contact person, the *counterpart representative*, with whom the *construction review team leader* interfaces directly. All subsequent activities of the *CORR mission* will be under the leadership and responsibility of these two individuals.

The *construction review team leader* is responsible for preparatory activities, acts as an official liaison with the *counterpart* organization, chairs the *review mission*, prepares and issues the mission report, and is responsible for follow-up activities. During the review mission, the *construction review team leader* may delegate part of these tasks to a deputy, so that he or she can concentrate on more strategic issues. In such cases, the delegation should be made clear to all concerned participants.

2.2.2. Objectives and scope of specific construction readiness review mission

Exact objectives and scope of the specific *CORR mission* need to be stated precisely, based on the *construction readiness review mission* request. These should clearly identify:

- Background information on why the *CORR mission* was requested and expectations;
- Project to be reviewed (designated as the *project under review*), including its scope of work, boundaries, and interfaces;
- Project activities, functions, features to be assessed by the review, and those (if any) to be specifically excluded;
- *Review basis and reference* documents against which the *project under review* will be assessed. These should usually include any relevant IAEA Safety Guides, IAEA Nuclear Energy Series Reports, and IAEA Technical Reports applicable to construction and turnover. Other documents describing recognised international good practices, such internationally accepted project management documents (e.g. PMBOK, Construction Industry Institute PDRI, PRINCE2, GAPPS etc.) may be considered.

  Potential IAEA references related to the review are listed as Refs [1] to [36]. Although not the focus of this review, other published IAEA documents may also be referred to if applicable.

  Potential internationally recognized project management documents are listed as Refs [37] to [102]. They may, with *counterpart* agreement, be utilized by the *construction review team* in evaluating readiness of the *project under review*, identifying potential best practices, or simply as background material. Identification of such documents does not represent official IAEA endorsement or a complete list of publications from the indicated organization. Other documents from other similar organizations may also be utilized in the review.

The *construction review team* is composed of the *construction review team leader* and typically eight to ten additional team members. A deputy team leader may be appointed if necessary. Typical team composition includes a majority of external senior experts and one or two IAEA staff members (the team leader and deputy team leader if applicable).

Composition and size of the team will usually depend on many factors, such as:

- Competencies needed for the review. Competencies may be identified based on project characteristics (size, complexity etc.), on scope of work to be assessed, and on the *review basis and reference*;
- Estimated volume of work for the review mission, based on a breakdown of work to be performed during the review mission into well-defined *technical sessions*;
- Need to represent a wide scope of international practices. Team members should represent a variety of national approaches to project management processes. Team members should have, in addition to their particular area of expertise, knowledge of some other national approaches and other relevant areas. Coupling this knowledge with IAEA safety standards and other guidance publications allows good international practices to be identified;
- Need to overcome possible language and/or cultural barriers. In such cases, a team member familiar with the language and culture of the *counterpart* organization may be of great benefit;
- Need to avoid conflicts of interest with the *counterpart*. Selection of team members should consider their impartiality and relationship of team members' organizations to those of the *counterpart*. In particular, reviewers from the *counterpart* and dependent organizations (e.g. suppliers) should not be included in the *construction review team* without *counterpart* agreement. Also, reviewers from organizations considered to be competitors of the *counterpart's* organization or of major project suppliers should be excluded from the review team unless specific *counterpart* agreement is obtained;
- Possible need of security vetting. Access to certain facilities and information may require security vetting to be carried out on the *construction review team*. Responsibility for identifying vetting requirements that allow such access to be granted lies with the *counterpart*. Responsibility for providing information to satisfy these requirements lies with the *construction review team leader* and team members. The *counterpart* is subsequently responsible for handling the information provided and to ensure that the vetting process is completed prior to the review mission.

Selection of team members is the responsibility of the *construction review team leader*; however the team member list (with brief biographies) will be submitted to the *counterpart representative* for acceptance.

Construction review team members are responsible for mission preparation by studying relevant information provided by the *counterpart* in the *advance information package*, preparing plans of their review, and formulating questions and comments prior to commencing the mission.

If the *construction review team leader* and *counterpart* agree, observers can join the review team. Normally an observer is either an IAEA staff member who needs to be trained for subsequent *construction readiness review missions*, or a person from an organization that has an upcoming *construction readiness review mission*. Observers may assist the *construction review team* during the review mission. They are subject to the same rules and constraints (e.g. *code of conduct*, non-disclosure agreement) as *construction review team* members.

Construction review team members should provide feedback on IAEA publications utilized during the mission (e.g. which parts need to be updated, what issues could not be referenced to standards), plus suggestions to help improve future missions.

2.2.3. Review mission agenda

The review mission should be conducted following a *review mission agenda*. The agenda would typically make provision for and plan different types of work sessions:

- *Briefing meeting* for the *construction review team*, to make sure that all team members have the required background information.
- A plenary *opening session*, where the *construction review team* and the *counterpart* introduce each other and present the objectives and scope of the construction review mission.
- Several *technical sessions*, where the *construction review team* and the *counterpart* discuss technical aspects of the *project under review*. Different sub-types of *technical sessions* may be identified, such as:
  - *Technical presentations*, where the *counterpart* presents aspects of the project to the *construction review team*;
  - *Technical visits* that allow the *construction review team* to collect *facts* that may be otherwise difficult to determine from documentation and/or presentations. This activity includes one on one or group interviews with applicable project personnel;
  - *Targeted reviews* that allow the *construction review team* to study selected topics in more detail.
- *Construction review team* meetings (involving only *construction review team* members) allow team members to share information and understanding, to compare points of view, and to reach a team consensus on questions and *findings*.
- A plenary *closeout session*, where the *construction review team* presents *findings*, the *counterpart* expresses their point of view, and the *construction review team* adjusts its *findings* as appropriate.
- *Debriefing meeting* (involving only *construction review team* members), where the team develops a quasi-final state for the mission report, and members provide feedback and lessons learned to the team leader to help improve future missions.

Section 2.3 provides specific guidelines for each of these work session types. The following are suggestions pertaining to the review *mission agenda*:

- Development and modification of the *review mission agenda* needs close cooperation between, and the agreement of, the *construction review team leader* and the *counterpart representative*, as both sides will need to do extensive preparation prior to the mission;
- *Technical sessions* may be a *plenary session* (i.e. involving the complete c*onstruction review team*) or a *breakout session* (i.e. involving only a part of the c*onstruction review team*). *Plenary sessions* facilitate sharing of information within the team. *Breakout sessions* optimise the use of team resources when many subjects need to be covered, or when team members have very different and exclusive competencies. It is usually the responsibility of the *construction review team leader* to decide which subjects will need to be covered by *plenary sessions*, and which by *breakout sessions*;
- Enough time needs to be devoted to *construction review team meetings*, so that f*inding*s and conclusions are those of the team, and not only of individual team members. Such meetings should be held at the end of each day. They may be short on the first days, but as the review mission gets closer to the c*loseout session*, more time is necessary to harmonise viewpoints and finalise the *finding*s list;

- Enough time should be given to the *counterpart* to provide adequate answers, however the *counterpart* should anticipate that issues will arise and should have adequate resources and competencies available to respond rapidly.

2.2.4. Terms of reference

During the preparatory phase, the *construction review team leader* should prepare draft terms of reference for the *CORR mission*. This should be discussed with the *counterpart* during the preparatory meeting. The terms of reference should contain the following items:

- Background information;
- Objectives and scope of the review;
- Date and place for the review;
- Names and resumes of *construction review team leader* and *counterpart representative*;
- Names and resumes of *construction review team* members;
- *Review basis and reference*. This includes selection of specific codes, guides and standards to be applied during the review mission (defined by *counterpart*);
- Review subjects (i.e. *project under review* and targeted areas);
- Work scope of each *construction review team* member (if applicable);
- Provisional *review mission agenda*;
- Reporting structure;
- Contents of *advance information package* (AIP).

2.2.5. Advance information package

The *advance information package* is the set of documents that the *counterpart* makes available to *construction review team* members during the preparatory phase. It should, as a minimum, contain programmatic type information for each reviewed area and should be written in English. Suggested contents of an AIP are given in Appendix I.

The *counterpart* should start preparing the AIP early enough to be submitted at least two months prior to the review mission in electronic format. Hard copies should be available at the mission location for *construction review team* member reference.

The *construction review team leader* should supplement the AIP with additional resources and administrative information, such as electronic templates for the mission report, *issue* sheet template, and a *code of conduct* for the review mission.

2.2.6. Code of conduct

The *counterpart* should have a set of procedures covering expectations for *code of conduct* appropriate to the facilities being visited by the *construction review team*. Compliance with these procedures must be adhered to in order to ensure that the review is carried out appropriately. The *counterpart* is responsible to provide these procedures as part of the AIP to ensure *construction review team* member understanding and agreement prior to the initial review visit.

Types of procedures likely to apply are as follows:

- Handling of sensitive information;
- Facility health and safety rules, including those for radiation protection and emergency response;
- Policies, procedures, and training requirements for working at the facility.

In addition, there may be circumstances where IAEA expectations for code of conduct are applicable. In this case these must be discussed and agreed with *construction review team* members before starting the review mission.

The *code of conduct* may also include rules or suggestions pertaining to cultural codes of the *counterpart*, and to cooperation within the *construction review team*.

2.2.7. Logistics

Finalization of logistical support for the review mission should be completed well in advance and documented by the *counterpart representative*. This includes, but may be not limited to:

- Accommodation for the *construction review team* during the review mission;
- Transportation of *construction review team* members to and from this location and *counterpart* facilities;
- Meeting facilities during the review mission, including for internal *construction review team* meetings (at site and potentially at accommodation location);
- Availability of necessary *counterpart* staff and documentation during *technical sessions*;
- Contact information so that colleagues and family of *construction review team* members can contact them during the mission;
- Contingency plans and mobile phone contact numbers to be used in the event that any team member encounters delays or other problems during travel;
- Arrangements for reimbursement of *construction review team* members and/or any review mission fee.

2.2.8. Non-disclosure agreements

Portions of review material may be deemed as proprietary information, and contents of the mission report itself will be proprietary information. Members of the *construction review team* are expected to sign non-disclosure agreements prior to mission start and to manage proprietary information in an appropriate manner.

The *counterpart* needs to provide reasonable access to proprietary material prior to and during the review process. It is expected that after the *closeout session*, any printed proprietary information provided to the *construction review team* is returned to the *counterpart* (or appropriately disposed of), and any electronic files associated with the review on team members' electronic media are deleted after the draft copy of the mission report has been submitted to the *counterpart*. Only the *construction review team leader* retains a master copy for future reference.

2.2.9. Language barriers

The working language of a *construction readiness review mission* is English. Where required, the *counterpart* is expected to provide translation services during the mission. In cases where original project documentation is in a language other than English, a summary of its contents can be provided to the *construction review team* as part of presentations or discussions. For key documents, the *construction review team* may need a translation of the full table of contents, and even a translation of selected (significant) portions of the document. It is preferred that at least one *construction review team* member be a native speaker of the working language of the *project under review*.

2.2.10. Contact with construction review team during preparation

To ensure good communications between *construction review team* members, regular contact should be maintained with the *construction review team leader*. This will help to minimise the risk that the team is not fully mobilised at the start of the review, and avoid the need to initiate contingency plans.

2.2.11. Preparatory meeting

The preparatory meeting's purpose is to facilitate preparation of the review mission, and to minimise risks of misunderstanding between the *construction review team leader* and *counterpart representative*. This may be a two or three day meeting at the location of the *CORR mission* where the *construction review team leader* and possibly some team members meet face to face the *counterpart representative* and management in order to:

- Finalise objectives and scope of the *CORR mission*;
- Resolve any difficulties related to the mission;
- Agree on a provisional *review mission agenda;*
- Resolve issues related to logistics, security, need for translation, *code of conduct*, end of meeting reports, press releases, political meetings, etc.

2.2.12. Counterpart preparation

The *counterpart* should ensure that key project personnel are briefed on the scope and purpose of the review mission, the need for cooperation with *construction review team* members, and are familiar with applicable reference material pertinent to the areas under evaluation.

2.3. REVIEW MISSION

2.3.1. General guidelines for review mission

The following guidelines pertain to the review mission:

- It is essential for review success to set and maintain a cooperative, professional, and courteous atmosphere, both within the *construction review team* and between the *construction review team* and *counterpart*;
- The review mission should be conducted following the *review mission agenda*. However, flexibility is necessary to take into account observed *finding*s (which could

require specific investigation) and contingencies inherent in any activity involving a large number of contributors;

- Throughout the mission, damaging misunderstandings could arise from different interpretations of technical terms, abbreviations and expressions. It is thus necessary for both the *construction review team* and the *counterpart* to maintain a glossary explicitly defining terms, abbreviations, and expressions that could be misunderstood;
- Examination of documents provided by the *counterpart* must be performed under procedural requirements of the *counterpart*. Agreement should be obtained from the *counterpart* to take documentation away from the facility if required as part of the review. Documentation taken away from the facility should be handled as required by the *counterpart*;
- Frequent communication between the *construction review team leader* and the *counterpart representative* and management is necessary, e.g. to agree on agenda modifications, to clarify misunderstandings etc. In particular, the *counterpart representative* should have daily meetings with the *construction review team* and should be invited to advise the *construction review team* when information may not be complete or correct. In cases of misunderstanding or where issues need further clarification, the *counterpart representative* should direct the *construction review team* to the responsible or knowledgeable *counterpart* staff, vendor, or contractor who can provide clarification.

2.3.2. Briefing meeting/conference call

The objective of the *briefing meeting* or conference call is to ensure the *construction review team* has all necessary information regarding:

- Objectives, scope and background of the review and the review mission from the IAEA standpoint; this includes a clear identification of the *project under review* and of the *review basis and reference* documents;
- *Code of conduct* to be applied by the *construction review* team members during the review mission;
- Name, background, domains of competence and role of each *construction review team* member. In particular, the *construction review team leader* may choose to delegate specific parts of their role to designated team members;
- *Review mission agenda*;
- Review and discussion of issues or questions rose from review of the AIP, and potential areas for further investigation during the mission. An initial construction review questions list resulting from this discussion should be prepared and submitted to the *counterpart*;
- Logistics for review mission.

The *briefing meeting*/conference call is an opportunity to finalise any pending formalities, such as signing of the non-disclosure agreement forms, or addressing last minute changes.

Suggestions:

- Meeting/conference call may be one week preceding the review mission or earlier, and typically lasts one to two hours. Additional meetings/conference calls may be necessary;
- Meeting is normally chaired by the *construction review team leader*;

- Meeting should involve all *construction review team* members as far as practical;
- *Construction review team leader* should ensure each *construction review team* member has a copy of terms of reference and is fully aware of its contents;
- In order to ensure that a quasi-final state of the mission report can be reached at the *debriefing meeting*, responsibilities within the team for different sections of the mission report should be allocated and agreed upon during the briefing;
- *Counterpart representative* may participate in the meeting/conference call as an observer, or to convey information that would be difficult or awkward to address in the plenary *opening session*.

2.3.3. Opening session

The *opening session's* objective is to ensure all review mission participants (*construction review team* and *counterpart*) have necessary information regarding:

- Objectives, scope and background of the review mission, from both *counterpart* and IAEA standpoints;
- *Counterpart's* organization and background;
- Precise description of the *project under review*, including its scope of work and boundaries;
- *Review basis and reference*;
- Name, background and role of each participant;
- *Review mission agenda*;
- Review mission logistics;
- Constraints pertaining to confidentiality of information, security and safety of participants.

The *opening session* may also be the opportunity for a:

- Welcome address and opening remarks by the *counterpart;*
- Presentation of initial questions from the *construction review team* based on review of the AIP.

Suggestions:

- Session is typically held at the beginning of the review mission (excluding the *briefing meeting*);
- Session is normally chaired by the *construction review team leader;*
- All participants in the review should be involved as far as practical in the *briefing meeting*;
- *Construction review team* members should describe their area of expertise and experience;
- *Counterpart* should introduce their staff in a similar fashion; *construction review team* members should note *counterpart* staff members corresponding to their review area(s);
- *Counterpart* should provide a project overview, showing overall organization structure, history, schedule, current status, and major issues being dealt with;
- An AIP, summarising topics that will be presented and discussed during the review, should have been provided electronically in advance by the *counterpart*. At this point each *construction review team* member should be given access to a hard copy of the package for use during the review unless otherwise agreed to;

- *Construction review team* members should make notes during the overview, but leave detailed questioning for the *technical sessions*.

2.3.4. Technical sessions

The *technical sessions'* objective is to allow for more in depth study of an issue with the *counterpart*. They may include simple one-on-one or small group discussions (*breakout sessions*), *technical presentations, technical visit*s, or may be part of a specific *targeted review.*

Suggestions:

- *Construction review team* and *counterpart* should each designate a co-chair for a session; the role of the co-chairs is to keep the session focused, maintain session schedule, and ensure discussions remain courteous and cooperative;
- Focus should remain on session objectives, i.e. compliance to elements of the r*eview basis and reference*;
- At end of the session, a discussion with the *counterpart* should take place to clarify any remaining questions from the c*onstruction review team*. A list of pending questions that need more time to be answered (i.e. requests for clarification or more information) should be established and agreed by the co-chairs, and a tentative time for resolution should be set;
- During the session, participating *construction review team* members should note possible *issues* and g*ood practices*;
- In case of a *breakout session*, participating *construction review team* members should prepare a brief report to inform other team members.

2.3.5. Technical presentations

In a *technical presentation*, the *counterpart* has the lead role and presents a specific aspect of the *project under review*, at a level of detail that allows the *construction review team* to assess project compliance with the *review basis and reference*. A typical *technical presentation* has three main phases:

- Introductory phase: aspect(s) of the project to be discussed, and pertinent elements of the *review basis and reference*, are clearly identified;
- Presentation phase: *counterpart* presents necessary information, either via presentation slides or in written documentation;
- Discussion phase: *construction review team* asks for clarification or additional details, and *counterpart* provides prompt answers where possible.

Suggestions:

- Whether interruptions can be made during the presentations should be agreed upon at the beginning of the session by the co-chairs, but interruptions should not prevent presenters from completing their presentation;
- Presentation slides, if any, should be included in the AIP or otherwise provided to *construction review team* members.

2.3.6. Technical visits

Technical visits are usually optional but are very desirable. They may help the *construction review team* to obtain information that would be difficult to gather from documentation or *technical presentations*. Visits may be performed at various locations, such as construction sites, prefabrication facilities, warehouses, staging areas, calibration facilities, planning areas, engineering buildings, etc.

Technical visits are usually less structured, and their objectives more open, than *technical presentations* and *targeted reviews*, but a few general suggestions apply:

- *Technical visits* are usually proposed by the *counterpart*, but the *construction review team leader* may make suggestions, based on review objectives and scope;
- *Technical visits* usually begin with a short *counterpart* presentation of what is to be seen, what specific rules and constraints may apply, who accompanying *counterpart* staff are, and their areas of responsibility;
- Participating *construction review team* members may decide prior to the visit or at the end of the *counterpart's* presentation to allocate different aspects to be examined during the visit to specific team members;
- "Surprising" observations during the visit should be shared with participating *construction review team* members, so that possible implications may be assessed more thoroughly.

2.3.7. Targeted reviews

A *targeted review* follows a specific subject through the *counterpart's* documentation at a deep level of detail. Topics that are the object of a *targeted review* are usually selected because of their importance with respect to review objectives, or because they are representative of large parts of the project.

A *targeted review* is usually under the leadership of the *construction review team*. It is typically composed of three phases:

- Definition phase: *construction review team* explains review session subject and objectives;
- Presentation phase: *counterpart* explains how the subject is handled in the *project under review,* in related work processes, or in documentation;
- "Thread analysis" phase: *construction review team* interviews and examines specific documents or parts of documents and further questions the *counterpart*. Where a complete analysis cannot be completed during the mission then *findings* and follow-up *recommendations* should be provided in the mission report.

Examples of such reviews might include:

- Project front end planning processes and adequacy;
- Review of measures in place to control material and related non-conformances;
- Engineering completeness/readiness prior to construction;
- Review of processes in place to plan, manage, and report on project activities;
- Construction progress reporting methodology;
- Construction turnover/handover processes;

- Quality surveillance processes and adequacy;
- Review of training, experience and qualification of project staff;
- Safety and human performance programmes and/or practices;
- Material receipt, storage, control and logistics;
- Status of *issues* or *recommendations* from previous IAEA missions or project stages.

Suggestions:

- List of *targeted reviews* and their scopes are usually determined by the *construction review team leader,* and agreed upon by the *counterpart representative*. Though it is preferable to plan them ahead of the review mission, some may be decided during the mission based on questions raised. Enough preparation time should be given to the *counterpart* so that they can make staff and documentation available;
- *Construction review team* members should dig deep enough to get a clear understanding of the subject, but should also guard against wasting time on less important technical details.

2.3.8. Construction review team meeting

These meetings involve only *construction review team* members. The objective is for team members to share information and understanding, compare points of view, maintain a list of questions and clarification items, and reach a consensus on *finding*s. Another essential objective is to develop the mission report.

Suggestions:

- One session should be held at the end of each day, while impressions and information are still fresh;
- Meetings are particularly necessary in the case of *breakout sessions*, so that the whole team shares information;
- During the first few days, meetings will usually tend to be short (typically one hour or less), but as the review mission nears closeout, more time will be necessary to merge individual *finding*s into a consistent, well-organised list;
- Progress regarding the mission report should be checked at each meeting. In order to ensure that a quasi-final state of the report can be reached at the *debriefing meeting*, relevant information should be inserted in the draft report as soon as it is available.

2.3.9. Closeout session

During the *closeout session* the *construction review team* presents their *findings* (*issues*, *recommendations*, *suggestions* and *good practices*) to the *counterpart*, and the *counterpart* provides feedback on the *findings*.

The meeting is an opportunity for the *construction review team* to take leave of *counterpart* staff and consider follow-up actions.

Suggestions:

- Session is typically held at the end of the review mission (excluding the *debriefing meeting*);

- Session is normally chaired by the *construction review team leader*;
- Session should involve all participants in the review, as far as practical;
- A written list of *finding*s should be provided to the *counterpart* prior to the session (typically, the day before), so that the *counterpart* has time to prepare a provisional response or feedback;
- Any adjustment from written *finding*s should be made clear during the session, in such a way that the *counterpart* is not "surprised" by final *finding*s.

2.3.10. Debriefing meeting/conference call

The *debriefing meeting* or conference call is for the *construction review team* to develop a quasi-final mission report, and to allocate any remaining work.

Suggestions:

- Meeting is typically held the day following the review mission, and typically lasts a few hours;
- Meeting is chaired by the *construction review team leader*;
- Meeting should involve all *construction review team* members, as far as practical;
- The IAEA line manager of the *construction review team leader* should be invited to participate;
- Responsibilities within the team for finalization of the mission report should be allocated and agreed upon;
- Lessons learned and suggestions from *construction review team* members for future missions should be documented.

2.4. FOLLOW-UP MISSION

The objective of a follow-up mission is to assess progress made in resolution of *issues* identified, and in particular in the implementation of *recommendations* and possibly of *suggestions*. This follow–up mission is at the discretion of the *counterpart*, and may be combined with a Phase 2 *CORR mission* if desired (where the follow-up is to a Phase 1 mission).

General guidelines:

- Decision, scope and timing are based on a mutual agreement between the *construction review team leader* and *counterpart;*
- Follow-up mission team should be composed of the team leader and preferably one or more members of the original review team;
- Should be performed typically 12 to 18 months after the main mission;
- Should last typically three days, depending on volume and complexity of *issues*;
- Should have a preparation phase similar to the main review mission. *Counterpart* sends in advance to IAEA all *issue* sheets from the main mission, having updated the recent status of *issues*, indicating also whether or not they believe the *issue* closed;
- Guidelines for the main review mission also apply.

2.5. REPORTING AND DOCUMENTING

2.5.1. Mission report

The mission report is the main deliverable of the *construction review team*. It presents the background, objective and scope of the mission, the *project under review*, the *review basis and reference*, and *finding*s made by the team during the review. A suggested report format is provided in Appendix III of this document.

Findings may be classified into two categories: *issues* and *good practices*, and are discussed in more details in the following sections. Figure 2 provides an overview of how mission *finding*s will be resolved and documented in the mission report.

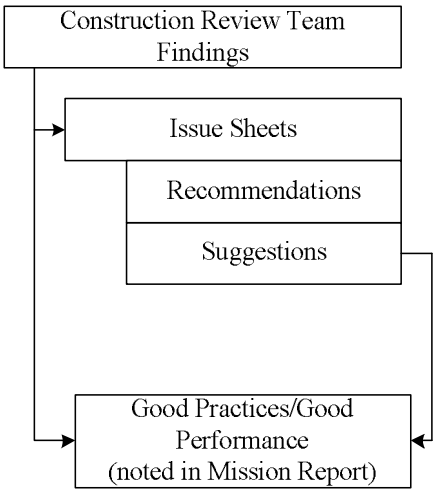


FIG. 2. Resolution of Mission Findings.

The *counterpart* will have an opportunity to comment on the draft report and will acknowledge receipt of the final report (Figure 1).

2.5.2. Issues and issue sheets

An *issue* is an identified concern or an area of improvement, which has been identified on the basis of documents listed in the *review basis and reference* and/or internationally recognized good practices in the subject area. Each *issue* is presented in an *issue* sheet *w*hich provides the following:

1. *Issue* identification, with *issue* number and title, mission name, reviewed area;
2. *Issue* clarification, with description of the *fundamental overall problem*, and the basis for the *issue* (observations and relevant documents);
3. Assessment by *construction review team*, with *facts*, consequences, *recommendations*/*suggestions*, and documents reviewed;
4. *Counterpart*'s actions taken after mission and prior to follow-up assessment;
5. Follow-up assessment by *construction review team*, with possibly new *facts*, and documents reviewed, and an assessment of the *resolution degree*.

An *issue* sheet template is given in Annex III of the mission report template (Appendix III of this document).

2.5.2.1. Sub-Section 3.3 of Issue Sheet: Recommendations and suggestions

Recommendations and suggestions are numbered in sequential order for further reference. Reviewed documents (corresponding specifically to the *issue* under consideration) are also listed.

As much as possible, each *recommendation* and *suggestion* should be referenced to the relevant requirement/recommendation of respective *review basis and reference* documents. *Recommendations* and *suggestions* may also be based on good practices or lessons learned from other international NPP projects.

2.5.2.2. Sub-Section 5 of Issue Sheet: Resolution degree and status of issue

The status of an *issue* is assessed and a respective *resolution degree* is assigned to reflect the judgment of the IAEA review team. The degree is either "withdrawn", "insufficient progress to date", "satisfactory progress to date", or "issue resolved" as indicated in the *issue* sheet template.

2.5.3. Good practices and good performances

Good practices and *good performances* observed should be documented in the text of the report. It should be confirmed that *good practices* are:

- Novel;
- Have proven benefits;
- Can be used on other projects; and
- Do not contradict an *issue*.

3. REVIEW PRINCIPLES

The *CORR mission* is intended to conduct a review of a major NPP construction project, such as a new build or refurbishment, to improve project performance. The mission is based on appropriate IAEA documents, such as the Safety Guides and the Nuclear Energy Series Reports(Refs [1] to [36]). In addition, other internationally accepted project management documents (e.g. PMBOK, Construction Industry Institute PDRI, PRINCE2, GAPPS etc.; see Refs [37] to [102]) will also be considered with *counterpart* concurrence.

The main documents from an IAEA perspective related to construction project management are IAEA Nuclear Energy Series documents Project Management in Nuclear Power Plant Construction: Guidelines and Experience NP-T-2.7 [16], and Construction Technologies for Nuclear Power Plants NP-T-2.5 [17].

3.1. REVIEW TECHNIQUES

Information utilized for the review should be based on observations, interviews, document reviews, and site walk downs.

The *construction review team* uses five steps to acquire the information needed to develop their *recommendations/suggestions*. The five steps are:

1. Review of written material and/or presentations;
2. Discussion and interviews;
3. Direct observation of programme implementation and project status;
4. Discussions among the review team;
5. Discussion of evaluations/tentative conclusions with *counterpart*.

3.1.1. Use of review techniques

The use of review techniques mentioned above should be planned in advance. Arrangements should be made with the *counterpart* as to how to perform discussions, interviews, and observations.

The IAEA review team has meetings in which experts present their *finding*s, summarize concerns, and discuss actual *issues*. This allows other team members to contribute their views, further strengthening the experience base of the evaluation. It is important that each expert comes prepared to make a concise statement of *finding*s, in order to allow all review areas to be discussed at the same meeting. These meetings will determine those *issues* to be presented to the *counterpart* for consideration by the *counterpart*'s organization. A template for the *issue* sheets is shown in Annex III of the mission report template (Appendix III of this document).

Formulation of *recommendations* and *suggestions* should be based on identified *issues*.

Good practices and *good performances* discovered during the review process that should be documented for the benefit of other Member States are described in the text of the mission report.

Based upon discussions and observations, reviewers can, if necessary, modify their preliminary view. Multiple cycles of document review, discussions, interviews, and observations may be required to clarify and resolve complex *issues* and/or *finding*s.

3.1.2. Review of written material

Reviewers should use the AIP in both the preparatory and implementation phases of the *CORR mission.*

Other than the AIP, the *construction review team* may gain access or request more detailed documentation during the mission. This is in support of a deeper investigation of more complex topics. Such documentation may include:

- Project metrics/reporting packages;
- Engineering metrics/reporting packages;
- Construction metrics/reporting packages (including safety metrics);
- Detailed procedures and other project governance;
- Contracts, legal documents;
- Regulatory submissions;
- Preliminary or final safety analysis report ;
- Equipment/material history dockets;
- Engineering modification information (modification packages, modification processes etc.);
- Work execution packages (released to trades for installation);
- Quality surveillance packages;
- Project charters, scope documents, work breakdown structures, explanation of how work is planned to be divided between organizations etc.;
- Risk management plans;
- Training and qualification records;
- Description of pertinent events relating to the construction project and corrective actions ;
- Databases and information repositories associated with the project:
    - Engineering/plant configuration databases ;
    - Calibration databases;
    - Work management databases;
    - Project schedules.

Appendix II of this document provides a broad range of topics that the *construction review team* should consider during the CORR mission. It should be noted however that the review mission scope will dictate which portions of the Appendix are relevant (and within the scope of the review mission).

3.1.3. Presentations, discussion and interviews

The *construction review team* will conduct discussions/interviews with the *counterpart* with the aim to:

- Provide additional information not covered by the AIP;
- Answer questions, and satisfy concerns arising out of the documentation review;

- Obtain an in-depth understanding of :
  - Important project characteristics;
  - Associated work procedures and activities;
  - Form a joint judgment on *findings*.

These discussions/interviews are also used to provide an opportunity for exchanging important information between *construction review team* members and their counterparts. These interviews provide opportunities for individuals to listen and share experiences, and not be an interrogation by team members. Properly conducted, these discussions/interviews are possibly the most important part of the *CORR mission*. Use precise questions that call for specific or exact answers where possible, and attempt to obtain corroboration from multiple sources of key *facts* or details.

Presentations by *counterparts* (both formal and informal) can be used as a means of obtaining further information and to fill in information gaps identified as a result of the review of the AIP.

Technical visits may be held where possible to provide the review team with a deeper understanding of the project. This may include demonstrations with mock-up or prototype hardware/systems or simulators.

3.1.4. Direct observation of performance, status and activities

Direct observation of activities related to the *project under review* means on-site observation of:

- Implementation of procedures and programmes related to the project, such as:
  - Project approval and oversight meetings;
  - Field construction and/or check/test/calibration activities;
  - Warehouse incoming material inspections ;
  - Project status/planning meetings;
  - Pre-job and post job briefings;
  - Constructability reviews;
  - Engineering review meetings;
  - Safety inspections;
  - Management meetings;
- Where appropriate, physical conditions related to the selected project within the scope of the review, such as:
  - General site walk-downs;
  - Specific sub-project field inspection(s).

From these observations, reviewers will form a position on:

- Quality of processes supporting the project;
- Staff level of commitment;
- Overall safety culture;
- Staff capability in terms of resources, technical knowledge and skills;
- Overall condition of facilities and project.

3.2. SOURCES OF INFORMATION

3.2.1. Background information

Background information will be required to achieve a common understanding. In particular, the following should form the basis of this common understanding:

- Position and role of the *counterpart* within the project;
- History of development and changes in the *project under review*;
- Previous assessments by other organizations (e.g. regulatory assessments, third party qualification, audits, etc.);
- Boundaries and constraints impacting the project.

3.2.2. Information provided by counterpart

Examples of information sources to be provided by the *counterpart* are:

- AIP;
- Written documentation as described in Section 3.1.2 above;
- Description of already identified problems areas based on a self-assessment by the *counterpart*; A pre-mission self-assessment could specifically be based on the subjects to be reviewed under this *CORR mission* (i.e. Appendix II Tables);

The scope of information sources should be defined and agreed in the terms of reference.

3.3. DEVELOPMENT OF FINDINGS

During the course of the review, the *construction review team* will hold internal consultation sessions (*construction review team* meetings) to develop a common set of *finding*s. The team will complete *issue* sheets and record *good practices*, update them as necessary after discussion with the *counterpart,* and modify them as required as the review progresses. The following should be noted for *issue* sheets:

- Emphasis should be given to reviewers' observations, with minimal description. Clear conclusions should be documented;
- Wherever possible, reference to IAEA or other reference documents should be provided;
- Language should be clear, concise, objective and impersonal;
- Short, direct sentences are preferred;
- *Issues* should be defined in terms of a *fundamental overall problem* that leads to or can have a significant consequence for the *project under review*;
- Official names should be used to designate organizational units, positions and systems;
- Abbreviations or acronyms shall be introduced upon their first use and compiled in a list;
- Sheets should be written in English.

Templates for *issue* sheets are provided in Annex III of the mission report template (in Appendix III of this document).

3.4. WORKING WITH COUNTERPART

Besides interviews and meetings with the *counterpart* as described in *section 3.1*, work with the *counterpart* on site involves the following activities:

- *Opening session*;
- Regular meetings (meeting with the *counterpart*, summary team meetings, etc.); and
- *Closeout session*.

During the *opening session*, the organization and schedule of the mission should be presented. Focused working teams for specific areas may be established at that time. Working teams in each area consist of designated *construction review team* members, *counterpart* experts, and site technical support as required. It is advisable to have a short meeting each day of all participants to discuss organizational issues related to that day's activities.

Construction review team members will plan their schedules such that a primary and an alternate objective are always scheduled. A schedule of activities should be updated daily and discussed with the *counterpart*.

The *counterpart* should be informed on a regular basis of preliminary *findings* and r*ecommendations* being made by the review team. Whenever possible, agreement should be reached between the *construction review team* and the *counterpart* on the *facts* supporting each *findings* and *recommendation*, and on the *recommendation* itself. Representatives of the *counterpart* may attend the daily team meeting, as necessary.

The day before the *closeout session*, *construction review team* experts should deliver their section of the mission report. The *facts* as documented in these sections should have been reviewed and agreed with by the *counterpart*.

A formal *closeout session* is held the last day of the review mission. At this session, all *construction review team* members will provide short statements summarizing *finding*s, *recommendations* and *suggestions* related their reviewed area(s).

APPENDIX I: SUGGESTED CONTENT OF ADVANCED INFORMATION PACKAGE

I.1. General

- Site description;
- *Code of conduct* requirements (refer to Section 2.2.6);
- Review mission logistics (refer to Section 2.2.7);
- Any useful background information, such as:
  - Reason *construction readiness review mission* was requested;
  - Development history of the *project under review*, and roles of project organizations, including the *counterpart*. Include any major project delays and local infrastructure improvements related to the project.

I.2. Project

- Project description, including an overview of specific activities that are to be reviewed;
- Project organizational structure and staffing within given functional areas;
- Project execution plan;
- Key performance metrics;
- Risk management processes and reports;
- Current key licensing issues and commitments.

I.3. Management system

- Major management system processes (engineering, modifications, procurement, warehousing, on-site material logistics/movement, design, installation, quality surveillance, records management, calibration, configuration management, training and qualification, human resources, work planning, corrective action etc.) and applicable organization charts;
- Front end planning and project management processes;
- Engineering change control and non-conformance procedures;
- Description of key management system and engineering databases maintained by the project.

I.4. Engineering

- Engineering work management/planning processes/progress metrics.

I.5. Procurement and material readiness

- Procurement/materials management processes;
- Material status/availability.

I.6. Quality management and records

- Previous assessments by other organizations (e.g. regulatory assessments, third party qualification, audits etc.);
- Key corrective actions underway addressing known project problem areas;
- Records and controlled document management processes.

I.7. Human resources and training

- Staffing plans;
- Training and qualification governance.

I.8. Construction management

- Construction work management processes/planning processes/regular coordination meetings held;
- Safety programme and metrics.

I.9. Construction completion assurance

- Construction completion assurance/system turnover process.

I.10. Targeted reviews

- Background information supporting any requested targeted area reviews.

I.11. Technical presentations

- Planned presentation slides from *technical presentations* (if available).

APPENDIX II: SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION, AND ASSOCIATED REFERENCES

The objective of this appendix is to help the *construction review team leader* and the *counterpart* clarify the scope and the basis and reference of the *construction readiness review mission*. It suggests a list of subjects that could be considered and discussed. Where applicable, it identifies related IAEA documents, and possibly other documents, that could be used as reference for the mission. The list of subjects may also be used by the *construction review team leader* and the *counterpart* to determine which *technical sessions* should be included in the *construction readiness review mission* agenda.

Note the *construction review team leader* and *counterpart* are free to discuss any other subject that might be relevant to the mission.

The proposed subjects are organised into 9 main themes:

1. Project management;
2. Engineering readiness (engineering deliverables required to support construction);
3. Procurement/material/supply chain readiness (material available to support construction activities);
4. Quality management and records;
5. Human resources and training;
6. Construction readiness;
7. Construction installation completion assurance/system turnover process;
8. Targeted area reviews (including project delays and corrective actions);
9. Technical visits.

For each theme, a table (Tables II.1 to II.9) lists associated subjects. Each table has four columns:

- "ID" column associating a short identification for further reference;
- "Subject and description" column explaining what the subject is about;
- "Specific references" column suggesting some possible reference documents;
- "Conclusion" column for *construction review team leader* and *counterpart* to note decisions regarding the subject.

This appendix is available in editable electronic form. The *construction review team leader* and *counterpart* would typically:

- Adjust the "Specific references" column as applicable and necessary. Agreement should be made as to what if any international project management references would be formally included in the review;
- Note in the conclusion column whether the subject is to be addressed by the mission, and if so, add any necessary precision or alteration to the "Subject and description" column;
- Add new lines for any subject that needs addressing and is not in the tables.

II.1. Project management review

The project management review objective is to determine if overall project management processes being applied provide adequate assurance of a successful project outcome.

This evaluation should assess the status of processes surrounding project management for the applicable project. Proper scope control, front end planning, control metrics, risk management, and change control processes are important for any project's success. This evaluation will assess how the project management organization aligns with international best practises. NPP projects have many unique aspects (such as the need for extremely strong plant configuration management processes in place), but overall project management principles and best practises can be derived from many organizations and industries.

General reference documents

- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5];
- Risk Management, a Tool For Improving NPP Performance, IAEA TECDOC-1209 [28];
- Guidelines for Integrated Risk Assessment and Management in Large Industrial Areas, IAEA TECDOC-994 [29].

TABLE II.1. POSSIBLE PROJECT MANAGEMENT SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
PM1	**Scope control** • Project and Construction Scope well defined.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.2 [16].	
PM2	**Front end planning** • Well-defined front end planning process in effect (some aspects might include gated planning/approvals, integration of schedules, evaluating resources, readiness assessments, risk assessments, action items, and senior management oversight etc.).	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.2 [16]. Risk Management, a Tool For Improving NPP Performance, IAEA TECDOC-1209 [28]. Guidelines for Integrated Risk Assessment and Management in Large Industrial Areas, IAEA TECDOC-994 [29]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.12 to V.14 [5].	
PM3	**Project estimating** • Funding authorization estimates performed at appropriate level of detail; • Reasonable project cost and schedule contingency included in estimates.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.58 [5].	

Id.	Subject and description	Specific references	Conclusion
PM4	**Project scheduling** • Integrated, resourced, project schedule available for all project work, including engineering, procurement, manufacturing, fabrication, construction and start-up; • Milestones and critical path activities identified and widely known; • Schedule integrated and consistent with protect financing and payment schedules; • All resources identified in the schedule (constructor, design organization, suppliers, sub-contractors, including specialty staff etc.); • Schedule updated regularly with best available information. Schedule review meetings held regularly with key staff (constructor, design organization, suppliers, sub-contractors etc.); • Schedule allows for worker orientation, training and skills verification; • High-risk activities identified in schedule with additional oversight applied; • Project team confident in accuracy and validity of schedule; • Project contingency/float usage reasonable/not at a high rate.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.2 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Section 11.2 [17]. Risk Management, a Tool For Improving NPP Performance, IAEA TECDOC-1209 [28]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.12 to V.14 [5].	
PM5	**Project metrics** • Tracking and forecasting metrics available (e.g. key milestones defined, earned value definitions in place with tracking and forecasting mechanisms, cost oversight and project forecasting metrics in place); • Goals and results communicated to staff. Workforce involved with developing corrective measures; • Project milestones and commitments consistently being met.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.2 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Section 11.2 [17]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.49 (b), 5.55 [5].	

Id.	Subject and description	Specific references	Conclusion
PM6	**Stakeholder alignment** • Key stakeholders, including owner, contractor, unions, technical support organizations, and regulator personnel, aligned with respect to expectations and required interfaces; • Business goals, project objectives, priorities, incentive schemes, and critical success factors widely known and used to guide project decisions; • No evidence of unreasonable requests from project owner and/or upper management, No evidence of hidden agendas and/or poor relationships between project team members; • Realistic/truthful reporting of unfavourable circumstances occurring.	Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities, IAEA Nuclear Energy Series NG-T-1.4 [21]. Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.15 [5].	
PM7	**Maintenance of community engagement and support** • Process in place to address local community issues/concerns to extent practical; • Community outreach and public information programmes exist.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.2 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.38, 5.39 [5].	
PM8	**Roles and responsibilities** • Project organization, project execution plan in place with roles clearly defined and assigned. Organizational change control processes in place. Project communications protocols defined.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.2 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.38, 5.39, 5.40 to 5.47, 5.49, 5.51, 5.52, 5.53, 5.175, and V.2 to V.6 [5].	
PM9	**Project oversight** • Senior Owner and Third Party independent oversight processes in place with continual assessment of construction organization activities.	The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.59, 5.60, and 6.3 [5].	

Id.	Subject and description	Specific references	Conclusion
PM10	**Risk management** Risk management processes in place. Typical examples might include: • Actively managed risk registers available at project and sub-project levels; • Processes and staff in place to independently seek out project risks; • Risks regarding physical site known and minimized (geological, environmental, archaeological, buried services, etc.); • Risks regarding human/knowledge management known and minimized (experience of workforce, training, first time project/use of operating experience etc.); • Risks external to Owner known, documented, and minimized (e.g. regulatory and licensing, financial, cost escalation, contractors (including contractor financial stability), supply chain, governments, etc.); • Suitable Corrective Actions for major risks.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.6 and 3.9 [16]. Financing of New Nuclear Power Plants, IAEA Nuclear Energy Series NG-T-4.2 Section 3.3 [20]. Risk Management, a Tool For Improving NPP Performance, IAEA TECDOC-1209 [28]. Guidelines for Integrated Risk Assessment and Management in Large Industrial Areas, IAEA TECDOC-994 [29]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.56 and 5.57 [5]. Construction and Commissioning Experience of Evolutionary Water Cooled Nuclear Power Plants, IAEA TECDOC-1390 [25].	
PM11	**Project contract and procurement strategies** • Project Contracting and Procurement Plans in Place.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.4 [16].	
PM12	**Project change control** • Project change control processes in place (cost and schedule impacts); • Project changes processed in a timely manner to allow for effective decision making.	The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.53 and 5.56 [5].	
PM13	**Project delay/suspension provisions** • Processes and commercial agreements exist to secure and preserve project documentation (engineering, quality etc.), including work in progress, in event of project delay or suspension.	Restarting of Delayed Nuclear Power Plant Projects, IAEA Nuclear Energy Series NP-T-3.4 [18]. Management of Delayed Nuclear Power Plant Projects, IAEA- TECDOC-1110 [24].	

II.2. Engineering readiness

The engineering readiness objective is to assess availability of engineering related documentation, processes and personnel to support the construction process.

This evaluation should assess overall completeness of engineering design work needed to commence construction activities. This review is to assess whether documents are being delivered on time, whether there is an integrated schedule, and whether configuration control is being maintained. Experience has shown that NPP projects are most successful when detailed design work is fully or near complete, a repeat design is utilized (not first-of-a-kind construction), and when trades and interdisciplinary engineering feedback processes have been robustly applied. To help save time during construction robust field change processes are required to be established in advance, and sufficient engineering staff is needed to support field activities. Engineering programmes need to be developed to the point where key initial data can be captured as construction progresses.

General reference documents

- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5].

TABLE II.2 POSSIBLE ENGINEERING SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
EN1	**Engineering documentation** • Design documentation, drawings, specifications, design manuals, flow sheets, operating instructions, maintenance instructions, calculations, etc. available or with delivery dates explicitly incorporated into project schedule; • Document control systems used by various organizations (owner, vendor, constructor etc.) well integrated.; • Standards, codes, and regulations applicable to project clearly defined. Equivalence or adaptation documents written where codes interface (e.g. ASME and RCC-M etc.); • Outstanding design work evaluated to pose minimal project risk; • Owner and/or regulator acceptance processes, roles, and timelines defined; • Engineering vendor oversight processes and roles defined.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.12, 5.79 to 5.83 [5].	
EN2	**Feedback incorporated** • Contractor trades/craft, commissioning staff, maintenance staff, and inter-disciplinary engineering feedback on engineering documentation incorporated into issued documents at the appropriate time (e.g. constructability process in place and assessments completed; complete assessments are of higher value than partial assessments); • Inputs from 3D modelling, laser scanning, and/or simulator incorporated where available; • Walkdown data incorporated where applicable.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16].	
EN3	**Engineering planning** • Plans and schedules issued, being utilized at a working level, and linked to construction schedule. Ability to project engineering workload available and in place; • Engineering progress measures in place; • Vendor documentation submittal schedule incorporated into engineering plan.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16].	

Id.	Subject and description	Specific references	Conclusion
EN4	**Design change process** • Design change implementation process procedures issued to construction and being followed (e.g. field change, non-conformance, as-built processes etc.); • Staff dedicated to support construction activities available with required authority; • Processes and roles defined for approvals of field changes and to respond to supplier enquiries.	Modifications to Nuclear Power Plants Safety Guide; IAEA Safety Standards Series No. NS-G-2.3 [8]. Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16]. Equipment Qualification in Operational Nuclear Power Plants: Upgrading, Preserving and Reviewing; Safety Reports Series No. 3 [31]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.135 to 5.140, 5.148, V.16 to V.18 [5].	
EN5	**Configuration management, engineering controlled documents and records** • Identification and documentation of system, structure and component characteristics, and ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded and incorporated into system documentation; • For items below, ensure control processes/procedures are issued and being followed:	The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.10, 5.11, 5.31, 5.32, 5.141 to 5.147, V.18 [5].	
EN5a	• Equipment and component data.		
EN5b	• Spare parts data.		
EN5c	• Calibration set-points (and tolerances).		
EN5d	• Design documentation.		
EN5e	• Models (e.g. CADD, software etc.) and software code.		
EN5f	• Engineering correspondence.		
EN5g	• Other engineering records.		

Id.	Subject and description	Specific references	Conclusion
EN6	**Computer/cyber security** • Measures to ensure computer/cyber security standards are in place (engineering, project and NPP computer systems); • Management systems appropriate to information technology and plant control software in place.	Computer Security at Nuclear Facilities Reference Manual; IAEA Nuclear Security Series No. 17, Technical Guidance [34]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.176 to 5.179 [5].	
EN7	**Delayed Project (if applicable)** • If project has experienced a significant delay (multi-year hold), processes exist for review of previous engineering work and materials to current codes/standards, and to validate site conditions/configuration management.	Restarting of Delayed Nuclear Power Plant Projects, IAEA Nuclear Energy Series NP-T-3.4 [18]. Management of Delayed Nuclear Power Plant Projects, IAEA TECDOC-1110 [24].	
EN8	**Engineering programmes** • Engineering programmes developed to support construction activities such as installation or check and test requirements. Key activities not completed are integrated into project schedule. Processes in place for recording initial "as left" data (baseline records) as required for component monitoring and/or periodic inspection programmes. Note: this item is typically not applicable for Phase 1 missions. o Ageing management; o Environmental qualification; o Fire protection; o Valve programme; o Periodic inspection; o Predictive maintenance; o Preventative maintenance; o Chemistry programme.	Ageing Management of Nuclear Power Plants NS-G-2.12 Section 3 [12]. Equipment Qualification in Operational Nuclear Power Plants, Upgrading, Preserving, and Renewing, Safety Report Series No. 3 [31]. Fire Safety in the Operation of Nuclear Power Plants NS-G-2.1 [7]. Maintenance, Surveillance and In-service Inspection in Nuclear Power Plants NS-G-2.6 [9]. Chemistry Programme for Water Cooled Nuclear Power Plants SSG-13 [14].	
EN9	**Engineering quality (Phase 2 mission)** • Low numbers of engineering/design/specification errors and scope changes. Timely and complete responses received for in progress work.	Modifications to Nuclear Power Plants Safety Guide; IAEA Safety Standards Series No. NS-G-2.3 [8]. Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16].	

II.3. Procurement/material/supply chain readiness

The procurement/material/supply chain readiness objective is to assess availability of key material and related processes to support construction activities.

This evaluation should assess overall availability of engineered and commodity material required to construct the project, as well as supporting processes. It focuses on measures to identify, track, and expedite material deliveries, what material is on site versus planned to be shipped, and if there are any material related risks stemming from not-yet-completed design, supplier availability and quality, and macro-economic conditions. Site material handling and logistics processes should also be reviewed.

General reference documents

- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5].

TABLE II.3. POSSIBLE PROCUREMENT SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
PR1	**Equipment, and material availability** • Equipment and bulk material on site or with known delivery; • Material tracking processes in place (order / delivery date tracking); • Material usage tracking process in place (bulk material used versus forecast e.g. steel, concrete, pipe, wire etc.); • Delivery dates tied to construction execution schedule; • Key supplier contracts in place; • Linkages to plant configuration management data in place (spare parts databases, serial number tracking, etc.).	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.2 [16].	
PR2	**Procurement procedures and plans** • Procurement plans and requirements in place; • Site warehousing plans in place; • Material tracking, expediting, and handover processes in place; • Processes and training in place to recognize fraudulent materials; • Processes in place to ensure cleanliness requirements in procurement specifications; • Linkages to plant configuration management data in place (spare parts databases, serial number tracking, etc.); • Spare parts available to support construction; • Warrantees consistent with construction schedule.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.2 [16]. IAEA-TECDOC-1169 Managing Suspect and Counterfeit Items in the Nuclear Industry, Section 3 [30]. The Management System for Nuclear Installations, IAEA Safety Guide No. GS-G-3.5, Section 5.33 to 5.37, 5.54, 5.151 to 5.162, and V.21 [5].	
PR3	**Packaging, warehousing and transportation** • Transportation, handling, and safe preservation of major plant components or modules arranged from place/country of fabrication to job site; • Roles and responsibilities for transportation defined and agreements in place; • Site warehousing facilities available; • In-warehouse maintenance and storage requirements defined and facilities and processes to perform required activities available; • Processes for in plant material handling and staging in place.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.2 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.151 to 5.159, V.23, and V.25 to V.30 [5].	

Id.	Subject and description	Specific references	Conclusion
PR4	**Material inspection** • Inspection programme in place for incoming equipment, components, and bulk material; rejection, quarantine and acceptance processes in place; • Facilities for material receipt inspection available.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.6 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Section 10.6 [17]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.24 [5].	
PR5	**Material risk management** • Key material risks understood; • Critical equipment list/tracking mechanism maintained; • Potential impact of material/equipment price increases assessed with no adverse trends; • Risk mitigation/contingency plans in effect.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.2 [16].	
PR6	**Quality assurance and quality surveillance** • Supplier and sub-supplier qualification and auditing programme in place; • Source and receipt inspection programmes in place; • Non-conformance processes in place.	The Management System for Facilities and Activities, GS-R-3 Sections 5.23 to 5.25 [3]. Application of the Management System for Facilities and Activities, GS-G-3.1 Appendix III [4]. The Management System for Nuclear Installations, GS-G-3.5 Sections 4.5, 5.33 to 5.37, 5.49 (d) [5].	

II.4. Quality management and records programme review

The quality management and records programme review objective is to determine whether quality processes applied by the counterpart during the project comply with the review basis and reference and best international practices.

This evaluation should assess the status of processes surrounding quality and material surveillance and oversight for the applicable project, as well as processed related to records and documentation control. NPPs have a high need for accurate, detailed construction surveillance and oversight, and a strong records management function. Non-conformance processes for observed quality problems need to be well defined and utilized by project staff. Third part auditing and oversight roles need to be in place. Note that some organizations may have a stand-alone quality manual while others may implement their project quality programme via a series of governing documents or procedures detailing roles and responsibilities and project interfaces.

General reference documents

- The Management System for Facilities and Activities Safety Requirements; IAEA GS-R-3 [3];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5];
- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17].

TABLE II.4. POSSIBLE QUALITY ASSURANCE SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
QA1	**Quality assurance and controls** • Strong quality programme and procedures defined and implemented with mandatory compliance; • QA managers have direct access to company executives; • Regular programme reviews conducted.	The Management System for Facilities and Activities Safety Requirements; IAEA GS-R-3 [3]. The Management System for Nuclear Installations, GS-G-3.5 (including Sections 6.1, 6.2, 6.40 and 6.41) [5]. Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.6 [16].	
QA2	**Independent assessments** • Processes in place for independent analysis and auditing of project (scope, findings, corrective actions, performance etc.); • Qualified, experienced personnel in place to perform assessments.	Safety Assessment for Facilities and Activities; IAEA Safety Standards Series No. GSR Part 4 [1]. Assessment of Defence in Depth for Nuclear Power Plants; Safety Reports Series No. 46 [32]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.50, 6.24 to 6.34 [5].	
QA3	**Non-conformance and corrective action programmes** • Non-conformance/corrective action/self-assessment and employee concerns programmes in place and valued for materials, equipment, processes and human performance issues; • Evidence of problem trending and of lessons learned being incorporated; • Repeat problems not tolerated; • Management oversight of programme exists.	Safety Assessment for Facilities and Activities; IAEA Safety Standards Series No. GSR Part 4 [1]. Assessment of Defence in Depth for Nuclear Power Plants; Safety Reports Series No. 46 [32]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 6.3 to 6.23, 6.42 to 6.69 [5].	

Id.	Subject and description	Specific references	Conclusion
QA4	**Construction experience** • Lessons learned from past and current domestic and international projects incorporated; • Site problems readily shared externally with industry.	Modifications to Nuclear Power Plants Safety Guide; IAEA Safety Standards Series No. NS-G-2.3 [8]. Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.48 and 5.61 [5].	
QA5	**Quality surveillance and construction inspection** • Quality surveillance and construction inspection programmes established and being followed; • Critical characteristics for constructions inspections defined (e.g. project-specific construction inspection checklists based on applicable codes); • Inspection and testing is planned and implemented according to issued procedures; • Regulatory interfaces and hold points defined; • Rework and equipment/material rejection metrics established and adverse trends identified; • Contractor oversight processes established.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.6 and 3.7 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Section 10 [17]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.14 to 5.23, 5.79 to 5.83, V.6, V.31 to V.35 [5].	
QA6	**Controlled documentation and records** • Process documented and systems in place for acceptance, storage, and revision control of controlled documentation and records related to procurement, plant configuration, construction, testing, and maintenance; • Some key construction related documentation includes material and field quality records such as material history dockets, pressure boundary documents, welding records, factory acceptance test (FAT) results, installation records, calibration results, turnover records etc. *Note for engineering related controlled documents and records see EN5.*	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 4.3 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Section 10.4/5/7 [17]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.10, 5.11, 5.31, 5.32, 5.141 to 5.147 [5].	

II.5. Human resources and training review

The human resources and training review objective is to determine whether human resources applied by the counterpart to the project are sufficient and adequately trained and qualified to comply with the review basis and reference and good international practices.

This evaluation should assess staff readiness associated with the applicable project to start and maintain work. Sufficient trained resources need to be confirmed available at a discipline level, and personnel forecasting tools should be in place. Risk mitigation methods need to be in place for first time projects or inexperienced staff. Special note should be taken with respect to technical support organizations as to whether their training and qualifications are sufficient for their project roles.

General reference documents

- Recruitment, Qualification and Training of Personnel for Nuclear Power Plants Safety Guide; IAEA Safety Standards Series No. NS-G-2.8 [10];
- Workforce Planning for New Nuclear Power Programmes, IAEA Nuclear Energy Series NG-T-3.10 [22].

TABLE II.5. POSSIBLE HUMAN RESOURCES SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
HR1	**Hiring, development, and training** • Hiring, development, and training plans are in place prior to start of major construction to ensure well-trained and qualified staff are available. • Personnel attrition rates being monitored and controlled. • No adverse trends due to lack of understanding of cultural differences.	Workforce Planning for New Nuclear Power Programmes, IAEA Nuclear Energy Series NG-T-3.10 [22].	
HR2	**Personnel qualification** • Training and qualification requirements defined for skilled construction workers, supervisors, quality inspectors, technical support organization, trainers, and owner/operator staff, etc. • Staff members understand and respect personnel qualification limits. Vendors, suppliers, service providers and contractors believe they are working within their areas of expertise and experience. • Process documented for collection and maintenance of training and qualification Records of skilled construction workers, technical support organization, and owner/operator staff, etc.	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants Safety Guide NS-G-2.8 [10]. Assuring the competence of nuclear power plant contractor personnel, IAEA TECDOC-1232 [27]. Project Management in Nuclear Power Plant Construction: Guidelines and Experience, Section 3.9 [16]. Managing Human Resources in the Field of Nuclear Energy, IAEA Nuclear Energy Series NG-G-2.1 Section 3 [23].	
HR3	**Human performance** • Training is in place on required work standards and practices, use of pre-job briefings and other human performance techniques (for example, stop, think, act, review - STAR), need to maintain strict configuration management, and expected behaviours. Individual ownership of work quality and safety is emphasized.	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants; Safety Guide NS-G-2.8 [10].	
HR4	**Health and safety training** • Health and safety training requirements identified and applied.	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants; Safety Guide NS-G-2.8 [10].	

Id.	Subject and description	Specific references	Conclusion
HR5	**Personnel availability** Required trained staff available when needed • Skilled construction worker and other staff availability pre-planned/forecast with tracking processes in place. • Mobilization/demobilization time integrated into forecasts. • Specialized skills needs understood (e.g. welding) and addressed. • Potential problem areas understood and addressed (e.g. other project competition, wage rates, undesirable work conditions/schedules/ locations/logistics). • Contingency plans in place.	Recruitment, Qualification and Training of Personnel for Nuclear Power Plants; Safety Guide NS-G-2.8 [10].	
HR6	**First line supervision and management** • Experienced supervision in place that is (a) knowledgeable in their area of responsibility and (b) reinforces high standards. • Key managers have appropriate nuclear design and construction experience and fully understand NPP construction complexity and regulations. Actions in place to mitigate acknowledged gaps (e.g. via use of advisors, education, training, visits or work experience at other NPP construction sites etc.).	Management of Operational Safety in Nuclear Power Plants INSAG-13 (Appendix: Planning, Control and Support - Supervision) [15]. SCART Guidelines, IAEA Services Series 16, Annex II, Characteristic B: Leadership for safety is clear [36].	

II.6. Construction readiness review

The construction readiness review objective is to identify and characterise attributes associated with field construction activities that the counterpart considers as important, and that could be addressed by the construction readiness review mission. These attributes will also serve as background information when addressing the other themes.

This evaluation should assess overall availability of trades workforce to construct the project. It focuses on site infrastructure and services readiness, tool and heavy lift equipment availability, work management processes, safety and security programmes, and overall construction planning. Information provided in this section will typically be targeted during a mission on a sampling basis due to volumes of documentation involved.

General reference documents

- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5].
- OSART guidelines, IAEA Services Series 12 [35].

TABLE II.6. POSSIBLE CONSTRUCTION SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
CO1	**Site infrastructure requirements** • Transportation (roads, water, rail, air etc.); • Loading/unloading requirements (docks, rail spurs, cranes etc.) and heavy lift capability in place; • Off-site permanent utilities (water treatment, power, sewage etc.); • Site support equipment and facilities (e.g. trailers, workshops, restrooms, cafeterias, parking, accommodation, hotels, IT, telecommunications, document processing equipment, waste collection/disposal etc.) adequate for construction project; • Temporary utility services in place (power, water, service air); • Laboratories available/in place for chemical analyses required during construction phase; • Concrete batching plant; • Module laydown and assembly area in place; • Training facilities available; • Mock-ups (models) of key components installed where practical to practice critical installation activities.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Sections 2.1 and 2.7 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Section 3 [17]. Basic Infrastructure for a Nuclear Power Plant Project, IAEA TECDOC-1513 [26].	

CO2	**Regulatory requirements**
	• Interfaces defined and processes in place to obtain and track compliance to applicable:
	  ○ Siting/building permits/orders;
	  ○ Environmental permits and approvals;
	  ○ Hazardous materials and wastes;
	  ○ Nuclear regulatory and license requirements;
	  ○ Other requirements as defined by local laws, rules, codes, standards, and regulations;
	• Outstanding actions integrated into project schedule. Risks related to these requirements documented (see PM9).
		Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.1 and 2.5 [16].
		Basic Infrastructure for a Nuclear Power Plant Project, IAEA TECDOC-1513 [26].
		Licensing Process for Nuclear Installations Specific Safety Guide Series No. SSG-12, Sections 3.36 to 3.43 [13].	

Id.	Subject and description	Specific references	Conclusion
CO3	**Tools availability** • Required tools on site or with known delivery; • Heavy lift cranes available or scheduled as necessary; • Calibration and testing facilities available. Process to control calibration records in place (calibration serial number tracking, etc.); • Tool tracking processes in place.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.2 [16]. Heavy Component Replacement in Nuclear Power Plants: Experience and Guidelines IAEA Nuclear Energy Series NP-T-3.2 [19]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.24 to 5.30 [5].	
CO4	**Construction sequencing** • Execution plan in place, taking into account design and material availability, large equipment deliveries, staging requirements, construction/module sequencing, tooling and craning requirements, trades availability, weather, etc. ; • Work management processes in place; • Key dependencies (e.g. funding releases, owner approvals, required contracts, work site availability) understood.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.1 to 3.5 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 Sections 4 to 9 [17]. Heavy Component Replacement in Nuclear Power Plants: Experience and Guidelines IAEA Nuclear Energy Series NP-T-3.2 [19]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Sections 5.62 to 5.64 [5].	
CO5	**Security and safeguards requirements** • Site security requirements and material control/inspection/transfer requirements understood; • Site boundary identified and controlled; • Personnel clearance requirements understood and in place; • Requirements for vehicle and other checks in place.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.8 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.181 to 5.183 [5].	

Id.	Subject and description	Specific references	Conclusion
CO6	**Construction execution plans and procedures** • Owner Approval Requirements defined; • Change Control and Non-Conformance Processes Defined (see section EN3); • Documentation/deliverables defined; • Construction procedures and standards identified and available; • Rehearsals completed or planned for key execution activities (e.g. concrete base slab pouring); • Foreign Material Exclusion (FME) programme in place; • Interfaces between companies defined; • Site logistics defined (work zone ownership, access/egress, waste disposal procedures etc.); • Preventative maintenance requirements during construction phase defined; • Human performance programme in place (with goal to ensure workers and supervisors understand and rigorously adhere to procedures and other work documents); • Activities that could impact nearby operating units addressed (carefully planned, formal interfaces and notification procedures in place).	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Sections 3.3, 3.4, 3.7, 5.1 [16]. The Management System for Nuclear Installations, IAEA Safety Guide No. GS-G-3.5, Sections 5.149, 6.42 to 6.69, V.7 to V10, V.19 to V.22 [5].	
CO7	**Environmental management** • Environmental management systems in place. • Hazardous material identification, storage, and control measures in place (including measures for bulk consumables, chemicals, solvents, cleaners etc.); • Monitoring and corrective action systems in place for construction impacts on site conditions (e.g. excavation and backfill) and natural environment (e.g. groundwater, wildlife etc.); Emergency response processes in place for spills and other incidents.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.8 [16]. Site Evaluation for Nuclear Installations, IAEA Safety Requirements No. NS-R-3 [2]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.170 to 5.174 [5].	

Id.	Subject and description	Specific references	Conclusion
CO8	**Safety management** • Good safety culture established; • Industrial safety programme documented and metrics established, including safety inspections, forward looking metrics (e.g. attitudes, behaviours, job site conditions); • High level of owner involvement in contractor construction safety programmes (e.g. safety briefings, inspections); • Low tolerance for safety violations; • Low levels of site safety incidents; • Safe behaviours valued and encouraged; • Design processes incorporate safety professional reviews; • Safety prequalification processes in place for contractors; • Tools, training and equipment available to achieve a safe work environment; • Housekeeping programme in place; • High-risk activity planning and hazard analysis processes in place; • Just in time training, pre-job briefs, and/or mock-ups used for first time, sensitive, or complex tasks. • Comprehensive lifting, rigging, material handling, radioactive source, and electrical safety programmes in place; • Processes in place to ensure physical conditions that might impact on safety are promptly addressed. • Employees stop-work authority processes to correct unsafe conditions (protect from imminent danger) defined; • Radiation protection programmes and training in effect prior to introduction of nuclear material to site (or where impacted by adjacent nuclear site); • Emergency preparedness capabilities established (fire, medical, radiation emergencies).	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.8 [16]. Safety Culture in Pre-operational Phases of Nuclear Power Plant Projects Safety Reports Series 74 [33]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.65 to 5.78, 5.150, 5.180, 5.181, 6.35 to 6.39, and Appendix I [5]. OSART guidelines, IAEA Services Series 12, Section 3.1.5 [35].	
CO9	**New construction practices and technologies** • Impact of planned new/advanced construction practices, technologies, and advanced materials evaluated and risks mitigated (first of a kind/first in a country risks).	Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17].	

II.7. Construction installation completion assurance/system handover

The construction completion assurance/system handover review objective is to assess quality of documented processes for assuring that all required construction related activities associated with a system, structure or component are completed to required quality levels prior to turnover to commissioning.

For a Phase 1 mission the focus would be on whether required processes are in place, while Phase 2 missions would review performance against the issued process. This evaluation should assess the status of processes surrounding system turnover to commissioning. Following start of construction systems will rapidly be built. The overall project requires a fast, quality, turnover to the commissioning organization in order to minimize project duration. These processes should be available as soon as construction begins, and the commissioning organization should be fully aware of the turnover schedule.

General reference documents

- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5].
- OSART guidelines, IAEA Services Series 12 [25].

TABLE II.7. POSSIBLE INSTALLATION COMPLETENESS SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
IC1	**Process defined** • Formal process in effect for documenting construction completion activities (including flushing, cleaning, or check and test activities performed by the constructor), transferring information to records, and transferring system and area ownership to commissioning organization and operations.	Modifications to Nuclear Power Plants Safety Guide; IAEA Safety Standards Series No. NS-G-2.3 [8]. Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 4.1 to 4.3 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.31, 5.32, V.11, V.18, and V.31 to V.35 [5]. OSART guidelines, IAEA Services Series 12, Section 3.10.12 [35]. Commissioning for Nuclear Power Plants Safety Guide Series No. NS-G-2.9, Sections 4.6 to 4.8, 4.27, 4.58 to 4.64 [11].	
IC2	**Walkdown processes** • Documented walkdown processes incorporated as part of completion assurance process (e.g. reports, photos, videos etc.).	The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 V.11 [5].	
IC3	**Hold points** • Construction completion activities completed prior to commissioning start; • Construction completion activities with appropriate hold points are scheduled as part of the master project schedule.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 4.1 to 4.3 [16].	
IC4	**Open item tracking** • Robust method in place for tracking and completing open items to be carried into commissioning or operational phase.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 4.1 to 4.3 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 V.11 (2) [5].	

Id.	Subject and description	Specific references	Conclusion
IC5	**Labelling and control of boundaries** • Process in place to label all SSCs and to control boundaries between turned over and not turned over SSC's (tagging, work protection, ownership boundaries list etc.).	The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.163 to 5.164, V.11 [5]. OSART guidelines, IAEA Services Series 12, Section 3.10.13 [35].	
IC6	**Inaccessible items** • Process in place for SSC's that will later become inaccessible to receive comprehensive inspection and oversight as part of handover review.		
IC7	**Interim maintenance during construction** • Maintenance procedures, tooling, and preventative maintenance programmes in place to support systems being operated while construction is still in progress.	The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.10 (g) [5].	

II.8. Targeted Area Review (including Project Delays and Corrective Actions)

The targeted area review objective is to review other areas as requested by the counterpart on a focussed basis.

For example where project delays have occurred, one possible action would be to review whether lessons learned about such delays on this or previous similar projects have been understood, and that appropriate measures have been taken to address them from a process or risk mitigation perspective (such a review would typically be for Phase 2 reviews only at *counterpart* request).

General reference documents

- None.

TABLE II.8. POSSIBLE TARGETED AREA SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Specific references	Conclusion
TA1	**Completed activities and expenditures** • Review of activities, work sequences, durations, manpower, and capital expenditures.		
TA2	**Detailed as-experienced schedule review** • Review duration and sequences of as-experienced schedule.		
TA3	**Variance review** • Variances between planned and actual performance and delay analysis.		
TA4	**Significant events of interest** • Significant incidents during Phase 1 construction.		
TA5	**Corrective action review** • Effectiveness of corrective actions to prevent repeat problems. • Managerial response to repeat issues.		
TA6	**Other areas** • Other areas (by request of counterpart). See Section 2.3.7.		

II.9. Technical Visits

The technical visit objective is to review specific facilities that may be pertinent to construction project success, which may be located off of the construction site proper, and thus would require special coordination or logistics as part of the construction mission.

These visits would typically only be at counterpart request.

General reference documents

- Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 [16];
- Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5 [17];
- The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 [5].

TABLE II.9. POSSIBLE TECHNICAL VISIT SUBJECTS FOR CONSTRUCTION READINESS REVIEW MISSION

Id.	Subject and description	Reference	Conclusion
TV1	**Component fabricators** • Major component manufacturer(s)/supplier(s) facility.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.6 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.16 [5]	
TV2	**Module assembly** • Construction module assembly area.	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 3.6 and 3.7 [16]. Construction Technologies for Nuclear Power Plants, IAEA Nuclear Energy Series NP-T-2.5, Section 8 [17]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section V.8, V.14 [5].	
TV3	**Remote TSOs** • Remotely located technical support organization(s) (e.g. engineering).	Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7 Section 2.3 [16]. The Management System for Nuclear Installations, IAEA Safety Guide GS-G-3.5 Section 5.79 to 5.83 [5].	
TV4	**Others** • Others (by request of counterpart). See Section 2.3.6.		

APPENDIX III: MISSION REPORT TEMPLATE

This appendix may be used by the *construction review team* as a template for the mission report. It is available in electronic form. On the following pages text in italics should be replaced with attributes of the given *construction readiness review mission*.

Construction Review -*location*-20XX Original: English
Distribution: Restricted

INTERNATIONAL ATOMIC ENERGY AGENCY

REPORT

INDEPENDENT REVIEW OF CONSTRUCTION READINESS FOR A NUCLEAR POWER PROJECT

IAEA REVIEW OF
Review Mission Title

Review Location and Review Period

INDEPENDENT REVIEW OF
CONSTRUCTION READINESS FOR A NUCLEAR POWER PROJECT
IAEA REVIEW OF title of project under review
DEPARTMENT OF NUCLEAR ENERGY
DIVISION OF NUCLEAR POWER

MISSION REPORT

INDEPENDENT REVIEW OF CONSTRUCTION READINESS FOR A NUCLEAR POWER PROJECT

IAEA REVIEW OF
Review Mission Title

Plant or Project Graphic may be added on this page.

REPORT TO
Counterpart Organization

Review location and review period

MISSION REPORT

INDEPENDENT REVIEW OF CONSTRUCTION READINESS FOR A NUCLEAR POWER PROJECT

IAEA REVIEW OF
Review |Mission Title

Mission date: *Review Period*

Location: *Location of Review*

Facility: *Counterpart Organization*

Organized by: International Atomic Energy Agency (IAEA)
Department of Nuclear Energy
Division of Nuclear Power

IAEA Review Team: *Participant Name* *(Organization, Country)*

Participant Name *(Organization, Country)*

Issued *Date*

CONTENTS

EXECUTIVE SUMMARY

In 2013 the IAEA Nuclear Power Engineering Section established the "Construction Readiness Review" (CORR) mission to conduct peer reviews of construction projects related to nuclear power plants.

This report documents the Construction Review performed during the week of *Review Period and Review Location, on the project being reviewed.*

Background of the system(s) being reviewed.

History of review request, discussion of preparatory meeting, and basis for review such as ….These guidelines were based on IAEA Nuclear Energy Series documents Project Management in Nuclear Power Plant Construction: Guidelines and Experience NP-T-2.7, Construction Technologies for Nuclear Power Plants NP-T-2.5, and well as other internally recognized project or construction management documents (list specific documents utilized during the mission).

The Construction Review was performed by a group of invited subject matter experts. Results of their review were published in a mission report at the end of the review, which provided recommendations, suggestions and noted good practices in the construction process.

Goals of counterpart organization….such as their goals were that the mission would provide them with a basis for proceeding with the next stage of the NPP construction project, and by implementing mission recommendations and findings future project risk would be minimized.

Description of general manner as to how the review was conducted…such as

Construction Review activities consisted of a series of formal presentations by *counterpart organization staff (supported by associated organizations)* clarification discussions between the IAEA review team and the *counterpart organization staff* after these presentations, as well as a tour of *the construction site and related facilities*. The IAEA mission review team then submitted a series of written questions to project staff, which were followed up by written responses and subsequent discussions between the two parties.

Conclusions of this report summarize the findings of the review mission and provide *number (99)* recommendations and *number (99)* suggestions for the project to consider, along with acknowledging *number (99)* good practices from which other project organizations may benefit. Through the review of presented documents and counterpart discussion, the IAEA review team confirmed that extensive work of high quality has been performed to develop the *project under review* to its current state. In general, the reviewed project contains the elements generally recommended IAEA Nuclear Energy Series documents related to project management of NPP projects, and construction technology for NPP projects. Specific issues, identified as areas for further improvement, are listed in the issues sheets, as suggestions and recommendations.

If deemed appropriate by review team, text similar to the following may be used….

It should be noted that nuclear power plant projects, such as those of the *project under review*, are extremely complex and the review mission was conducted for only a relatively

short time period. It is the opinion of the review team that some comments in the report should not be seen as deficiencies in the overall project, but may be a result of the difficulty in resolving all of their concerns in such a limited time period.

1. INTRODUCTION

1.1. MISSION BACKGROUND

A review mission entitled the "Review of Construction Readiness for a Nuclear Power Plant Project" (CORR review) was established in 2013 at the Nuclear Power Engineering Section of the IAEA. The mission is intended to conduct peer reviews of construction projects related to nuclear power plants.

Construction Readiness review missions are performed by a group of invited subject matter experts from various IAEA member states. The *construction readiness review mission* is based on appropriate IAEA documents, such as Safety Guides and Nuclear Energy Series reports.

This portion may be tailored based on the results of the preparatory meeting….

Guidelines for this *construction readiness review mission* were established at a consultancy meeting in *location and date of the preparatory meeting*. Review methodology follows the structure of IAEA CORR guidelines – Guidelines for preparing and conducting review missions of construction project readiness for nuclear power plants [37].

More specifically, nine (9) specific requirement areas were selected for review:

[Adjust list below as necessary]

1. Project management;
2. Engineering readiness (engineering deliverables required to support construction);
3. Procurement/material/supply chain readiness (material available to support construction activities);
4. Quality management and records;
5. Human resources and training;
6. Construction readiness;
7. Construction installation completion assurance/system turnover process;
8. Targeted reviews (including project delays and corrective actions);
9. Technical visits.

The subject of the current construction review was the *project under review and a brief discussion of its background including a discussion of any previous third party and/or regulatory reviews.*

1.2. MISSION OBJECTIVE AND SCOPE

Objectives of the construction review mission were to:

- Conduct an independent and comprehensive review of the *project under review* using information provided by the counterpart and obtained by the construction review team during the mission period. The review focussed on project readiness to proceed to its next stage, and covered the *nine (9)* areas identified in Section 1.1;
- Produce a mission report, including issue sheets.

It is the *counterpart organization's* expectation that the IAEA's construction review findings, as an independent international technical review, will provide the following benefits to their project:

- Improvement performance of the *project under review* by implementing mission recommendations and findings;
- *Other expectations of the counterpart.*

1.3. REVIEW BASIS AND REFERENCES

1.3.1. Guideline references for review conduct

The review basis was IAEA Nuclear Energy Series documents Project Management in Nuclear Power Plant Construction: Guidelines and Experience NP-T-2.7 [16], Construction Technologies for Nuclear Power Plants NP-T-2.5 [17], and well as other internally recognized project or construction management documents *(list specific documents utilized during the mission)*.

Review team members also used expert judgment to compare review subjects against or existing international good practices.

1.3.2. Information reviewed

Information provided by *counterpart* for the review purposes was supported by the following documents:

Item No.	Title	Revision (date)	Page
1	Listing of review basis documents…		
2			
3			
4			
5			

1.4. REVIEW CONDUCT

The construction review mission was conducted based on technical information provided by *counterpart* in the following forms:

- Presentations by *counterpart* experts and representatives of *other companies*, delivered on the first two days of the mission;
- Description of the review material and discussion of any demonstrations and technical visits held during the review process;
- *As required…*Additional presentations and discussions, including *counterpart* responses to the initial list of items to be clarified. (The list of *XX* general and *YY* specific questions and requests compiled by the review team on the second day of the mission can be found in Annex IV of this report.).

Counterparts from *counterpart* and additional counterparts from participating organizations were involved in technical meetings and discussions. A list of all participants can be found in Annex I of this report.

The *counterpart organization* was very well prepared and comprehensive, and also was presented very well. Material on the selected subjects included:

- *Summary of the topics covered during the presentations and discussions.*

During the course of the mission, *the counterpart* also prepared responses and additional presentations to clarify details addressed by the IAEA experts.

Discussion of any technical visits and/or demonstrations during the review follows…

Conclusions, recommendations, suggestions, and good practices (documented in the remainder of this report) were presented and agreed upon with the counterparts during the *closeout session*.

This report is a joint effort of the IAEA review team and its content was shared among all review team members.

The review was conducted in an excellent atmosphere of mutual understanding with a positive sharing of experience between team members and counterparts.

1.5. MISSION REPORT CONTENT

Section 1 of the report provides general mission information. Section 2 provides a summary with general conclusions, and a list of specific recommendations, suggestions, and good practices identified. Section 3 provides detail regarding findings in each area reviewed, while section 4 provides further explanation regarding good practices and performances that have been identified.

Annexes I and II of the report provide a list of participants in the meetings and the mission programme. Detailed technical recommendations and suggestions developed by the IAEA

experts are collected in Annex III in issue sheets. Annex IV contains a list of clarification questions that were submitted to the counterpart.

2. MAIN CONCLUSIONS AND RECOMMENDATIONS

2.1. GENERAL CONCLUSION

Concluding remarks will be dependent on observations made during review but a suggested format is…

Through review of presented documents and discussions with counterparts, the IAEA review team confirmed that extensive work of high quality has been performed to progress the project *project(s) under review* to its current state. Reviewed parts of the project generally contain the elements generally recommended in IAEA Nuclear Energy Series documents related to Project Management of NPP Projects, and Construction Technology for NPP projects. Specific issues, identified as areas for further improvement, are listed in issues sheets, as suggestions and recommendations.

2.1.1. Review of presented documents

The review areas covered *(as appropriate)*:

- Review area 1;
- Review area 2;
- Review area n.

2.1.1.1. Review area 1

Discussion of review area 1

2.1.1.2. Review area 2

Discussion of review area 2

2.1.2. Tours and/or demonstrations

Summary of review findings …

After review and discussion with counterparts, the IAEA review team compiled AA recommendations, BB suggestions, and CC good practices (See Sections 2.2, 3, 4, and Annex III for more details.)

2.2. SPECIFIC RECOMMENDATIONS, SUGGESTIONS, AND GOOD PRACTICES

List specific text of recommendations, suggestions and good practices only. Further explanation will be contained in Sections 3 and 4.

2.2.1. Recommendations

R1) *Text of recommendation 1;*

R2) *Text of recommendation 2.*

2.2.2. Suggestions

S1) *Text of suggestion 1;*

S2) *Text of suggestion 2.*

2.2.3. Good Practices

GP1) *Text of good practice 1*;

GP2) *Text of good practice 2*.

3. ASSESSMENT OF ISSUES

3.1. ISSUES

3.1.1. General

In this section, issues arising from the project review performed by the IAEA review team are presented in detail, following the prepared format for the CORR service.

Recommendations and suggestions are numbered in sequential order for further reference. Reviewed documents, corresponding specifically to the issue under consideration, are also listed in the issue sheets.

Information documented in issue sheets, developed in accordance with Section 2.5.2 of the construction review mission protocol [37], should be included at this point,

3.1.2. Reviewed issues summary

The following table summarizes the issues and associated recommendations and suggestions:

Issue No.	Title of Issue	Recommendation No.	Suggestion No.
CO-I1	Text from Section 2 of the issue sheet No. 1 from the "CO" area.	Applicable R No. (if one exists)	Applicable S No. (if one exists)
CO-I2	Text from Section 2 of the issue sheet No. 2 from the "CO" area.	Applicable R No. (if one exists)	Applicable S No. (if one exists)
HR-I1	Text from Section 2 of the issue sheet No. 1 from the "HR" area.	Applicable R No. (if one exists)	Applicable S No. (if one exists)
Total	No. of issue sheets	No. of Recommendations	No. of Suggestions

All issue sheets are collected in Annex III.

4. GOOD PRACTICES AND PERFORMANCES OBSERVED

Good practices and good performances identified by the IAEA review team, developed in accordance with Section 2.5.3 of the construction review mission protocol [37], should be included and expanded upon at this point.

During the course of this CORR mission, a number of good practices were observed or identified by the IAEA review team that are novel, have proven benefits, and can be used on other NPP construction projects. These include *[insert explanation of identified good practices here]*…..

A summary of identified good practices is in the following table:

GP No.	Title of Good Practice
GP-1	Text of Good Practice GP-1
GP-2…	Text of Good Practice GP-2
GP-n	Text of Good Practice GP-n

A number of good performance areas were also identified. These include *[insert explanation of identified good performances here]*……

ACKNOWLEDGEMENTS

Tailored based on how the review went….

The host organization provided excellent conditions for conducting the mission. The *counterpart organization* staff was fully prepared for technical discussions, presentations and demonstrations, and promptly responded to questions and clarification requests from the IAEA review team.

REFERENCES (FOR MISSION REPORT)

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities; IAEA Safety Standards Series, General Safety Requirements Part 4, No. GSR Part 4 IAEA, Vienna (2009).

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[3] INTERNATIONAL ATOMIC ENERGY AGENCY, The Management System for Facilities and Activities, GS-R-3, IAEA, Vienna (2006).

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

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

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Commissioning for Nuclear Power Plants Safety Guide Series No. NS-G-2.9, IAEA, Vienna (2003).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY Ageing Management of Nuclear Power Plants, NS-G-2.12, IAEA, Vienna (2009).

[13] INTERNATIONAL ATOMIC ENERGY AGENCY, Licensing Process for Nuclear Installations Specific Safety Guide Series No. SSG-12, IAEA, Vienna (2010).

[14] INTERNATIONAL ATOMIC ENERGY AGENCY, Chemistry Programme for Water Cooled Nuclear Power Plants, Specific Safety Guide Series No. SSG-13, IAEA, Vienna (2011).

[15] INTERNATIONAL ATOMIC ENERGY AGENCY, Management of Operational Safety in Nuclear Power Plants, INSAG-13, IAEA, Vienna (1999).

Add others referred to in the report. Although not the focus of this review, other published IAEA Safety guides specific to NPP design or ageing management may also be referred to if applicable.

[16] INTERNATIONAL ATOMIC ENERGY AGENCY, Project Management in Nuclear Power Plant Construction: Guidelines and Experience, IAEA Nuclear Energy Series NP-T-2.7, IAEA, Vienna (2012).

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[21] INTERNATIONAL ATOMIC ENERGY AGENCY, Stakeholder Involvement Throughout the Life Cycle of Nuclear Facilities, IAEA Nuclear Energy Series NG-T-1.4, IAEA, Vienna (2011).
[22] INTERNATIONAL ATOMIC ENERGY AGENCY, Workforce Planning for New Nuclear Power Programmes, IAEA Nuclear Energy Series NG-T-3.10, IAEA, Vienna (2011).
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Add others referred to in the report. Although not the focus of this review, other published IAEA Technical Documents, Reports, or Guidelines specific to NPP design, ageing management and/or construction may also be referred to if applicable.

The following list contains titles of a sampling of internationally recognized project and construction management documents that with the agreement of the *counterpart* were utilized by the *construction review team* in evaluating the readiness of the NPP construction project, identifying potential best practices, and/or simply as background material. Identification of such documents does not represent their official endorsement by the IAEA nor a complete list of publications from the indicated organization.

Edit to remove any documents not utilized on the mission, or add any additional documentation that was utilized.

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ABBREVIATIONS USED (FOR MISSION REPORT)

List should be tailored for the review (do not include if small and abbreviations can be included in report text).....

AIP	Advance Information Package
CORR	Construction Readiness Review Mission
NPP	Nuclear Power Plant
SSC	Systems, Structures, and Components

ANNEX I. LIST OF PARTICIPANTS

I. IAEA Expert Team

1. *Reviewer 1* IAEA/NENP, Team Leader
2. *Reviewer 2…* *Organization, country*
3. *Reviewer n…* *Organization, country*

II. Counterpart Participants

1. *Participant 1* *Organization*
2. *Participant 2…* *Organization*
3. *Participant n…* *Organization*

ANNEX II. MISSION PROGRAMME

Insert agenda/timetable of review meeting

ANNEX III. ISSUE SHEET TEMPLATE

Insert issue sheets in sequential order by area.

1. ISSUE IDENTIFICATION		Issue Number: _____- I _____ (format Area - I#)
NPP:	Unit:	
Mission: IAEA Review of (*PROJECT UNDER REVIEW)*		
Reviewed Area:		
Issue Title:		
2. ISSUE CLARIFICATION		
2.1 – FUNDAMENTAL OVERALL PROBLEM:		
2.2 – IAEA BASIS:		
3. ASSESSMENT BY THE IAEA REVIEW TEAM		Date: D1/M1/YYY1
3.1 – FACTS: F1) F2) F3) F4)		
3.2 –CONSEQUENCES:		
3.3 – RECOMMENDATIONS / SUGGESTIONS: **R)** … should…. **S)** Consideration should be given to **…**		
3.4 – DOCUMENTS REVIEWED:		
4. COUNTERPART ACTIONS		**Date:** D2/M2/ YYY2
n.a.		

5. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM		**Date:** D3/M3/ YYY3
5.1 – FACTS: F1) n.a.		
5.2 – DOCUMENTS REVIEWED: n.a.		
5.3 – RESOLUTION DEGREE:		
1.	Withdrawn	
2.	Insufficient progress to date	
3.	Satisfactory progress to date	
4.	Issue resolved	

Withdrawn - Recommendation/suggestion is not appropriate due, for example, to poor or incorrect definition of original finding, its having minimal impact, or where additional clarification was provided.

Insufficient progress to date - Actions taken or planned do not lead to conclusion that issue will be resolved in a reasonable time frame. This category includes recommendations for which no action has been taken, unless the recommendation has been withdrawn.

Satisfactory progress to date - The implemented actions meet partially the intent of recommendation/suggestion of previous mission.

Issue resolved - The intent of recommendation/suggestion of previous mission is fully met. Issue closed.

ANNEX IV. IAEA REVIEW TEAM QUESTIONS, REQUESTS FOR ADDITIONAL EXPLANATION

These are clarification questions submitted by the review team prior to development of issue sheets…

General questions

1. General question 1
2. General question n

Detailed questions

1. Detailed question 1
2. Detailed question n

Besides "IAEA REVIEW TEAM QUESTIONS" add any other Annexes or Appendices as needed here after Annex IV.

End of Mission Report Template.

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DEFINITION OF TERMS

Advance information package: A set of documents provided to *construction review team* members by the *counterpart* organization during the preparatory phase prior to the review mission.

Breakout session: A *technical session* during the review mission where only part of the *construction review team* is involved.

Briefing meeting: A meeting or conference call of the *construction review team* held prior to the review mission, to ensure all members of the *construction review team* have all necessary information, and to gather a list of initial questions for the *counterpart*.

Code of conduct: A set of policies and practices that *construction review team* members must observe during the review mission.

Closeout session: Final *plenary session* during the review mission, where the *construction review team* presents *Finding*s, the *counterpart* expresses their point of view, and mutual agreement is attained on any remaining outstanding issues.

Construction readiness review mission (CORR mission): Review service directly addressing strategy and key elements for implementation of construction projects for NPPs noting, in applicable cases, specific concerns related to quality assurance requirements, and readiness related to *project under review*.

Construction review team: Group of industry experts and/or IAEA staff members assembled to perform the *construction readiness review mission*.

Construction review team meeting: Meeting during the *construction readiness review mission* involving the *construction review team* only. It allows team members to share information and understanding, compare points of view, and to reach a team consensus on questions and *Findings*.

Construction review team leader: An IAEA staff member designated as responsible for all preparatory activities, to act as an official liaison with the *counterpart*, to co-chair the review mission with the *counterpart representative*, to prepare and issue the mission report, and to be responsible for follow-up activities.

Counterpart: Organization that requested the *construction readiness review mission*, that is responsible for providing information and answers necessary to the review, and that hosts the review mission.

Counterpart representative: Person designated by the *counterpart* to be their representative and point of contact with the *construction review team leader*.

Debriefing meeting: Meeting of *construction review team* held after the review mission to develop the quasi-final state of the mission report.

Fact: An evidence of deficiency in programmes or performance. Based on grouping facts of similar nature, each reviewer develops an *issue* stated as a *fundamental overall problem* which can have a significant consequence for the *project under review*.

Finding: An *issue, recommendation, suggestion* or *good practice* that the *construction review team* mentions, or intends to mention, in the mission report.

Fundamental overall problem: A generic deficiency in programmes or performance which can lead to significant consequences for the *project under review*.

Good practice: An outstanding, markedly superior, and proven performance, programme, activity or design element that contributes directly or indirectly to project or nuclear power plant good performance. They should be sufficiently superior and have broad enough application to be brought to the attention of other NPPs, construction companies, suppliers, assessors, integrators, etc. and be worthy of their consideration in a general drive for excellence. Just fulfilling normal requirements or expectations would not merit a *good practic*e.

Good performance: A superior objective that has been achieved, or a good technique or programme that contributes directly or indirectly to sustained project performance that works well for the project in question. However, it might not be necessary to recommend its adoption on other NPP projects, because of financial considerations, differences in approach, technical reasons, or others.
Issue: An identified concern or an area for improvement, which has been identified on the basis of the *review basis and reference,* and/or internationally recognized *good practices* in the subject area.
Opening session: Initial *plenary session* during the review mission, to ensure all participants in the review mission (*construction review team* and *counterpart*) have all necessary or useful information.
Plenary session: Session during the review mission involving the complete *construction review team* and *counterpart*.
Project under review: The NPP project to be reviewed, with its defined scope and boundaries.
Recommendation: Advice from the *construction review team* on what improvements should be made that would contribute to resolve an *issue*. Follow-up action is required.
Resolution degree: A status related to an *issue* at a given time. It is one of "issue resolved", "satisfactory progress to date", "insufficient progress to date", or "withdrawn".
Review basis and reference: A set of documents against which the *project under review* will be assessed.
Review mission agenda: A documented schedule for the conduct of the *construction readiness review mission*.
Suggestion: Advice from the *construction review team* on what improvements may be made that would contribute to resolve an *issue*. Follow-up action is not strictly required; it is only optional in order to get closer to internationally recognized good practices.
Targeted review: *Technical session* during the review mission that allows the *construction review team* to study a selected topic in deep detail.
Technical presentation: *Technical session* where the *counterpart* presents a specific aspect of the *project under review*, at a level of detail that allow the *construction review team* to assess the project's compliance to the *review basis and reference.*
Technical session: A session during the review mission involving the *construction review team* and *counterpart*, where the *construction review team* reviews specific technical subjects.
Technical visit: *Technical session* where the *construction review team* can collect facts first hand that would otherwise be difficult to gather from documentation or presentations.

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