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Specific Considerations in the Assessment of the Status of the National Nuclear Infrastructure for a New Research Reactor Programme

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SPECIFIC CONSIDERATIONS IN THE ASSESSMENT OF THE STATUS OF THE NATIONAL NUCLEAR INFRASTRUCTURE FOR A NEW RESEARCH REACTOR PROGRAMME

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FOREWORD

The IAEA's statutory role is to "seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world". Among other functions, the IAEA is authorized to "foster the exchange of scientific and technical information on peaceful uses of atomic energy". One way this is achieved is through a range of technical publications including the IAEA Nuclear Energy Series.

The IAEA Nuclear Energy Series comprises publications designed to further the use of nuclear technologies in support of sustainable development, to advance nuclear science and technology, catalyse innovation and build capacity to support the existing and expanded use of nuclear power and nuclear science applications. The publications include information covering all policy, technological and management aspects of the definition and implementation of activities involving the peaceful use of nuclear technology.

The IAEA safety standards establish fundamental principles, requirements and recommendations to ensure nuclear safety and serve as a global reference for protecting people and the environment from harmful effects of ionizing radiation.

When IAEA Nuclear Energy Series publications address safety, it is ensured that the IAEA safety standards are referred to as the current boundary conditions for the application of nuclear technology.

Undertaking a nuclear research reactor programme is a major commitment for a country, requiring careful preparation, planning and implementation. This commitment is made not only to the citizens of the country developing such a programme, but also to the international community.

In recent years, the interest of IAEA Member States in developing research reactor programmes has grown, and currently several countries are in different stages of developing new research reactor programmes. The majority of these countries are building their first or subsequent research reactors as key national facilities for the development of their nuclear science and technology programmes, whether or not these reactors are steps towards the introduction of nuclear power as a source of energy.

An appropriate national infrastructure is essential for the safe, secure and sustainable construction and operation of a research reactor. The IAEA publication Specific Considerations and Milestones for a Research Reactor Project (IAEA Nuclear Energy Series No. NP-T-5.1, issued in 2012) contains a description of 19 infrastructure issues to be considered during the different phases of development of a research reactor programme. It describes the sequential development — three phases (pre-programme phase, programme formulation phase and programme implementation phase) for each of the 19 infrastructure issues, ranging from the government's national position on the nuclear research reactor to the procurement of items and services for the research reactor.

Following its publication, Member States requested that the IAEA provide additional information on determining how to assess the progress of their national infrastructure development to support new or expanding research reactor programmes. For consistency with the evaluation framework established for nuclear power programmes in the publication Evaluation of the Status of National Nuclear Infrastructure Development (IAEA Nuclear Energy Series No. NG-T-3.2 (Rev. 1), issued in 2016), relevant sections of such a framework are used, with a graded approach when applicable, in this publication.

The assessment approach described here provides a comprehensive means to determine the status of the infrastructure conditions covering all 19 issues. This approach can be used by any interested Member State for self-assessment to identify weaknesses and to determine the additional work needed to develop its national infrastructure to an appropriate level. In addition, the approach is used for the preparation and implementation of integrated nuclear infrastructure review for a new research reactor that, upon a Member State's request, the IAEA may conduct to assist in determining the degree of progress in developing and implementing various national nuclear infrastructure issues.

The IAEA wishes to acknowledge the assistance provided by the many contributors listed at the end of this publication. A special acknowledgement is due to I. Rotaru (Romania) and D. Jinchuk (Argentina) for their significant contribution to the development and review of the document. The IAEA officers responsible for this publication were A. Borio di Tigliole of the Department of Nuclear Energy,

A. Sitnikov of the Division of Nuclear Fuel Cycle and Waste Technology, D. Ridikas of the Division of Physical and Chemical Sciences and A.M. Shokr of the Division of Nuclear Installation Safety.

EDITORIAL NOTE

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Guidance provided here, describing good practices, represents expert opinion but does not constitute recommendations made on the basis of a consensus of Member States.

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CONTENTS

1. INTRODUCTION

1.1. BACKGROUND

A research reactor programme is a major undertaking that requires careful preparation, planning, implementation and investment in time and human and financial resources. The development and implementation of the required national infrastructure represent a major challenge; in particular, the infrastructure requires strict attention to nuclear safety, nuclear security, safeguards and nuclear liability. This infrastructure is wide ranging; it includes the physical facilities and associated equipment, additional facilities for both fresh and spent fuel handling and radioactive waste management (including radioactive waste generated by reactor operation and utilization) and for the transportation of nuclear materials and supplies. It also includes the establishment of legal, safety, security and safeguards frameworks and an adequate emergency preparedness and response (EPR) infrastructure. The development of this infrastructure requires considerable resources to ensure safe and secure construction, operation and effective utilization of the research reactor throughout its lifetime, followed by decommissioning. All these topics are interlinked, need to be addressed adequately and require integrated and coordinated efforts by all involved parties. For this reason, activities related to research reactors are implemented by the IAEA with a cross-cutting one-house approach involving all technical departments.

In recent years, the interest of Member States in developing new research reactors has seen some growth and currently several countries are in different stages of implementing such programmes. The IAEA publication Specific Considerations and Milestones for a Research Reactor Project [1], also known as the Research Reactor Milestones publication, provides guidance on the timely preparation of a research reactor programme through a systematic infrastructure development process. The publication includes a detailed description of 19 infrastructure issues that need to be addressed and the expected level of achievement (or milestones) at the end of each phase of the programme.

To continue the process of facilitating the successful development of new research reactor programmes, in conjunction with other already existing IAEA standards, guidance and services, the IAEA has developed this specific publication to assist Member States in assessing the status of their national nuclear infrastructure needed to support a research reactor programme and to identify gaps and needs for improvement. It is therefore essential that the teams and individuals involved in developing the research reactor infrastructure read and fully assimilate the contents of the Research Reactor Milestones publication [1] before considering this assessment approach. In the areas of safety, security and safeguards, the framework for the required infrastructure development is well established by the IAEA and is mainly based on the fulfilment by the Member State of its obligations under international instruments applicable to the corresponding conventions. Furthermore, this publication assumes that a programme to construct a research reactor is being undertaken by a single Member State. However, it is recognized that some Member States may wish to undertake such a research reactor programme jointly with one or more other Member States. In this case, the same issues need to be addressed, but there is clearly scope and need for sharing some of the infrastructure issues and addressing them jointly. Nevertheless, the infrastructure of the research reactor hosting country will be of the most concern.

This publication utilizes elements of the framework established in Evaluation of the Status of National Nuclear Infrastructure Development [2] for a nuclear power programme but with a graded approach, whenever applicable, to address the assessment (and self-assessment) of the two initial phases of a new research reactor programme as described in the Research Reactor Milestones publication [1] for three key reasons:

(a) It is important in any major programme to invest wisely and effectively during the initial preparatory stages.

(b) Several Member States requesting guidance and support from the IAEA are in these initial phases of their new research reactor programmes.
(c) Assistance for the assessment of the status of a number of the infrastructure issues during Phase 3 and beyond is already ensured by several other well established IAEA services, assessment tools and methodologies (some of which could be partially applicable also in Phases 1 and 2).

During the assessment process, it is necessary to review progress across all 19 infrastructure issues because each of them is essential and because there are significant relationships between them. For example, the human and financial resources that are required to support each of the infrastructure issues need to be fully integrated. It is for this reason that the assessment approach described in this publication addresses all 19 issues in an equal and consistent manner. Member States wishing to use this publication need to ensure that all 19 issues are reviewed in depth and the results brought together in a final report to provide an integrated view of infrastructure status and any gaps, thereby allowing the country to decide on its readiness to move to the next phase. In general, the scale of a typical research reactor programme requires infrastructure of similar scope, but to a lesser extent than would be the case for a nuclear power programme. Thus, a graded approach needs to be used, i.e. the nuclear infrastructure elements are tailored to the scale of the research reactor programme and the potential hazards of the facility. Through appropriate consideration of all key issues, the infrastructure establishment for the research reactor programme can be simplified whilst maintaining the required high standards for nuclear safety and nuclear security and inspection measures.

1.2. OBJECTIVE

The main objective of this publication is to provide guidance for the assessment of progress in the development of the national nuclear infrastructure to support a new research reactor programme, based on the Research Reactor Milestones publication [1]. It can be used either by a Member State wishing to evaluate its own progress (self-assessment) or as the basis for Integrated Nuclear Infrastructure Review for a new Research Reactor (INIR-RR) missions that, upon a Member State's request, the IAEA may perform to independently assess the status of the infrastructure or the progress made in developing it. The main aims of the assessment process are to:

(a) Allow all research reactor infrastructure issues to be assessed in an equal and consistent manner;
(b) Bring the results together to develop an integrated action plan (IAP) for moving into a subsequent phase of the research reactor programme;
(c) Collect evidence to demonstrate that all work required in the phase leading up to the milestone has been adequately completed;
(d) Demonstrate that the plans for the following phase(s) are well defined, comprehensive and realistic;
(e) Enhance national competence through participation in a comprehensive assessment.

1.3. SCOPE

The scope of this publication is to support the assessment and development of the national nuclear infrastructure needed to realise new research reactor programmes. This scope also covers planning and conducting IAEA INIR-RR missions. In a case where a Member State is planning to embark on both a research reactor programme and a nuclear power programme, this publication intends to ensure that the approach and methodology for the implementation of both programmes is harmonized, efficient and effective.

The issues related to research reactor utilization, operation, spent fuel and waste management, as well as decommissioning, are addressed by this publication to the degree necessary prior to research

reactor commissioning. This publication takes the view that all these issues will be addressed, and the corresponding planning will be in progress by the time the bid invitation is issued or an intergovernmental agreement with the research reactor vendor country is ready to be finalized.

This publication is primarily aimed at Member States developing their first research reactor; however, it could also be useful for the re-assessment of the national nuclear infrastructure for a subsequent research reactor in a country, in particular considering a new research reactor of higher power and therefore of higher potential hazard.

This publication will be used as guidance for the assessment of the status of development of the national infrastructure required for the planning, construction and operation of a new research reactor. However, neither this publication, nor the Research Reactor Milestones publication [1] are intended to provide a comprehensive description of how to establish the entire infrastructure needed for a new research reactor programme. A wealth of information and guidance on each of the infrastructure issues is provided by relevant IAEA publications as well as from relevant reports made available by countries already operating research reactors.

1.4. STRUCTURE

This publication consists of four sections. This introductory Section 1 is followed by Section 2, which summarizes the programme phases and milestones associated with a new research reactor programme. Section 2 also describes the steps of the assessment approach. In Section 3 a detailed basis for assessment of each of the 19 infrastructure issues for Phases 1 and 2 of the programme is provided. Section 4 provides brief guidance for preparing and conducting INIR-RR missions.

1.5. USERS

The primary users of this publication are the national core teams involved and responsible for the new research reactor programme, including the existing or future operating organization, decision makers, advisers and senior managers in the governmental institutions, nuclear safety and nuclear security regulatory authorities, state authority responsible for safeguards implementation, user community representatives and utilization stakeholders (academic and scientific institutions, industries, etc.) of a Member State interested in constructing and operating a research reactor. Other organizations such as donors, suppliers, technical support organizations (TSOs) and emergency response organizations may also use this publication or the results of its application to obtain assurances that a country is adequately developing the infrastructure necessary to regulate, construct, safely and securely operate and efficiently use a research reactor. Intended users of this publication are also the IAEA staff and international experts assigned to prepare and conduct INIR-RR missions.

2. RESEARCH REACTOR PROGRAMME PHASES AND MILESTONES

2.1. SYNERGIES IN DEVELOPING A RESEARCH REACTOR PROGRAMME AND A NUCLEAR POWER PROGRAMME

In 2016, IAEA Member States representatives attending the IAEA Technical Meeting on the Role of Research Reactors in Providing Support to Nuclear Power Programmes concluded that, while

building a domestic research reactor cannot be considered a prerequisite for establishing a nuclear power programme, research reactors can play an important role in supporting new and ongoing nuclear power programmes. The following main areas of contribution were identified:

(a) Research and development;
(b) Human resources development;
(c) Public awareness and confidence building;
(d) Development of other elements of the national infrastructure.

More details on the discussions held and resulting deliberations can be found in Annex II of the IAEA publication on Feasibility Study Preparation for New Research Reactor Programmes [3].

2.2. USE OF THE GRADED APPROACH IN ESTABLISHING A NEW RESEARCH REACTOR

Research reactors are used for special and varied purposes such as research, education and training, radioisotope production, non-destructive testing, materials and nuclear fuel R&D, including nuclear fusion technology, and a number of other applications [4]. These diverse applications call for different design features and different operation regimes. A risk informed analysis of the characteristics, uses and associated facilities of the research reactor influence the scale of the required infrastructure. The guidance provided by this publication will apply to research reactors of all types and sizes, including critical and sub-critical assemblies, with a proper use of a graded approach being proportional to the potential hazards of the research reactor facility under consideration [5–7].

It is important to note that the majority of the infrastructure issues to be developed to support a research reactor programme are similar to those needed to support a nuclear power plant programme [8]. In general, though, the smaller scale of the typical research reactor programme requires infrastructure of a similar scope less extensive than that which would be required for an nuclear power plant programme. Through appropriate consideration of all issues, the infrastructure implementation for a research reactor programme can be simplified without compromising the application of high standards of nuclear safety and nuclear security.

2.3. PHASES AND MILESTONES OF A NEW RESEARCH REACTOR PROGRAMME

The Research Reactor Milestones publication [1] provides an overview of the overall efforts to develop the national infrastructure to support a new research reactor programme. Table 1 and Figure 1 show the various phases of such a programme. The activities are split into three progressive phases of development. The completion of the work of each of these phases is marked by a specific milestone at which the progress and success of the development effort can be evaluated, and a decision made to move on to the next phase. The milestones do not have a specific timeframe; the duration of each phase will depend upon the degree of commitment and resources applied by the Member State, as well as the size and scale of the programme, its complexity (planned experimental facilities, radioisotope production facility, etc.) and the associated potential hazards.

2.3.1. Milestone 1

During Phase 1, a preliminary strategic plan [9], based on quantitative determination of the stakeholders' needs, is completed to justify the construction, future operation and effective utilization of the research reactor. However, to make an informed decision on whether to proceed with the research reactor programme or not, the Member State also needs to develop a comprehensive understanding of the obligations and commitments involved and ensure that there is a long term national strategy and

TABLE 1. INFRASTRUCTURE DEVELOPMENT PHASES AND MILESTONES [1]

Phase	Description	Milestone
(1) Pre-project	Justification of the research reactor and considerations before a decision to launch a research reactor programme is taken	Ready to make a knowledgeable commitment to a research reactor programme
(2) Project formulation	Preparatory work for the establishment of a research reactor after a policy decision has been taken	Ready to invite bids for the research reactor
(3) Implementation	Activities to design and construct a research reactor	Ready to commission and operate a research reactor

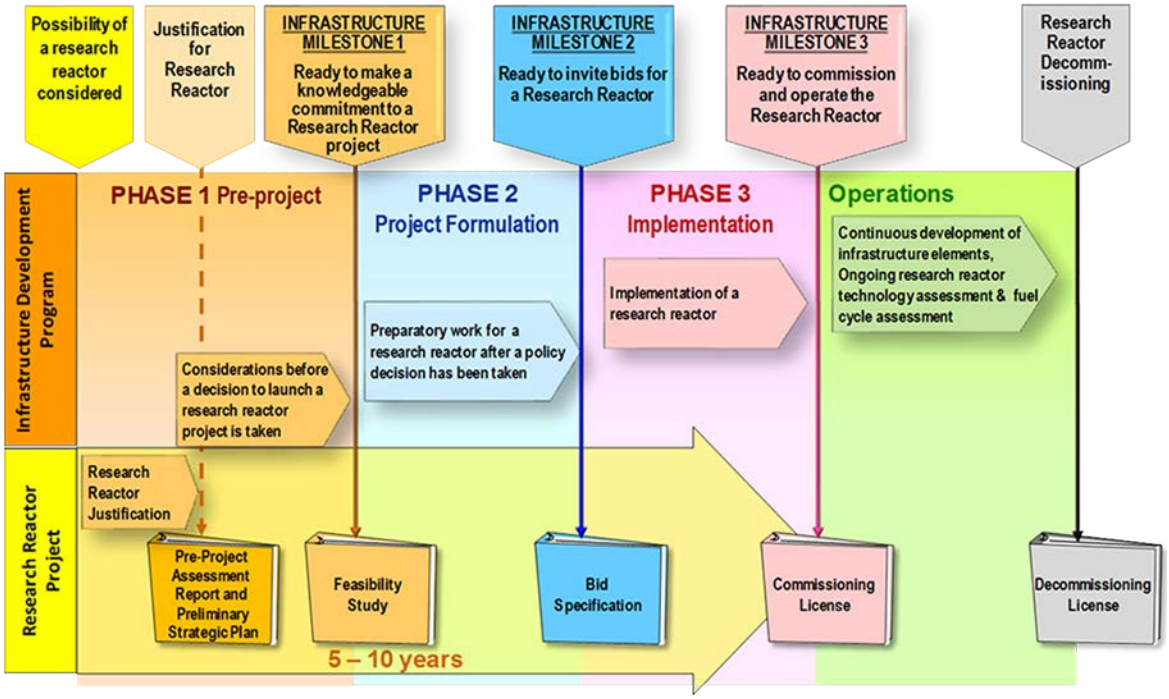

FIG. 1. Milestones for a research reactor programme (reproduced from Ref. [1]).

resources available to meet them. This work will culminate in the attainment of Milestone 1 and the production of the feasibility study report [3]. This publication will incorporate the results of a detailed and comprehensive assessment of the 19 issues of the national infrastructure, including identification of future development needs and means to address these needs, the results of the preliminary strategic plan as well as a cost–benefit analysis of the programme.

2.3.2. Milestone 2

Following the decision to proceed with a new research reactor, substantial work for achieving the necessary level of technical and institutional competence and development of the national infrastructure needs to be undertaken. This second phase requires a significant and continuing commitment from the government and from the future research reactor operating organization. In fact, during this phase, the

Member State will carry out the work required to prepare for the establishment of a research reactor. At the end of Phase 2, the necessary infrastructure needs to be established to the point of complete readiness to enter the bidding process for the procurement of the research reactor or direct negotiations with a vendor [10].

2.3.3. Milestone 3

After the vendor country has been chosen, the third phase of the programme development consists of all the activities necessary to build the new research reactor and complete most of the infrastructure development. During this phase, the greatest capital expenditures will occur. Attention by all involved organizations and stakeholders, who all have important roles to play, is crucial to the successful outcome. At the end of this phase, the research reactor operating organization will have developed from an organization capable of ordering a research reactor to an organization capable of accepting responsibility for commissioning a research reactor and with the capability for future operation.

Procedures and arrangements to ensure safe operation and control of a research reactor under both normal and accidental operation conditions will have been developed as well as the required professional development and training for all levels of staff. While achieving the third milestone is a major accomplishment, it has to be remembered that it is only the beginning of a long lasting commitment to the safe, secure operation and effective utilization of the research reactor for its entire lifetime.

2.4. ASSESSMENT APPROACH

2.4.1. Overview

Self-assessment is encouraged as the first step in any overall review of readiness to proceed to the next phase of the development of a research reactor nuclear infrastructure. Self-assessment is also an essential tool for continuous improvement. Although a self-assessment will be performed by a Member State itself and will include persons that are part of the multiple organizations involved in the programme, consideration needs to be given to augmenting the team by involving consultants and independent experts from within the Member State or from other countries. The key requirement for any assessment is to assign people, internally or externally, who have a good understanding of the research reactor nuclear infrastructure issues and have knowledge and experience in conducting assessment activities.

It is essential that an integrated assessment is carried out across all 19 infrastructure issues both because each one is essential and because there is significant linkage between them, and thus there is a need to fully integrate the management of each infrastructure issue and associated human and financial resources.

It is also necessary to understand the purpose of the assessment at each milestone. At Milestone 1 the assessment is about the quality of information available, the effective investment of resources for informed decision making and the management of programme risk. While a Member State can do less work in Phase 1, this might carry a much greater risk of a decision not being well informed, Phase 2 taking much longer than planned because the necessary issues have not been properly addressed, or of low utilization of the new facility because the utilization stakeholders' involvement was insufficient [3, 9]. The guidance in this publication considers the wide international experience of how best to control the associated risks and plan preventive actions for the research reactor programme.

A Member State considering building its first research reactor is encouraged to make much use of the available international experience and good practices. The use of partnership agreements with countries with experience in research reactor programmes and the use of internationally recognized experts as independent consultants are considered beneficial for the success of the programme. However, it is important to note that any responsibility for readiness to proceed to the next phase remains with the Member State embarking on the research reactor programme.

Following the self-assessment, a Member State is encouraged to request an independent review of their evaluation through an IAEA INIR-RR mission. Such an activity will need to be planned well in advance of its expected date (see Section 4 of this publication).

2.4.2. Evaluation steps

The 19 infrastructure issues will be covered in the Member State's self-assessment to obtain a complete picture of the status and progress of the national infrastructure development. In principle, a self-assessment can be carried out at any time, but this publication assumes that assessments will be carried out at the beginning of Phase 1 (initial self-assessment) and when the development of the research reactor infrastructure is close to one of the identified milestones of Phase 1 or Phase 2.

A comprehensive assessment comprises four main steps:

(1) Defining the terms of reference for the assessment, including the identification of the organizations to be involved and the individuals who will conduct the assessment;
(2) Evaluating the status of development of the research reactor infrastructure against the conditions for Phases 1 and 2 as listed in Section 3 of this publication;
(3) Identifying areas and gaps that need further attention;
(4) Preparing an IAP to address these areas and fill the gaps.

It is recommended that all these steps be undertaken to obtain comprehensive and accurate information of whether the Member State has completed the work across all the infrastructure issues for a particular milestone and to identify any infrastructure gaps and outstanding work to be done.

2.4.3. Documenting the results and the integrated action plan

Following the self-assessment process, the Member State should prepare a self-evaluation report (SER). The SER is expected to contain, as a minimum, the following elements:

- Identification of the 'team of evaluators' by position or role in their respective organizations;
- Identification of the 'team of respondents';
- A description of the process used to conduct the assessment;
- Lists of the evidence reviewed and further actions required;
- Summary and conclusions giving the state of achievement of each condition;
- References to any relevant material used for conducting the assessment;
- Confidentiality requirements, if any.

A tabular format (see Fig. 2 as an example) is expected to be used to collate and summarise in the SER the results of the assessment carried out for each condition related to each infrastructure issue.

To assess overall progress and to assign priorities, each condition should be given a status. Three options are suggested: (a) significant actions needed; (b) minor actions needed; (c) no actions needed (see Section 4 of this publication).

Upon completion of the SER, an IAP needs to be developed. The observations from the SER will be used by the Member State to determine this IAP. Each Member State will decide the most appropriate way to prepare the IAP, but it needs to include:

- The issue being addressed;
- A clear statement of the actions to be taken, showing how they will address the identified shortfall;
- A definition of the objectives, which should be 'SMART' (specific, measurable, achievable, relevant and timely), to be achieved under each action to fulfil the conditions of the issue;
- An agreed completion time for each action;

1. National position **Condition 1.1:** Long term commitment made and importance of safety, security and non-proliferation recognized		**Phase 1**
Basis for evaluation	**Summary of the condition to be demonstrated** A clear statement adopted by the government of its intent to establish a new research reactor and of its commitment to safety, security and non-proliferation, with evidence that their importance is embedded in the ongoing work programme.	
Examples of how the condition may be demonstrated: 1. A clearly stated government commitment 2. Evidence of clear responsibilities for each issue, with government	**EVIDENCE**	
EVALUATION Condition 1.1. **Actions needed**		
Significant	**Minor**	**None**
ACTION PLAN **AP-1.1. No. 1:**		
COMMENTS **CM 1.1. No. 1:**		

FIG 2. Example of a self-assessment form for a selected infrastructure issue (1) and one of the conditions (1.1).

- The organization, function and post holder responsible for the completion of the actions;
- If possible, the budget required to complete the actions.

It is important that the actions are 'owned' by the organization responsible for their completion and that that organization identifies the resources (staff and budget) to complete the actions within the agreed timeframe.

3. BASIS FOR INFRASTRUCTURE ASSESSMENT

3.1. OVERVIEW

The conditions for each infrastructure issue and for each milestone are described in the following series of tables in Sections 3.2 and 3.3, which include examples of evidence to demonstrate the fulfilment of the conditions. Compared with the conditions listed in the IAEA Research Reactor Milestone publication [1], in some cases and for some infrastructure issues, for the sake of clarity, additional conditions have been developed and included as reference for the assessment while other have been modified.

The tables in Sections 3.2 and 3.3 refer to *evidence* and *plans*. Evidence can include laws and decrees, formalized agreements, contracts, reports, meeting notes, correspondence, presentations, conferences attended with meeting reports, discussions held with minutes, personnel curricula,

organization descriptions and job descriptions. Plans need to contain clear actions with associated timeframes, resources required and evidence that they are available. In all cases, documents need to be approved by a person or organization with the appropriate authority.

There are many ways to establish and manage a research reactor programme, for example, own country lead contractor, turnkey, multipackage contract. This publication does not seek to prescribe a particular approach and therefore can be applied as a general approach since the requirements do not change. What may change in some cases is how the conditions are fulfilled, and this is recognized within the detail of the proposed basis.

On completion of the comprehensive assessment, what is clearly required is strong evidence of a holistic approach to information gathering, analysis, resource development and decision making. This view will be obtained by addressing each of the 19 issues and then integrating them into the overall evaluation report.

The proposed methodology and format closely follow the IAEA publication on the Evaluation of the Status of National Nuclear Infrastructure Development for a nuclear power programme [2]. Indeed, in many instances the conditions to achieve the different infrastructure issues are the same or similar, and therefore in such cases the tables in both publications would match one another almost one-to-one.

3.2. EVALUATION OF INFRASTRUCTURE STATUS IN PHASE 1

1. National position	**Phase 1**
Conditions	**Basis for evaluation**
1.1. Long term commitment made and importance of safety, security and non-proliferation recognized	**Summary of the condition to be demonstrated** A clear statement adopted by the government of its intent to establish a new research reactor and of its commitment to safety, security and non-proliferation, with evidence that their importance is embedded in the ongoing work programme.
	Examples of how the condition may be demonstrated (1) A clearly stated government commitment; (2) Evidence of clear government responsibilities for each issue; (3) Commitment to use low enriched uranium for the research reactor fuel and its applications.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NP-T-5.1, Specific Considerations and Milestones for a Research Reactor Project [1] IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]
1.2. Assessment Marketing and Project Team (AMPT) and Research Reactor Programme Implementing Commission (RRPIC) established	**Summary of the condition to be demonstrated** The AMPT[1] and RRPIC[2] (a) Have clear terms of reference that call for a comprehensive review of all the issues relevant to making a decision to proceed with a new research reactor programme; (b) Are recognized by all relevant ministries as having that role; (c) Have appropriate human and financial resources; (d) Involve all relevant stakeholders, including the new research reactor users, the regulatory body for security and radiation safety, other relevant government agencies, legislative representatives and other decision makers.

[1] An RRPIC is to be established to review and accept, as appropriate, recommendations provided by the AMPT and to ensure that the necessary infrastructure and policies are in place prior to the construction of the reactor [1].

[2] An AMPT is to be established to study, develop and promote the research reactor project. Its task include but are not limited to: formulating the justification for the reactor, developing its technical specification and recommending to the government actions that should be taken to reinforce or implement the nuclear infrastructure and policy or intergovernmental issues that should be addressed [1].

1. National position	Phase 1
Conditions	**Basis for evaluation**
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NP-T-5.1, Specific Considerations and Milestones for a Research Reactor Project [1]
1.3. Comprehensive feasibility study performed, documented and the necessary commitments understood	**Summary of the condition to be demonstrated** A comprehensive feasibility study report, defining and justifying a new research reactor; this report will incorporate and update the assessment of the national nuclear infrastructure, the preliminary strategic plan and the cost–benefit analysis and integrate these with the analysis of the obligations, commitments and resources required.
	Examples of how the condition may be demonstrated (1) List of the studies that are feeding into the comprehensive feasibility study; (2) Current status and conclusions; (3) Contents list for the report(s); (4) Executive summary of the report(s); (5) Evidence of RRPIC and ministerial review of the report(s).
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]

2. Nuclear safety	Phase 1
Conditions	**Basis for evaluation**
2.1. Key requirements of nuclear safety understood	**Summary of the condition to be demonstrated** The key requirements for nuclear safety specified in the IAEA safety standards and relevant to research reactors are understood by the RRPIC and AMPT and other relevant stakeholders, and their implications are recognized.
	Examples of how the condition may be demonstrated (1) Evidence that the RRPIC and AMPT have an understanding of, and commitment to, nuclear safety and the principles described in IAEA Safety Standards Series No. SF-1, Fundamental Safety Principles [11], and is aware of how nuclear safety requirements are taken into account in various designs of research reactor; (2) Evidence that the responsibility for nuclear safety is recognized, for example in the consideration of leadership, funding and expertise; (3) Evidence that the need to develop adequate capability and skills in nuclear safety is recognized, including emergency preparedness and response; (4) Evidence of familiarity with IAEA safety standards and other States' practices, and recognition of the need for, and commitment to, the development of national safety standards.
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7]
2.2. Support through international cooperation initiated	**Summary of the condition to be demonstrated** The need for international cooperation and open exchange of information related to nuclear safety as an essential element is recognized and demonstrated.
	Examples of how the condition may be demonstrated (1) Evidence of a review of options for bilateral or regional cooperation and specific actions for selected cooperation started, especially with countries with established research reactors; (2) Implementation of a national technical cooperation programme with the IAEA and evidence of government financial support including for nuclear safety aspects.
2.3. Provisions of the Code of Conduct on the Safety of Research Reactors are understood and have been considered	**Summary of the condition to be demonstrated** The provisions of the Code of Conduct on the Safety of Research Reactors [7] are recognized and commitments to be incorporated in the national safety regulations understood.
	Examples of how the condition may be demonstrated Evidence that the provisions of the Code of Conduct on the Safety of Research Reactors [7] have been integrated into the programme for this milestone since the earliest stages, for example, by demonstrating use of the IAEA safety standards or attending or participating in related IAEA meetings and activities.
	Selected relevant IAEA publication Code of Conduct on the Safety of Research Reactors [7]

3. Management	Phase 1
Conditions	**Basis for evaluation**
3.1. Need for appropriate leadership and management systems recognized	**Summary of the condition to be demonstrated** There is a commitment to leadership and management systems that will ensure success and promote safety and security culture as well as the peaceful use of nuclear technologies. There are plans to ensure the knowledge gained by the RRPIC and AMPT is transferred to the future regulatory body and the owner/operator of the new research reactor.
	Examples of how the condition may be demonstrated (1) Plans to ensure the appointment of leaders with the appropriate training and experience to plan, procure, construct and operate a research reactor as well as to ensure the leadership and management of nuclear safety, security and safeguards; (2) Evidence that the importance of nuclear safety and security culture in each of the organizations to be established is recognized; (3) Evidence that the importance of ensuring the peaceful use of nuclear technology is recognized; (4) Evidence of a clear understanding of management system requirements; (5) A plan to implement management systems in future key organizations is consistent with the appropriate standards and guidance.
	Selected relevant IAEA publications Safety Reports Series No. 75, Implementation of a Management System for Operating Organizations of Research Reactors [12] IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13]

4. Funding and financing	Phase 1
Conditions	**Basis for evaluation**
4.1. Strategies for funding established	**Summary of the condition to be demonstrated** Mechanisms have been defined for funding a range of key activities that are specific to a research reactor programme but may not be the fiscal responsibility of the owner/operator. The activities include: (a) Establishing a legal framework; (b) Activities of the regulatory body for safety, security and safeguards; (c) The government's stakeholder involvement in the programme; (d) Siting and environmental protection activities that are the responsibility of the government; (e) Emergency preparedness and response (EPR); (f) Education, training and research; (g) Any required improvements to the specific infrastructure issues, if such improvements are the government's responsibility; (h) Storage and disposal of radioactive waste, including spent fuel; (i) Decommissioning of the research reactor.
	Examples of how the condition may be demonstrated (1) Clear statements of how the above areas will be funded, based on a consideration of options; (2) Evidence that the scale of the costs of each of these activities has been recognized.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]
4.2. Potential strategies for financing identified	**Summary of the condition to be demonstrated** Potential options have been identified with financial and risk management strategies, which together: (a) Clearly identify the role of the government in financing a research reactor programme; (b) Ensure the long term viability of the owner/operator to fulfil all its responsibilities.
	Example of how the condition may be demonstrated A review of financing options and risk management strategies, considering the long term economics and risks associated with the research reactor. This should include the extent of government funding, equity partners and possible borrowing, among other things.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]

5. Legal framework	Phase 1
Conditions	**Basis for evaluation**
5.1. Adherence to all relevant international legal instruments planned	**Summary of the condition to be demonstrated** There is an understanding of the requirements of the relevant international legal instruments and their implications and a commitment to adhere to them. The following instruments are covered: (a) Convention on Early Notification of a Nuclear Accident (INFCIRC/335) [14]; (b) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (INFCIRC/336) [15]; (c) Code of Conduct on the Safety of Research Reactors [7]; (d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the 'Joint Convention') (INFCIRC/546) [16]; (e) Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1) and Amendment thereto (INFCIRC/274/Rev.1/Mod.1) [17]; (f) Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500) [18]; (g) Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/566) [19]; (h) Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (INFCIRC/402) [20]; (i) Treaty on the Non-Proliferation of Nuclear Weapons (NPT) [21]; (j) The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/153 (Corrected)) [22]; (k) Model Protocol Additional to the Agreement(s) Between States(s) and the International Atomic Energy Agency for the Application of Safeguards (INFCIRC/540 (Corrected)) [23]; (l) Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA [24].
	Examples of how the condition may be demonstrated (a) Plans for when each of the instruments will be adhered to; (b) Identification of the actions that will need to be undertaken and the required timescales; (c) Evidence that the resources required are understood and have been defined.
	Selected relevant IAEA publications Handbook on Nuclear Law [25] Handbook on Nuclear Law: Implementing Legislation [26]

5. Legal framework	Phase 1
Conditions	**Basis for evaluation**
5.2. Plan in place for development of a comprehensive national nuclear law	**Summary of the condition to be demonstrated** There is an understanding of the requirements of the comprehensive national nuclear law that needs to be enacted, a plan with the actions and timescales for development and enactment, together with a commitment from the government to achieve the stated plan. The plan includes the need for the law to: (a) Establish an independent nuclear regulatory body with adequate human and financial resources and a clear and comprehensive set of functions; (b) Identify responsibilities for safety, security and safeguards; (c) Formulate safety principles and rules (for radiation protection, nuclear installations, radioactive waste and spent fuel management, decommissioning, EPR and the transport of radioactive material); (d) Formulate nuclear security principles; (e) Give appropriate legal authority to, and define the responsibilities of, the regulatory body and all competent authorities establishing a regulatory control system (authorization, inspection and enforcement, review and assessment, and development of regulations and guides); (f) Implement IAEA safeguards, including a State system of accounting for and control of nuclear material (SSAC); (g) Implement import and export control measures for nuclear and radioactive material and items; (h) Establish compensation mechanisms for nuclear damage.
	Examples of how the condition may be demonstrated (1) A plan for how the law will be developed and approved; (2) A summary of how each of the areas listed above will be addressed within the law; (3) Interactions with the IAEA and the other relevant organizations.
	Selected relevant IAEA publications Handbook on Nuclear Law [25] Handbook on Nuclear Law: Implementing Legislation [26]

5. Legal framework	Phase 1
Conditions	**Basis for evaluation**
5.3. Plans in place to enact and/or amend other legislation affecting the research reactor programme	**Summary of the condition to be demonstrated** There is an understanding of which legislation that affects the research reactor programme needs to be enacted and/or amended and timescales for its development and approval, together with a commitment from the government to achieve the stated plan. The subjects of the legislation to be considered include: (a) Environmental protection; (b) EPR; (c) Occupational health and safety of workers; (d) Protection of intellectual property; (e) Local land use controls; (f) Foreign investment; (g) Roles of national and local governments; (h) Stakeholders and public involvement; (i) International trade and customs; (j) Financial guarantees and any other required financial legislation; (k) R&D.
	Examples of how the condition may be demonstrated (1) A plan for how the legislation will be developed and approved; (2) A summary of how each of the areas listed above will be addressed within the proposed legislation; (3) Interactions with the IAEA and the other relevant organizations.
	Selected relevant IAEA publications Handbook on Nuclear Law [25] Handbook on Nuclear Law: Implementing Legislation [26]

6. Safeguards	Phase 1
Conditions	**Basis for evaluation**
6.1. Terms of international safeguards agreement in place	**Summary of the condition to be demonstrated** (a) The Member State has a comprehensive safeguards agreement with associated subsidiary arrangements in force with the IAEA. (b) If the Member State currently has concluded a small quantities protocol to its comprehensive safeguards agreement, a plan needs to be developed setting out the necessary steps to rescind the small quantities protocol in a timely manner. (c) The Member State is aware of the requirements of the additional protocol; if the Member State has made the decision to ratify the additional protocol but has not already done so, a plan is in place for the timely ratification.
	Examples of how the condition may be demonstrated (1) Plans for rescinding the small quantities protocol and/or for ratification of the additional protocol, including the actions that need to be taken, clear assignment of responsibilities and understanding of the resources and the required timescales; (2) Evidence that the need for outreach activities is recognized to ensure that all existing and future entities having to report to the State authority for safeguards are aware of their roles and obligations.
	Selected relevant IAEA publications IAEA Services Series No. 21, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols [27] IAEA Services Series No. 22, Safeguards Implementation Guide for States with Small Quantities Protocols [28]
6.2. Strengthening of the SSAC planned	**Summary of the condition to be demonstrated** The Member State has a plan describing how the existing SSAC will be strengthened or adjusted to deal with the increase of activities and resources, as well as the need for enhancement of capabilities.
	Examples of how the condition may be demonstrated (1) The RRPIC and AMPT include a representative knowledgeable in the requirements of the comprehensive safeguards agreement; (2) A plan produced by the RRPIC and AMPT covering the enforcement of national legislation, policies and procedures relevant to safeguards; the development of the legislation itself is covered under issue no. 5, legal framework; (3) Evidence that approaches undertaken by one or more States with existing research reactors have been reviewed and the information gained has been adapted for the national context.

6. Safeguards	Phase 1
Conditions	**Basis for evaluation**
	Selected relevant IAEA publications IAEA Services Series No. 21, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols [27] IAEA Services Series No. 15, Nuclear Material Accounting Handbook [29] IAEA Services Series No. 30, Safeguards Implementation Practices Guide on Facilitating IAEA Verification Activities [30] IAEA Services Series No. 13, ISSAS Guidelines: Reference Report for IAEA SSAC Advisory Service [31] IAEA Services Series No. 31, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure [32]
6.3. Recommendations from any previous reviews or audits being addressed	**Summary of the condition to be demonstrated** If any reviews or audits have been undertaken of the existing safeguards provisions, there should be evidence that the actions resulting from them are progressing.
	Example of how the condition may be demonstrated Action plans resulting from a review or audit with progress identified indicating the required timescales, responsibilities and resources required.
	Selected relevant IAEA publications IAEA Services Series No. 21, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols [27] IAEA Services Series No. 22, Safeguards Implementation Guide for States with Small Quantities Protocols [28] IAEA Services Series No. 15, Nuclear Material Accounting Handbook [29] IAEA Services Series No. 30, Safeguards Implementation Practices Guide on Facilitating IAEA Verification Activities [30]

7. Regulatory framework	Phase 1
Conditions	**Basis for evaluation**
7.1. Development of an adequate regulatory framework planned	**Summary of the condition to be demonstrated** The prospective senior managers of the regulatory body have been identified. There are plans to develop a regulatory framework for nuclear safety, nuclear security and safeguards that matches the overall plan for the research reactor programme, and includes: (a) Designation of an effectively independent competent regulatory body with clear authority, adequate human and financial resources, and strong government support; (b) Assignment of core safety, security and safeguards regulatory functions for developing regulations, review and assessment, authorization, inspection, enforcement and public information; (c) Authority and resources to obtain technical support as needed; (d) A clear definition of the relationship of the regulatory body to other organizations (e.g. TSOs and the environmental agency); (e) Clearly defined responsibilities of licensees; (f) Authority to implement international obligations, including IAEA safeguards; (g) Authority to engage in international cooperation; (h) Provisions to protect proprietary, confidential and sensitive information; (i) Provisions for stakeholder and research reactor users' involvement and communication with the public. There are agreed terms of reference for each regulator and a clear definition of roles of, and interfaces with, other regulators. There is recognition of the need for integrating existing security and radiation safety regulations with new regulations for research reactors. Plans to develop competence are addressed under infrastructure issue no. 10, human resource development.
	Examples of how the condition may be demonstrated (1) Evidence of what has been done, or is planned to be done, to develop the experience of the senior regulators; (2) Proposals on the overall approach to assessment, licensing, inspection and enforcement, among other things; (3) Plans to develop the regulatory body for safety, security and safeguards; (4) Plans to develop the required regulations; (5) Evidence of interaction and cooperation with established regulatory organizations; (6) Plans to secure assistance from international regulatory organizations or TSOs.
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Services Series No. 31, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure [32] IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), Governmental, Legal and Regulatory Framework for Safety [33]

8. Radiation protection[3]	Phase 1
Conditions	**Basis for evaluation**
8.1. Enhancements to radiation protection programmes planned	**Summary of the condition to be demonstrated** The needed enhancements to the existing radiation protection programme to address research reactor operation have been identified, including consideration of transport of radioactive materials and radioactive waste management. They consider both the increase in scale and the need to cover new technical issues. This issue is closely linked to infrastructure issue no. 7, regulatory framework, in particular regarding the development of regulations and whether the existing regulatory body will expand its role or whether the infrastructure issues will be addressed by a separate organization.
	Examples of how the condition may be demonstrated (1) Evidence of discussions with specialists from other countries; (2) Identification of the main areas requiring enhancement; (3) Recognition that additional competences will be required to review proposed designs against the requirement to control contamination and to optimize safety and protection in accordance with the radiation protection principles; (4) Recognition that the programme for dose assessment will need to be significantly expanded; (5) Plans for who will be responsible for the radiation protection programme.
	Selected relevant IAEA publication IAEA Safety Standards Series No. GSG-8, Radiation Protection of the Public and the Environment [34]

[3] This covers protection of workers and the public on-site during planned operation. Off-site releases from planned operation are addressed in infrastructure issue no. 13, environmental protection; and accidental releases and associated radiation protection are addressed in infrastructure issue no. 14, emergency preparedness and response.

9. Utilization[4]	Phase 1
Conditions	**Basis for evaluation**
9.1. Stakeholders and users identified and consulted	**Summary of the condition to be demonstrated** The stakeholders and users of a research reactor were identified and consulted, their needs analysed and quantified. The mechanisms to adapt the reactor mission to evolving stakeholder and user needs were addressed.
	Examples of how the condition may be demonstrated (1) A justifiable list of the entities regarded as stakeholders and users is available and is complete; (2) A methodology (e.g. a questionnaire that has been distributed and evaluated) for interaction between the future research reactor operating organization and the identified stakeholders and users has been developed; (3) A document reporting on the assessment of stakeholders' and users' needs has been prepared for initial evaluation regarding sufficiency and the proposed time schedule.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.3, Applications of Research Reactors [4] IAEA Nuclear Energy Series No. NG-T-3.16, Strategic Planning for Research Reactors [9]
9.2. Range of potential utilization of the research reactor studied	**Summary of the condition to be demonstrated** The functional specifications for the research reactor and its facilities were developed based on the assessment of stakeholder and user needs. A full evaluation of the proposed initial capabilities of the research reactor and its facilities as well as the potential evolution during its lifetime are developed and documented.
	Examples of how the condition may be demonstrated (1) Documentation of the assessed stakeholder and user needs for the initial application of the research reactor and its facilities is available; (2) A further evaluation of the potential capabilities of the research reactor as well as flexibility in design requirements to meet this are documented.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.3, Applications of Research Reactors [4] IAEA Nuclear Energy Series No. NG-T-3.16, Strategic Planning for Research Reactors [9]
9.3. The rationale for the research reactor and its facilities are confirmed	**Summary of the condition to be demonstrated** The rationale on the purpose and feasibility of the proposed research reactor and its required auxiliaries and ancillaries have been presented, debated on, prioritized and accepted by the RRPIC.

[4] This issue is closely linked to infrastructure issue no. 1, National position, condition no. 1.3. comprehensive feasibility study performed, documented and the necessary commitments understood, and issue no. 11, stakeholder involvement.

9. Utilization	Phase 1
Conditions	**Basis for evaluation**
	Examples of how the condition may be demonstrated (1) A draft preliminary strategic plan has been prepared and presented as part of the feasibility study for the proposed research reactor and, among other items, includes: • Evaluation of stakeholder and user needs (immediate and future); • A list of the identified and prioritized products and services of theresearch reactor; • Identification of the functional specification of the research reactor and its facilities; • A description of the role of the research reactor in the regional and international contexts and the considerations for regional and international cooperation. (2) Evidence of RRPIC's statement accepting and approving the rationale on the purpose and feasibility of a new research reactor.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.3, Applications of Research Reactors [4] IAEA Nuclear Energy Series No. NG-T-3.16, Strategic Planning for Research Reactors [9]

10. Human resource development	Phase 1
Conditions	**Basis for evaluation**
10.1. Necessary knowledge and skills identified, and gaps in current capability assessed	**Summary of the condition to be demonstrated** A broad assessment of the typical staffing needs of each of the key organizations and their technical support has been completed together with an assessment of improvements required to the current capability of the country to meet the programmes need. The assessment covers the full range of scientific, technical, managerial and administrative disciplines, and considers: (a) Current human resource competences and capabilities; (b) Estimated required competence and capability; (c) The availability of domestic and foreign capacity for education and training; (d) Which facilities and programmes need to be established for education, training and experience building; (e) Which research capability needs to be developed; (f) A senior leaders' development programme.
	Examples of how the condition may be demonstrated (1) An analysis identifying the competences and number of staff needed, covering all the future organizations. The analysis needs to include a breakdown by knowledge, skills and discipline per phase. (2) An assessment of the capability of existing education and training facilities.
	Selected relevant IAEA publications Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13] IAEA Safety Standards Series No. NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors [35]
10.2. Development of human resources planned	**Summary of the condition to be demonstrated** Outline plans have been agreed to: (a) Enhance national education and training; (b) Develop a detailed human resource development plan for each key organization.
	Examples of how the condition may be demonstrated (1) Plans to develop human resources required including: (a) Identification of national organizations that could support human resource development; (b) Enhancement of education and training infrastructure; (c) Development of national competences (through schools, universities, institutes and industry); (d) Non-national human resources that are needed to augment national resources and how they will be secured; (e) International cooperation and vendor support; (f) Leadership development. (2) Strategies for the recruitment and retention of staff. (3) Recognition of the need for qualification and certification programmes for personnel. (4) Evidence that key stakeholder organizations have participated in the development and review of the plans.

10. Human resource development	Phase 1
Conditions	**Basis for evaluation**
	Selected relevant IAEA publications Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13] IAEA Safety Standards Series No. NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors [35]

11. Stakeholder involvement[5]	Phase 1
Conditions	**Basis for evaluation**
11.1. Open and transparent stakeholder involvement programme initiated	**Summary of the condition to be demonstrated** Stakeholder involvement strategy and plan, with the required resources and competence, implemented by the AMPT, with the endorsement of the RRPIC, based on transparency and openness. The public and other relevant interested parties receive information about the benefits and risks of research reactors.
	Examples of how the condition may be demonstrated (1) A clear mandate for the AMPT to engage with stakeholders; (2) Actions to disseminate information in the context of the national nuclear science and technology roadmap, needs for research reactor products and services, pros and cons for alternative technologies, using a range of effective tools; (3) Evidence of a professional communication team available to the AMPT, with appropriate financial resources; (4) Approaches to address public concerns, including waste management and severe accidents; (5) Evidence of activities at the local, regional and national level; (6) A plan for ongoing interaction with the public, in particular, opinion leaders, media, local and national governmental officials and neighbouring countries.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]

[5] This issue is closely linked to infrastructure issue no. 9, utilization, and condition no. 9.1. stakeholders and users identified and consulted.

12. Site survey, site selection and evaluation	Phase 1
Conditions	**Basis for evaluation**
12.1. General survey of potential sites conducted, and candidate sites identified	**Summary of the condition to be demonstrated** Exclusion and avoidance criteria (covering safety, security, cost, socioeconomic issues, engineering and the environment) have been identified and a regional analysis to identify candidate sites has been conducted. The analysis includes the impact of external hazards on security and emergency response capability. Consultations with stakeholders have been part of the process.
	Examples of how the condition may be demonstrated (1) A report covering: (a) Safety and security criteria for initial research reactor site selection; (b) National criteria (e.g. socioeconomic and environmental); (c) Engineering and cost criteria. (2) An assessment report issued and approved identifying: (a) Regional analysis and identification of potential sites; (b) Screening of potential sites and selection of candidate sites. (3) Evidence that the human resources that were used for research reactor site selection are competent and have experience with research reactor site selection. (4) Plans for the work that will be required in Phase 2 to select and justify the site. (5) Evidence that safety and security related activities conducted (e.g. site evaluation and environmental impact studies) are included within the framework of an effective management system.
	Selected relevant IAEA publications The IAEA Safety Standards Series No. NS-R-3 (Rev. 1), Site Evaluation for Nuclear Installations [36] IAEA Safety Standards Series No. SSG-35, Site Survey and Site Selection for Nuclear Installations [37]

13. Environmental protection[6]	Phase 1
Conditions	**Basis for evaluation**
13.1. Environmental requirements considered	**Summary of the condition to be demonstrated** The RRPIC has considered the main environmental requirements related to the siting of a research reactor, including land use, water use, water quality and the impacts of low level radioactive effluents.
	Examples of how the condition may be demonstrated (1) Identification of key requirements for siting and during construction; (2) Evidence of discussions by specialists with States operating research reactors; (3) Evidence that the non-radiological environmental issues, such as water use, transport of materials, disposal of hazardous waste, additional environmental monitoring requirements and construction impact, have been considered and taken into account by the RRPIC.
13.2. Framework for environmental protection reviewed	**Summary of the condition to be demonstrated** The RRPIC has reviewed the suitability of the State's existing framework for environmental protection and for meeting its international obligations.
	Examples of how the condition may be demonstrated (1) Procedures developed for the elaboration, reporting and assessment of environmental studies for nuclear and other related facilities; (2) Evidence of interactions by specialists with countries operating research reactors.

[6] This covers off-site releases from planned operation and all other environmental issues. Protection of workers and the public on-site during planned operation is addressed in infrastructure issue no. 8, radiation protection. Accidental releases and radiation are addressed in infrastructure issue no. 14, emergency preparedness and response.

14. Emergency preparedness and response	Phase 1
Conditions	**Basis for evaluation**
14.1. Requirements of and resources for developing an emergency response capability recognized	**Summary of the condition to be demonstrated** (a) The RRPIC is aware of the EPR arrangements and capabilities that will be required for the research reactor programme. It has evaluated existing EPR arrangements and capabilities in the country and is aware of the major gaps that will need to be addressed. (b) The RRPIC has identified the main organizations and resources that will need to be involved in the establishment of adequate national EPR capabilities. (c) The lead for the execution of the action plan and the action plan coordination framework has been identified. The process of developing adequate EPR will be initiated in Phase 2 and will be largely carried out in Phase 3. The requirements of the conventions on early notification and assistance are covered under infrastructure issue no. 5, legal framework.
	Example of how the condition may be demonstrated A report summarizing existing EPR arrangements and capabilities and identifying those to be enhanced and/or developed as well as identifying the main organizations and resources that will need to be involved in the establishment of adequate national EPR capabilities.
	Selected relevant IAEA publications IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency [38] IAEA Safety Standards Series No. GSG-2, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency [39] IAEA Safety Standards Series No. GS-G-2.1, Arrangements for Preparedness for a Nuclear or Radiological Emergency [40] IAEA Safety Standards Series No. GSG-11, Arrangements for the Termination of a Nuclear or Radiological Emergency [41]
14.2. Recommendations from any previous reviews or audits being addressed.	**Summary of the condition to be demonstrated** If any reviews or audits have been undertaken of the existing framework, there is evidence that the actions resulting from it are progressing.
	Example of how the condition may be demonstrated Presentation of any action plans resulting from a review or audit with progress identified.

15. Nuclear security	Phase 1
Conditions	**Basis for evaluation**
15.1. Nuclear security requirements recognized, and the actions of all relevant organizations coordinated	**Summary of the condition to be demonstrated** The RRPIC and AMPT recognize the importance of nuclear security, based on a national threat assessment and principles of prevention, detection and response. All competent authorities that are involved in nuclear security have been identified and there is a coordinating body or mechanism established that brings together all of the organizations that have responsibility for nuclear security. The need to establish legislation and a regulatory framework is addressed under infrastructure issues no 5 and 7, legal framework and regulatory framework, respectively.
	Examples of how the condition may be demonstrated (1) Evidence of familiarity with IAEA Nuclear Security Series publications and other States' practices; (2) Clear identification of all organizations that have roles and responsibilities for nuclear security and of the work that will need to be carried out in the subsequent phases; (3) Evidence that nuclear security considerations for siting have been defined and have been considered as part of the siting assessment (see infrastructure issue no. 12, site and supporting facilities); (4) Evidence that international cooperation and assistance is being used; (5) Evidence that the need to address the interface of nuclear security with safety and safeguards is recognized.
	Selected relevant IAEA publication IAEA Nuclear Security Series No. 19, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme, paras 2.1–2.10, 4.1, 4.2, 4.26, 4.53, 5.4, 5.7–5.8, 6.1 and 6.3 [42]
15.2. Recommendations from any previous reviews or audits being addressed	**Summary of the condition to be demonstrated** If any reviews or audits have been undertaken of the existing framework, there is evidence that the actions resulting from it are progressing.
	Example of how the condition may be demonstrated Presentation of any action plans resulting from a review or audit with progress identified

16. Nuclear fuel cycle	Phase 1
Conditions	**Basis for evaluation**
16.1. Options for nuclear fuel cycle (front end and back end) considered	**Summary of the condition to be demonstrated** At a strategic level, options have been considered for the front end and back end of the fuel cycle. For the front end, fuel supply and/or manufacture have been addressed. For the back end of the fuel cycle, spent fuel storage needs and capacities, possible reprocessing or return to the country of origin of the spent reactor fuel have been considered.
	Examples of how the condition may be demonstrated (1) A document: (a) Identifying potential sources of supply and services for the reactor fuel; (b) Assessing available options for a national fuel cycle strategy, taking into account non-proliferation issues, including the use of low enriched uranium as fuel. (2) A document clearly demonstrating that the RRPIC and AMPT understand the long term commitments related to the back end of the nuclear fuel cycle and have considered the options and their implications (e.g. it addresses the need for adequate capacity for spent fuel storage at the reactor site, the possibility of interim storage of spent fuel at a dedicated facility and any plans for reprocessing or return to the country of origin). (3) Clear allocation of responsibilities for development of the fuel cycle policy and strategy (front end and back end) to be undertaken during Phase 2.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NW-T-1.11, Available Reprocessing and Recycling Services for Research Reactor Spent Nuclear Fuel [43]

17. Radioactive waste management	Phase 1
Conditions	**Basis for evaluation**
17.1. The requirements for management of radioactive waste from research reactors recognized	**Summary of the condition to be demonstrated** The RRPIC and AMPT understand the significantly increased requirements for the processing, storage and disposal of high, intermediate and low level radioactive waste from a research reactor, and have developed options for the management of radioactive waste, taking into account existing arrangements.
	Example of how the condition may be demonstrated A document addressing possible approaches to the management of radioactive waste arising from research reactor operation and decommissioning, the capabilities and resources needed, and the options and technologies for its processing, handling, storage and disposal.[7]
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NW-G-1.1, Policies and Strategies for Radioactive Waste Management [44]
17.2. Options for disposal of all radioactive waste categories understood	**Summary of the condition to be demonstrated** The RRPIC and AMPT understand the options for disposal of each of the different waste categories. Although the specific routes for disposal of the different waste categories can be decided later, the need to select and plan for adequate options is recognized.
	Example of how the condition may be demonstrated A document indicating that the RRPIC and AMPT understand options for disposal of different radioactive waste categories and options for funding these activities.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NW-G-1.1, Policies and Strategies for Radioactive Waste Management [44] IAEA Safety Standards No. SSG-40, Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors [45]

[7] Regulatory framework and financing schemes are addressed under infrastructure issues Nos 7 and 4, regulatory framework, and funding and financing, respectively.

18. Industrial involvement	Phase 1
Conditions	**Basis for evaluation**
18.1. National policy with respect to domestic industrial involvement considered	**Summary of the condition to be demonstrated** A recommended policy for national involvement, covering availability of expertise, industrial capability and technical services for the research reactor programme; the balance between capability, quality standards and intended industrial development should be recognized.
	Examples of how the condition may be demonstrated (1) A survey of companies with the potential to participate in the research reactor project for construction, equipment provision or support services, with a review of their ability to satisfy the requirements of a research reactor project. (2) Meetings with, or training of, potential suppliers to explain standards and qualifications required, review feasibility of involvement, and identify required actions and funding requirements.

19. Procurement	Phase 1
Conditions	**Basis for evaluation**
19.1. Requirements and procedures for purchasing research reactor recognized	**Summary of the condition to be demonstrated** Recognition of the requirements and procedures associated with purchasing a research reactor and associated facilities.
	Examples of how the condition may be demonstrated (1) Appropriate procurement of consulting services in Phase 1; (2) Evidence that the issues related to services for Phase 2 activities are recognized, allowing for both national and foreign suppliers.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.6, Technical Requirements in the Bidding Process for a New Research Reactor [10]

3.3. EVALUATION OF INFRASTRUCTURE STATUS IN PHASE 2

1. National position	Phase 2
Conditions	**Basis for evaluation**
1.1. Government support role defined and effective	**Summary of the condition to be demonstrated** The government has approved a research reactor programme, with a clear commitment to safety, security and non-proliferation. The AMPT and RRPIC continues to ensure that the work to develop the nuclear infrastructure is coordinated and a government ministry has been assigned the responsibility to support the development of the programme to ensure that: (a) All the government actions needed to support the programme are monitored and coordinated with the programme schedule; (b) A policy for nuclear fuel cycle, radioactive waste management and decommissioning is established; (c) Safety, security and safeguards responsibilities are formulated and understood by all relevant organizations; (d) The country fully participates in the relevant activities associated with the global nuclear safety and security and non-proliferation regime.
	Examples of how the condition may be demonstrated (1) Evidence that an ongoing government role for research reactor programme implementation has been clearly defined and established. (2) Evidence that the required government actions are monitored and coordinated with the programme schedule. (3) Appropriate bilateral agreements in place with vendor countries (e.g. an intergovernmental agreement). These may not be complete at the end of Phase 2 or may be subject to review given that the detailed contract may still need to be agreed. (4) A defined responsibility for formulating a strategy for fuel cycle and radioactive waste management. (5) Examples of how the country participates in the global nuclear safety, security and safeguards regime.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No.NP-T-5.1, Specific Considerations and Milestones for a Research Reactor Project [1] IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]
1.2. Overall strategic approach established for contracting for the research reactor	**Summary of the condition to be demonstrated** The State has a clear justification for its research reactor programme, has established a strategy for developing contract arrangements for the research reactor and has a rationale supporting the decision. The strategy may include requesting bids for more than one option.
	Examples of how the condition may be demonstrated (1) Document reviewing contracting strategies and justifying the chosen approach with evidence that the chosen strategy is consistent with national legislation and has been agreed to by all relevant stakeholders. (2) Implications recognized, and plan to fulfil necessary requirements in place. Document setting out responsibilities of key national organizations and intended contracting strategy.

1. National position	Phase 2
Conditions	**Basis for evaluation**
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.6, Technical Requirements in the Bidding Process for a New Research Reactor [10]
1.3. Commitments and obligations of owner, operator and regulatory body established	**Summary of the condition to be demonstrated** The owner, operator and regulatory body have been established and the responsibilities of each organization have been clearly defined and understood, including their safety, security and safeguards responsibilities. The role of any national supporting organization (e.g. a TSO) has been clearly defined, as has any significant role for non-national organizations (e.g. vendor or other regulator). The latter is clearly defined in the contracting strategy.
	Examples of how the condition may be demonstrated (1) Roles and responsibilities clearly defined with respect to nuclear safety, security and safeguards in the operating and regulatory organizations as well as TSOs as needed. (2) Definition of the organization that will be the licensee of the research reactor and evidence of adequate resources to comply with licence requirements. Definition of the roles and responsibilities of the owner if different from the operator. (3) Definition of any intended regulatory collaboration.
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), Governmental, Legal, and Regulatory Framework for Safety [33]

2. Nuclear safety	Phase 2
Conditions	**Basis for evaluation**
2.1. Safety responsibilities of key organizations recognized	**Summary of the condition to be demonstrated** The government has expanded its nuclear safety policy and strategy to include a research reactor. The owner/operator and regulatory body have a detailed understanding of safety standards and have begun the task of understanding the safety basis of a research reactor. Senior positions in the owner/operator and regulatory body have been filled and the leadership of both the owner/operator and the regulatory body have initiated programmes and practices to build a safety culture in their respective organizations. They have also agreed on a protocol for communication between owner/operator, regulatory body and vendor that covers correspondence, meetings and actions, among other things. The regulatory body has specified requirements on how the competence of owner/operator staff in positions related to safety is ensured. The owner/operator, the regulatory body and external support organizations, as appropriate, have the expertise to prepare for the review of safety assessments supplied by the vendor**.**
	Examples of how the condition may be demonstrated; (1) Nuclear safety principles and requirements developed by regulatory body and owner/operator; (2) Appropriate training for regulators, owner/operators and technical specialists carried out; (3) Knowledge of international experience that is relevant to research reactor designs being considered; (4) For key leadership positions, a summary of research reactor safety related experience and development; (5) Programmes being developed to promote safety culture through leadership; (6) Protocol agreed for interactions between owner/operator and regulator as well as TSOs, as applicable; (7) Process and responsibilities defined for review and understanding of information supplied by vendor during construction.
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), Governmental, Legal, and Regulatory Framework for Safety [33]
2.2. Expectations for relationship with suppliers established	**Summary of the condition to be demonstrated** Future role of the vendor, or other bodies, in supporting safe operation has been defined by the owner/operator (e.g. any design authority role or support role in managing emergency situations). Training requirements from the vendor or other bodies have also been defined.
	Example of how the condition may be demonstrated Statements defining the required levels of support from the vendor and other bodies and mechanisms for information exchange, training and technical support, among other things.

3. Management	Phase 2
Conditions	**Basis for evaluation**
3.1. Contract specifications and evaluation criteria determined	**Summary of the condition to be demonstrated** If competitive bidding for a research reactor is being undertaken, a detailed bid invitation specification (BIS) has been completed, together with the criteria that will be used to evaluate the bids. If the vendor has already been selected (e.g. by an intergovernmental agreement), the customer has included its requirements in the specifications for negotiating with a sole supplier.[8] Negotiating strategy and criteria have also been developed.
	Examples of how the condition may be demonstrated (1) Documented BIS available and evaluation criteria clearly defined; (2) Description of the negotiating strategy defined by the research reactor owner/operator.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NP-T-5.6, Technical Requirements in the Bidding Process for a New Research Reactor [10]
3.2. Owner/operator competence for procuring and managing the research reactor contract evident. Plans to develop operator competence available.	**Summary of the condition to be demonstrated** The owner/operator team is competent to manage the procurement requirements and to ensure the contract requirements are fully met. This will include verification of programme progress and quality requirements. The owner/operator needs to have plans to develop the capability for safe and secure operation, including: (a) Recruiting and training staff; (b) Procedures to ensure that knowledge critical to safe and secure operation will be preserved; (c) Procedures to create the required awareness regarding the risk of proliferation of nuclear weapons through export or import.
	Examples of how the condition may be demonstrated (1) Description of organization including roles and responsibilities of departments and individuals with respect to bid assessment, supervision of construction, development of knowledge base, understanding of operating and maintenance requirements. (2) Evidence of a suitably qualified and experienced team with competence in all required areas, including: (a) Bid requesting and bid evaluation; (b) Awarding, issue of purchase orders; (c) Financing, letter of credit, taxes; (d) Quality programmes, including inspection of items under manufacturing, testing and receipt of goods, non-conformance procedures; (e) Transportation, insurance, customs clearing; (f) Types of proven designs of research reactors and potential suppliers; (g) Main technical characteristics of research reactor related facilities; (h) Codes and standards; (i) Contracting methodologies; (j) Programme management, manufacturing schedule and delivery time.

[8] The rest of this publication refers to BISs, which are applicable to a country using a competitive bidding process. A country using an intergovernmental agreement, strategic partner or sole supplier, instead of a competitive process, needs to therefore interpret BISs as specifications for negotiating with a sole supplier.

3. Management	Phase 2
Conditions	**Basis for evaluation**
	(3) Plans to develop: (a) Programme reporting mechanisms; (b) Acceptance procedures and criteria; (c) Commissioning skills; (d) The organization that will be required for commissioning and operating the research reactor; (e) Commissioning, operating and maintenance procedures. (4) Interfaces with other organizations defined and agreed. (5) Evidence that appropriate staff have gained experience from operating research reactors similar to those being considered.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NP-T-5.6, Technical Requirements in the Bidding Process for a New Research Reactor [10]
3.3. Management systems established	**Summary of the condition to be demonstrated** Management systems have been defined for each of the three key organizations and include roles, responsibilities, organizational structure and processes (for Phase 2) including record keeping. The processes for Phase 3 are in place or planned to be produced. The management systems cover safety, nuclear security and safeguards and are consistent IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13]. The systems promote a strong safety and security culture, include plans for self- and independent evaluation and include procedures to ensure that knowledge critical to the safe, secure and peaceful use of nuclear energy will always be preserved. For the owner/operator and the regulatory body, they also include mechanisms to monitor the programme for infrastructure development and ensure it is consistent with the programme schedule.
	Examples of how the condition may be demonstrated (1) For each organization, availability of the Integrated Management System manual, definition of key processes and responsibilities and plans to produce required detailed documentation; (2) Mechanism for owner/operator, the regulatory body and other relevant national authorities to manage the infrastructure development programme.
	Selected relevant IAEA publications Safety Reports Series No. 75, Implementation of a Management System for Operating Organizations of Research Reactors [12] IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13]

4. Funding and financing	Phase 2
Conditions	**Basis for evaluation**
4.1. Funding plan available	**Summary of the condition to be demonstrated** The means by which costs that are not the fiscal responsibility of the owner/operator have been identified. Depending on the contracting model, these may include costs associated with legislation, setting up the owner/operator, education, training, research, government roles (e.g. site characterization, environmental assessment process, stakeholder involvement), the regulatory body, EPR, spent fuel and radioactive waste management and decommissioning.
	Examples of how the condition may be demonstrated (1) Mechanisms for funding of the regulatory body established; (2) Proposed means for funding spent fuel and radioactive waste management and decommissioning identified; (3) Phase 3 funding plan matched to research reactor programme plan including all national commitments for participation in construction, owner/operator costs, regulator costs, other stakeholders, and EPR.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]
4.2. Means of financing established and strategy for management of financial risks available	**Summary of the condition to be demonstrated** A credible feasibility study has been finalized and realistic financing options for the research reactor have been identified. An owner/operator financial team has been established, competent to evaluate and/or negotiate financing offers, analyse the extent of, and risks associated with, any State backed research reactor products and services purchase agreement and/or sovereign guarantees and identify and analyse additional financial risks. A clear sense of what is acceptable to senior decision makers is available. The financial risks have been clearly identified and a strategy for negotiation and/or evaluation of key finance related proposals has been developed.
	Examples of how the condition may be demonstrated (1) Document identifying how the programme will be financed and demonstrating the financial viability of the programme. (2) Risk management proposals identifying all the key financial risks, and how they can be addressed through contracts and/or guarantees. These need to cover operational difficulties, public liabilities, delays in construction, regulatory delays and government/public intervention. (3) A negotiating mandate and/or more detailed guidance based, for example, on the high level terms in an intergovernmental agreement (if applicable).
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]

5. Legal framework	Phase 2
Conditions	**Basis for evaluation**
5.1. International legal instruments governing nuclear activities adhered to	**Summary of the condition to be demonstrated** The State has adhered to the following international legal instruments and is following an action plan for their implementation: (a) Convention on Early Notification of a Nuclear Accident (INFCIRC/335) [14]; (b) Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (INFCIRC/336) [15]; (c) Code of Conduct on the Safety of Research Reactors [7]; (d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the 'Joint Convention') (INFCIRC/546) [16]; (e) Convention on the Physical Protection of Nuclear Material (INFCIRC/274/Rev.1) [17] and Amendment thereto (INFCIRC/274/Rev.1/Mod.1) [17]; (f) Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/500) [18][9]; (g) Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (INFCIRC/566) [19]; (h) Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (INFCIRC/402) [20]; (i) Treaty on the Non-Proliferation of Nuclear Weapons (NPT) [21]; (j) The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (INFCIRC/153 (Corrected)) [22]; (k) Model Protocol Additional to the Agreement(s) Between States(s) and the International Atomic Energy Agency for the Application of Safeguards (INFCIRC/540 (Corrected)) [23]; (l) Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA [24].
	Example of how the condition may be demonstrated Evidence that the State has adhered to the relevant international legal instruments and is implementing the obligations arising from them.
	Selected relevant IAEA publications Handbook on Nuclear Law [25] Handbook on Nuclear Law: Implementing Legislation [26]
5.2. A comprehensive nuclear law enacted	**Summary of the condition to be demonstrated** The State has enacted the national nuclear legislation, which: (a) Establishes an independent nuclear regulatory body with adequate human and financial resources and a clear and comprehensive set of functions; (b) Identifies responsibilities for safety, security and safeguards; (c) Formulates safety principles and rules (radiation protection, nuclear installations, radioactive waste and spent fuel management, decommissioning, EPR, and transport of radioactive material); (d) Formulates nuclear security principles; (e) Gives appropriate legal authority for, and definition of, the responsibilities of the regulatory body and all competent authorities establishing a regulatory control system (authorization, inspection and enforcement, review and assessment, and development of regulations and guides); (f) Implements IAEA safeguards including an SSAC; (g) Implements import and export control measures for nuclear and radioactive material and items; (h) Establishes compensation mechanisms for compensation of nuclear damage.

[9] The Paris Convention on Third Party Liability in the Field of Nuclear Energy is another relevant legal instrument under the auspices of the Organisation for Economic Co-operation and Development (OECD) [43].

5. Legal framework	Phase 2
Conditions	**Basis for evaluation**
	Example of how the condition may be demonstrated Evidence that a comprehensive nuclear law is enacted and promulgated.
	Selected relevant IAEA publications Handbook on Nuclear Law [25] Handbook on Nuclear Law: Implementing Legislation [26]
5.3. All other legislation affecting the research reactor programme	**Summary of the condition to be demonstrated** Legislation has been reviewed and amended as necessary to cover: (a) Environmental protection; (b) EPR; (c) Occupational health and safety of workers; (d) Protection of intellectual property; (e) Local land use controls; (f) Foreign investment; (g) Funding of long term liabilities related to spent fuel, radioactive waste and decommissioning; (h) International trade and customs; (i) Roles of national and local governments; (j) Stakeholders and public involvement; (k) Financial guarantees and any other required financial legislation; (l) Research and development.
	Example of how the condition may be demonstrated Presentation of a review identifying relevant laws and evidence that the necessary laws have been enacted or there is a clear plan to enact them at the appropriate time.
	Selected relevant IAEA publications Handbook on Nuclear Law [25] Handbook on Nuclear Law: Implementing Legislation [26]

6. Safeguards	Phase 2
Conditions	**Basis for evaluation**
6.1. Strengthening of the SSAC underway	**Summary of the condition to be demonstrated** The State authority shall establish and maintain a system of accounting for and control of all nuclear material subject to safeguards, and that such safeguards shall be applied in such a manner as to enable the Agency to verify, in ascertaining that there has been no diversion of nuclear material from peaceful uses to nuclear weapons or other nuclear explosive devices. An SSAC as a system is comprised of all of the elements that enable the State authority to carry out its nuclear material accounting and reporting responsibilities. The duties of the State authority responsible for safeguards implementation include: (a) Collecting, processing and reporting, on time, correct and complete safeguards relevant information to the IAEA; (b) Facilitating IAEA activities and providing access for IAEA in-field verification; (c) Confirming or verifying the information provided; (d) Resolving questions and inconsistencies, through institutional arrangements.
	Examples of how the condition may be demonstrated (1) Description of the State authority roles and responsibilities; (2) Evidence that all organizations involved in the establishment or adjustment of the State authority are prepared for the increase of activity, the increase of resources and enhancement of capabilities needed to successfully embark on a research reactor programme; (3) A plan to develop relevant safeguards procedures; (4) A programme in place to build up the required technical and administrative competence on timescales consistent with the development of the research reactor programme; (5) Evidence through information exchange with the IAEA that the State authority has a good understanding of the principles of safeguarding a research reactor including the type of equipment the IAEA may install in the facility.
	Selected relevant IAEA publications Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols [27] IAEA Service Series No. 15, Nuclear Material Accounting Handbook [29] IAEA Services Series No. 31, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure [32]
6.2. SSAC requirements for the research reactor recognized and addressed	**Summary of the condition to be demonstrated** The owner/operator is aware of the requirements of nuclear materials accounting and control, including the necessary staffing, training and technical resources.
	Examples of how the condition may be demonstrated (1) Human technical and financial resource requirements are included in the owner/operator organization plans; (2) Plans to develop the required system and related procedures for collecting, processing and reporting safeguards relevant information.
	Selected relevant IAEA publications IAEA Services Series No. 21, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols [26] IAEA Service Series No. 15, Nuclear Material Accounting Handbook [29]

6. Safeguards	Phase 2
Conditions	**Basis for evaluation**
6.3. Design information requirements for safeguards recognized	**Summary of the condition to be demonstrated** The State has notified the IAEA of its plans for research reactor construction, understands the need for early planning of safeguards relevant features in the design and construction phases (including such requirements in the BIS) and plans to submit early design information to the IAEA as soon as the technology has been decided. Any plans for fuel cycle facilities have been communicated to the IAEA.
	Examples of how the condition may be demonstrated (1) Additional Protocol declaration (under Article 2.a.x) on 10 year plans for the research reactor submitted and regularly updated. (2) Evidence through information exchange with the IAEA that the owner/operator has a good understanding of the principles of safeguarding a research reactor, including the type of equipment the IAEA may install in the facility. (3) Information on technology and list of designs being included in the BIS provided to the IAEA. If a design has already been chosen, design information has been submitted to the IAEA with any specific national variations. (4) Future safeguards requirements for the research reactor identified and included in the BIS. (5) Any proposals for fuel cycle facilities discussed with the IAEA.
	Selected relevant IAEA publications IAEA Services Series No. 21, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols [27] IAEA Services Series No. 11, Guidelines and Format for Preparation and Submission of Declarations Pursuant to Articles 2 and 3 of the Model Protocol Additional to Safeguards Agreements [46] IAEA Nuclear Energy Series No. NP-T-2.8, International Safeguards in Nuclear Facility Design and Construction [47] IAEA Services Series No. 33, Safeguards Implementation Practices Guide on Provision of Information to the IAEA [48], Design information questionnaire, Form no 72 (Template for Research and Power Reactors)

7. Regulatory framework	Phase 2
Conditions	**Basis for evaluation**
7.1. Competent, independent nuclear regulatory body established	**Summary of the condition to be demonstrated** The regulatory body has the legal authority, technical competence, resources and procedures to fulfil the statutory obligations and is ready to assess an application for a licence, issue a licence with licence conditions and inspect the construction of the research reactor against a clearly defined set of regulatory requirements. Its regulatory decisions are free from undue political and economic influence.
	Examples of how the condition may be demonstrated (1) Demonstration of effective independence including separation from the promotional aspects of the research reactor; (2) Evidence of adequate human and financial resources, including technical and leadership competence; (3) Processes for communications with the public and liaison with the international community; (4) A documented formal management system including roles, responsibilities, organizational structure and processes including record keeping (see infrastructure issue no. 3, management); (5) TSOs and/or advisory experts available to support the regulatory function; (6) Arrangements for interfaces with operating organizations, other regulatory bodies, transport organizations and international forums; (7) Defined process for assessment of applications for licence, licence issuance, inspections and enforcement actions. **Note**: A report evaluating the regulatory framework against the actions described in SSG-16 [49] would address these conditions with respect to safety. If an IAEA Integrated Regulatory Review Service mission has been conducted, the results of this mission could be used as evidence. However, subsequent work on any identified recommendations would be noted, but not reviewed in detail as that would occur during an Integrated Regulatory Review Service follow-up mission.
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 1 (Rev.1) [32] IAEA Safety Standards Series No. GSG-8, Radiation Protection of the Public and the Environment [34] IAEA Services Series No. 31, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure [32]
7.2. Regulatory framework developed	**Summary of the condition to be demonstrated** The regulatory framework addresses all the relevant aspects for safety, security and safeguards related to siting, design and construction of the proposed research reactor. The framework will ultimately need to cover all the phases of the programme, but at this stage some aspects (e.g. commissioning, operation, arrangements for spent fuel, waste management and transport of radioactive material, and decommissioning) may be covered by future work plans.
	Examples of how the condition may be demonstrated (1) A comprehensive list of regulations in which those regulations issued, those in draft and those yet to be developed are identified; (2) Evidence showing how the regulations have been developed and how they are consistent with IAEA safety standards, security guidance and safeguards requirements.

7. Regulatory framework	Phase 2
Conditions	**Basis for evaluation**
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), Governmental, Legal, and Regulatory Framework for Safety [33] IAEA Safety Standards Series No. GSG-8, Radiation Protection of the Public and the Environment [34] IAEA Services Series No. 31, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure [32]

8. Radiation protection[10]	Phase 2
Conditions	**Basis for evaluation**
8.1. Development of radiation protection programmes and expansion of appropriate infrastructure planned	**Summary of the condition to be demonstrated** Plans have been developed for programmes to control and monitor exposure of individuals on-site before any radioactive material arrives there, including staff training, procurement of equipment and services and design requirements. The plans take into account increased requirements during construction and commissioning.
	Examples of how the condition may be demonstrated (1) Plans in place to implement radiation monitoring and protection programmes for exposure of workers and the public on-site, before any radioactive material arrives on the site; (2) The appropriate equipment and systems for radiation monitoring are included in the BIS; (3) A review of the national infrastructure for monitoring and recording radiation doses with plans for the required expansion; (4) Evidence of visits to other research reactors to understand the issues of dose and contamination control; (5) Availability of competent staff to review vendor proposals for dose and contamination control.
	Selected relevant IAEA publication IAEA Safety Standards Series No. GSG-8, Radiation Protection of the Public and the Environment [34]

[10] This covers protection of workers and the public on-site during planned operation. Off-site releases from planned operation are addressed in infrastructure issue no. 13, environmental protection. Accidental releases and associated radiation protection are addressed in infrastructure issue no. 14, emergency preparedness and response.

9. Utilization	Phase 2
Conditions	**Basis for evaluation**
9.1. Utilization requirements for the research reactor addressed	**Summary of the condition to be demonstrated** The preliminary strategic plan issued in Phase 1 is updated and includes new findings, detailed information and decisions on the research reactor, technical specifications for the research reactor and its facilities, based on the stakeholders' needs and commitments.
	Examples of how the condition may be demonstrated (1) Content of the detailed research reactor strategic plan; (2) Evidence of the consultation of the stakeholder and user communities (identifying stakeholder interaction groups) and how they endorse the technical specifications for the research reactor and its facilities; (3) Evidence of inclusion of technical requirements for research reactor utilization are included in the BIS; (4) Evidence that the experience of the regional and international research reactor communities has been used to fully understand the research reactor utilization issues, associated human resources and funding requirements.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.3, Applications of Research Reactors [4] IAEA Nuclear Energy Series No. NG-T-3.16, Strategic Planning for Research Reactors [9]
9.2. Plans, funding and schedule for development of utilization programme available	**Summary of the condition to be demonstrated** The plans for, and funding of, the development of the utilization programme are available, and the schedule is consistent with the research reactor construction timeframe.
	Example of how the condition may be demonstrated Evidence that schedules have been established and resources available for the development of the utilization programme, compatible with the foreseen construction and commissioning of the research reactor
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.3, Applications of Research Reactors [4] IAEA Nuclear Energy Series No. NG-T-3.16, Strategic Planning for Research Reactors [9]

10. Human resource development[11]	Phase 2
Conditions	**Basis for evaluation**
10.1. Knowledge and skills needed in organizations for Phase 3 and operational phase identified	**Summary of the condition to be demonstrated** All relevant organizations have identified an appropriate organizational structure and the staff requirements for Phase 3 and the operational phase and key staff are already in place.
	Examples of how the condition may be demonstrated For each organization (including support organizations), an analysis of what resources and competences are needed at what time during Phase 3 and the initial operational phase and which positions need to be formally licensed. The competence areas need to include: (1) Technical (including those that are nuclear specific); (2) Business (e.g. legal, finance); (3) Licensing; (4) Stakeholder involvement and public relations; (5) Fuel cycle management and procurement; (6) Construction management and commissioning; (7) Operation and maintenance; (8) Utilization; (9) Spent fuel and radioactive waste management and decommissioning; (10) Training and development (including systematic approach to training).
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13] IAEA Safety Standards Series No. NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors [35]
10.2. A plan available to develop and maintain human resources	**Summary of the condition to be demonstrated** A gap analysis has been completed (based on the requirements of 10.1, above) and recruitment and training plans developed (for each organization). The plans cover education, training and experience requirements and also include consideration of bilateral and international training activities.
	Examples of how the condition may be demonstrated (1) Training plans for senior executives. (2) Recruitment, training and development programmes to provide the competences defined in 10.1 including: (a) Nature of, and time required for, development of each competence; (b) Proposed courses and location of training; (c) The need for training abroad at a similar operating research reactor to those being considered, with any necessary language training planned; (d) Programmes in place for involvement of future operation and maintenance personnel with the construction and commissioning groups; (e) Licensing of identified management and operating staff. (3) Proposals for training infrastructure requirements and development of training expertise. (4) The BIS addresses what is required from suppliers, including competence development of national personnel (training and on the job experience).

[11] This issue addresses the future development of capability for Phase 3 and beyond. The skills already required to be in place for Phase 2 are covered under the appropriate issues (e.g. infrastructure issue no. 7, regulatory framework).

10. Human resource development	Phase 2
Conditions	**Basis for evaluation**
	Selected relevant IAEA publications IAEA Safety Standards Series No. SSR-3, Safety of Research Reactors [6] Code of Conduct on the Safety of Research Reactors [7] IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [13] IAEA Safety Standards Series No. NS-G-4.5, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors [35]

11. Stakeholder involvement	Phase 2
Conditions	**Basis for evaluation**
11.1. Stakeholder involvement plans being implemented	**Summary of the condition to be demonstrated** Each of the key organizations (government, regulator and owner/operator) has a proactive stakeholder involvement plan that is in use and regularly updated.
	Examples of how the condition may be demonstrated (1) Documented stakeholder involvement strategy and plan for each of the key organizations (government, regulator and owner/operator) addressing the full range of issues, including technology choice, utilization, safety, security, waste management, health and environmental impact; (2) Evidence of a competent communications person/team in each organization, with experience and evidence of engagement with senior staff; (3) Examples of communications in a range of formats with the general public, local government, industry, educational institutions, media, non-governmental organizations, and opposition groups; (4) Evidence that the owner/operator engages, on a regular basis, with local stakeholders on, for example, construction plans, opportunities for local jobs and benefits to the community; (5) Regulator strategy regarding the availability of information to the public, regulatory communication and consultation with stakeholders; (6) Evidence that the role of the regulator is understood by stakeholders and that they are perceived as competent and independent.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3]

12. Site survey, site selection and evaluation[12]	Phase 2
Conditions	**Basis for evaluation**
12.1. Detailed site characterization completed	**Summary of the condition to be demonstrated** The basis for the site selection has been justified against clearly defined siting criteria. These cover safety, security, engineering, environmental, EPR, social and economic aspects. Site characterization and an evaluation by the regulatory body have been completed (the detailed approach will depend on the specific authorization stages defined in the State). Site related design basis information is available and included in the research reactor requirements. A plan for addressing the siting of fuel cycle and waste facilities is available.
	Examples of how the condition may be demonstrated (1) Report demonstrating ranking of possible sites and basis of the chosen site or sites. (2) Evidence that the site meets all siting requirements and the necessary characterization studies have been completed. (3) Evidence that local legal, political and public acceptance issues have been identified and resolved or that their resolution is planned. (4) Analysis of sites required for fuel interim storage, and for waste conditioning, storage and, where appropriate, disposal. Plans for selecting sites available. (5) Evidence that, where appropriate, transport between the research reactor and any waste storage or disposal sites has been considered.
	Selected relevant IAEA publications The IAEA Safety Standards Series No. NS-R-3 (Rev. 1), Site Evaluation for Nuclear Installations [36] IAEA Safety Standards Series No. SSG-35, Site Survey and Site Selection for Nuclear Installations [37]
12.2. Plans in place to prepare site for construction	**Summary of the condition to be demonstrated** Infrastructure either exists or is planned to support construction, for example, access, workforce housing, water and construction materials. Any outstanding work is planned in accordance with the construction requirements or is included in the BIS.
	Examples of how the condition may be demonstrated (1) A review of the current infrastructure and plans to implement any enhancements required; (2) Existing and planned site facilities are clearly described in the BIS.

[12] There are also some siting related requirements addressed in infrastructure issue no. 13, environmental protection.

13. Environmental protection[13]	Phase 2
Conditions	**Basis for evaluation**
13.1. Environmental impact assessment performed	**Summary of the condition to be demonstrated** A complete assessment of the environmental impact of the proposed research reactor has been carried out in accordance with national requirements and an environmental impact assessment report has been submitted to the appropriate authority. Plans for monitoring to provide a baseline for the site and its surroundings have been developed.
	Examples of how the condition may be demonstrated (1) Availability of the environmental impact assessment report and the status of approval by all relevant regulators and agencies; (2) Mitigation measures evaluated; (3) Plans to develop systems and facilities for necessary environmental monitoring (including radiation monitoring), with clearly assigned roles for the operating organization and the environmental regulator.
13.2. Environmental characteristics provided	**Summary of the condition to be demonstrated** Comprehensive specification of environmental site conditions, factors, characteristics and data have been included in the BIS in as much detail as possible.
	Examples of how the condition may be demonstrated (1) The BIS identifying local environmental factors. Areas to consider include: (a) Pathways for effluent transport and concentration in the surrounding environment; (b) Local population demographics and trends; (c) Predominant plant and animal life and relevant radioecological sensitivities; (d) Predominant land use; (e) Data relevant to justifying heat removal capability; (f) Sites and means for disposal of hazardous waste; (g) Local environment issues affecting construction. (2) Bidders have free access to all detailed site studies including environmental impact assessment documents and collected site data, with the environmental limitations, commitments and conditions. (3) Established procedure for the resolution of vendor questions regarding the interpretation of the site data.
13.3. Clear and effective regulation of environmental issues established	**Summary of the condition to be demonstrated** The environmental regulator for the research reactor programme has the skills and resources required to fulfil the roles and responsibilities assigned. The interface between this organization and the nuclear regulator has been defined.
	Examples of how the condition may be demonstrated (1) Roles and responsibilities of the environmental regulator for the research reactor defined; (2) Memoranda of understanding between the environmental and nuclear regulatory bodies; (3) Evidence of adequate skills and resources to evaluate the environmental impact assessment, and plans to develop adequate skills to assess acceptability of design information, inspect/audit activities during construction and evaluate monitoring results.

[13] This covers off-site releases from planned operation and all other environmental issues. Protection of workers and the public on-site during planned operation is addressed in infrastructure issue no. 8, radiation protection. Accidental releases and radiation are addressed mainly in infrastructure issue no. 14, emergency preparedness and response.

14. Emergency preparedness and response	Phase 2
Conditions	**Basis for evaluation**
14.1. Responsibilities of each organization clearly defined and approach for EPR being developed	**Summary of the condition to be demonstrated** An overall action plan is being implemented to provide the required EPR arrangements and capabilities to be demonstrated before fuel is brought to the site. The organizations involved have identified the resources that will be required to execute the action plan and have made a commitment to provide those resources.
	Examples of how the condition may be demonstrated (1) Action plan that addresses any gaps and leads to a demonstration of adequate EPR arrangements and capabilities prior to fuel being brought to the site, including: (a) Actions to be completed, schedule and milestones; (b) Organizations responsible for each action; (c) Resources required for the implementation of the action plan; (d) Action plan implementation progress report. (2) Regulations related to EPR developed. (3) EPR roles and responsibilities documented at all levels. (4) Types of accidents have been identified and potential consequences assessed including the likely size of emergency planning zones and distances for a research reactor. (5) A generic protection strategy has been defined based on assessed hazards and consequences.
	Selected relevant IAEA publications IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency [38] IAEA Safety Standards Series No. GSG-2, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency [39] IAEA Safety Standards Series No. GS-G-2.1, Arrangements for Preparedness for a Nuclear or Radiological Emergency [40] IAEA Safety Standards Series No. GSG-11, Arrangements for the Termination of a Nuclear or Radiological Emergency [41]

15. Nuclear security	Phase 2
Conditions	**Basis for evaluation**
15.1. Required physical protection measures developed	**Summary of the condition to be demonstrated** The national threat assessment and design basis threat for the research reactor have been completed. Requirements for the design of physical protection for the research reactor have been defined in the BIS or in other appropriate documents. Specific physical protection requirements during construction and the transport of nuclear or other radioactive material have also been developed. Roles and responsibilities for preparing for, detecting and responding to nuclear security events have been defined.
	Examples of how the condition may be demonstrated (1) A documented national threat assessment that covers the full range of threats affecting nuclear material and nuclear facilities and radioactive material and associated facilities; (2) A competent authority defined with assigned responsibility for developing the design basis threat in coordination with other relevant authorities; (3) Clear definition of roles and responsibilities for each organization involved in the response to nuclear security events; (4) A design basis threat has been developed, the BIS includes physical protection requirements for the research reactor; (5) Nuclear security requirements during construction and the transport of nuclear or other radioactive material have been defined; (6) Nuclear security measure requirements have been defined based on a graded approach; (7) The State has established one or more thresholds of radiological consequences in order to determine appropriate levels of physical protection.
	Selected relevant IAEA publications IAEA Nuclear Security Series No. 19, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme, paras 4.3, 4.4, 4.6–4.14, 5.1–5.8, 5.31–5.33, 6.1, 6.4 and 6.8 [42] IAEA Nuclear Security Series No. 10, Development, Use and Maintenance of the Design Basis Threat [50] IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5) [51] IAEA Nuclear Security Series No. 14, Nuclear Security Recommendations on Radioactive Material and Associated Facilities [52]
15.2. Programmes in place for the management of sensitive information	**Summary of the condition to be demonstrated** For each of the key organizations, a process for the categorization and management of sensitive information has been developed. This includes control of any sensitive information made available to contractors.
	Example of how the condition may be demonstrated Processes for the protection of sensitive nuclear security information and protection of computer systems, networks and other digital systems that store sensitive information.
	Selected relevant IAEA publications IAEA Nuclear Security Series No. 19, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme, paras 4.27–4.33 [42] IAEA Nuclear Security Series No. 23-G, Security of Nuclear Information [53]
15.3. Programmes in place for the trustworthiness of personnel	**Summary of the condition to be demonstrated** For each of the key organizations, a screening/vetting process for recruitment and selection of personnel with access to facilities, nuclear material and sensitive information has been developed.

15. Nuclear security	Phase 2
Conditions	**Basis for evaluation**
	Example of how the condition may be demonstrated Processes for the screening/vetting of personnel including a graded approach depending on the level of access required.
	Selected relevant IAEA publication IAEA Nuclear Security Series No. 19, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme, para. 4.34 [42]
15.4. Programmes in place for promotion of nuclear security culture	**Summary of the condition to be demonstrated** All relevant organizations understand the importance of a nuclear security culture and have plans to develop a nuclear security culture at all levels of the organization.
	Example of how the condition may be demonstrated Evidence of the promotion of a security culture by leaders and managers within all key organizations involved in the research reactor programme, including recognition of the importance of integrated management systems and leadership for security, security of information and trustworthiness.
	Selected relevant IAEA publications IAEA Nuclear Security Series No. 19, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme, paras 4.54–4.58 [42] IAEA Nuclear Security Series No. 7, Nuclear Security Culture [54]

16. Nuclear fuel cycle	Phase 2
Conditions	**Basis for evaluation**
16.1. Front end fuel cycle strategy defined	**Summary of the condition to be demonstrated** Based on the national policy, a clear front end fuel cycle strategy has been defined identifying how new fuel will be available in the short and long term, or which options are being pursued.
	Examples of how the condition may be demonstrated (1) A document defining a realistic front end nuclear fuel cycle strategy at a level of detail appropriate for Milestone 2. (2) Evidence that basic decisions needed for Milestone 2 have been made. This includes a decision on the number of reloads to be requested with the first core, and a short and long term purchasing strategy for the new fuel. (3) An integrated plan for bidding and construction of any intended front end fuel cycle facilities consistent with the national long term fuel cycle strategy, the research reactor construction programme and the national non-proliferation commitment.
16.2. Back end fuel cycle strategy defined	**Summary of the condition to be demonstrated** Based on the national policy, a back end fuel cycle strategy has been defined, including plans or options for storage (on-site and off-site), possible reprocessing or arrangements for fuel take back. Actions and timescales are consistent with the planned research reactor construction programme.
	Examples of how the condition may be demonstrated (1) Document on spent fuel management strategy, including identification of facilities needed, actions, resources and timescales. (2) Evidence that basic decisions needed for Milestone 2 have been made. This includes a decision on fuel take back if considered, a decision on spent fuel storage capacity on-site and off-site and a strategy for purchasing or building these capacities. (3) Initial requirements clearly defined in the BIS.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NW-T-1.11, Available Reprocessing and Recycling Services for Research Reactor Spent Nuclear Fuel [43]

17. Radioactive waste management	Phase 2
Conditions	**Basis for evaluation**
17.1. Handling the burdens of radioactive waste considered	**Summary of the condition to be demonstrated** Based on the national policy, a clear strategy for the processing, storage and disposal of radioactive waste has been developed. Plans for any national facilities for radioactive waste management and waste management organizations have been defined and are consistent with the research reactor construction programme.
	Examples of how the condition may be demonstrated (1) Policy and strategy documents for the management of radioactive waste, including: (a) Disposal of all waste types. (b) Consideration of regulatory and implementation infrastructures. (c) Allocation of responsibilities. (d) Technical approaches. (e) Capabilities and financing schemes. This may include the creation of a specific national waste management organization. (2) Requirements for facilities to be provided as part of the research reactor and provisions for minimizing waste volumes and toxicity included in the BIS. (3) A plan for bidding and construction of any separate waste facilities available and consistent with the research reactor construction programme. (4) A plan to initiate or enhance national waste disposal programmes.
	Selected relevant IAEA publication IAEA Nuclear Energy Series No. NW-G-1.1, Policies and Strategies for Radioactive Waste Management [43]
17.2. Preliminary decommissioning plan requested	**Summary of the condition to be demonstrated** A request for a preliminary decommissioning plan from the vendor has been included in the BIS. Specific national requirements have been included.
	Examples of how the condition may be demonstrated (1) Document discussing national requirements for decommissioning; (2) Requirements for a decommissioning plan included in the BIS.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NW-G-1.1, Policies and Strategies for Radioactive Waste Management [44] IAEA Safety Standards No. SSG-40, Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors [45] IAEA Nuclear Energy Series No. NW-T-1.10, Advancing Implementation of Decommissioning and Environmental Remediation Programmes [55]

18. Industrial involvement	Phase 2
Conditions	**Basis for evaluation**
18.1. National capabilities assessed and plans to enhance capability defined	**Summary of the condition to be demonstrated** A review of national capability has been completed, identifying areas where national supply is available or can be developed. Based on this, volume targets or specific areas for national involvement have been developed. Plans for upgrading national capability have been defined and funded. The transfer of technology including intellectual property has been considered.
	Examples of how the condition may be demonstrated (1) A realistic assessment of the national and local supplier capabilities based on the national policy performed. (2) An assessment of the training and funding requirements to upgrade quality. (3) Extent of national industrial participation agreed, desired targets for local and national industrial involvement specified, and requirements for transfer of technology including intellectual property included in the BIS. (4) Clear plans and programmes identifying: (a) Specific industrial involvement in future construction, maintenance and operational support services; (b) Audits of the progress of industrial preparation and ability to meet the requirements for addition to the approved supplier list; (c) Short term and long term programme (including future programmes) to develop the ability to produce items initially being supplied by foreign suppliers; (d) Requirements for industries to be added to the potential vendor or service supplier lists; (e) Requirements for export and import consistent with the State's commitment and obligations regarding non-proliferation of nuclear weapons and safeguards implementation.

19. Procurement	Phase 2
Conditions	**Basis for evaluation**
19.1. Procurement capability available	**Summary of the condition to be demonstrated** A procurement capability has been established for specific services, such as siting work and consultancy services.
	Examples of how the condition may be demonstrated (1) Procedures or audits to ensure suppliers have appropriate expertise and experience; (2) Evidence of preparation of formal specifications for the services required; (3) Quality standards included in the service specifications; (4) Awareness of the non-proliferation regime regarding nuclear or nuclear related trade.
	Selected relevant IAEA publications IAEA Nuclear Energy Series No. NG-T-3.18, Feasibility Study Preparation for New Research Reactor Programmes [3] IAEA Nuclear Energy Series No. NP-T-5.6, Technical Requirements in the Bidding Process for a New Research Reactor [10]

4. INIR-RR MISSIONS FOR A NEW RESEARCH REACTOR

4.1. INTRODUCTION

Similarly to the Integrated Nuclear Infrastructure Review (INIR) missions for a nuclear power programme (see the IAEA publication Guidelines for Preparing and Conducting an Integrated Nuclear Infrastructure Review (INIR) [56]), INIR-RR missions were established to provide international peer reviews, conducted by the IAEA upon request from a host Member State, to assess the status of development of the State's national nuclear infrastructure, but are specific for the research reactor programme. Besides the INIR-RR missions, a Member State may request other more specific IAEA missions to review or assist on particular issues of research reactor nuclear infrastructure development.

4.2. WHAT THE INIR-RR MISSION IS

The INIR-RR mission is a holistic IAEA peer review conducted by a team of international experts who have direct experience in research reactors and specialized research reactor infrastructure areas. The team comprises both designated IAEA staff from various disciplines and organizational units and international experts selected by the IAEA in consultation with the host Member State, and it is led by a senior IAEA staff member (team leader) experienced in providing integrated support to research reactor infrastructure assessment and development.

The major objective of an INIR-RR mission is to assist the Member State in determining its research reactor infrastructure status and to identify further development needs; hence, the preparation of a Member State self-assessment is emphasized as a prerequisite. While an INIR-RR mission aims to perform an independent and objective review, it is not intended to be an external audit of a Member State's national nuclear infrastructure.

The INIR-RR mission's detailed scope is specifically defined and adjusted to meet the needs of the requesting Member State. In particular, a graded approach needs to be adopted in the application of the conditions for the research reactor programme, including for the development of the national supporting infrastructure, based on the complexity and potential hazard of the programme. The review is based upon the approach and the basis for assessment presented in this publication, which assume that all 19 infrastructure issues are assessed in an equal and consistent manner.

When available, the INIR-RR mission will use the knowledge already obtained by the IAEA and the recommendations of previous IAEA peer review missions, in particular if the Member State has already received an INIR mission in connection with its nuclear power programme. Such coordination and exchange of information among the involved parties and teams should ensure that there is no duplication of the work carried out by these missions. As a result, the review scope of the INIR-RR is adjusted to the degree of development of the different infrastructure issues but is focused on evaluating, as much as is realistic in a limited period of time, all parts of the national infrastructure in a holistic approach.

4.3. WHAT THE INIR-RR MISSION IS NOT

It is important to note that the INIR-RR mission is not:

— An audit or inspection against established requirements;
— An endorsement of the Member State's self-assessment;

— A detailed assessment or verification of specific activities;
— A confirmation of the effectiveness of the Member State's processes or actions.

For example, the INIR-RR mission can evaluate whether some research reactor site prospecting activities were performed and criteria established. However, an assessment of the appropriateness of the prospecting performed and the adequacy of the criteria adopted is a matter for research reactor site specialists, and an appropriate IAEA review service would be needed to cover these technical aspects in detail. The same logic applies to all the other infrastructure issues. Therefore, the results of an INIR-RR mission cannot be considered as a 'release stamp' that certifies the quality and completeness of the work done and validates the host Member State's actions and programmes.

The results of INIR-RR missions are considered inputs for future assistance in support of national nuclear infrastructure development through IAEA technical cooperation and extra budgetary programmes. This assistance is planned and implemented through IAPs that include activities from all concerned IAEA departments.

4.4. TIMING OF AN INIR-RR MISSION

The timing of the INIR-RR mission needs to be agreed with the Member State, considering the pace of the Member State's infrastructure development, the completion of the Member State's self-assessment and preparation of a SER and, therefore, the added value of the INIR-RR mission in covering all the 19 issues. In depth reviews of specific issues can be accomplished by the other IAEA issue-focused review services.

INIR-RR missions are arranged in the following sequence:

(a) Pre-INIR-RR mission;
(b) INIR-RR main mission;
(c) INIR-RR follow-up mission.

4.4.1. Pre-INIR-RR mission

Six to nine months before the main INIR-RR mission, a pre-INIR-RR mission will be conducted in the Member State. The purpose of the pre-INIR-RR mission is to present the methodology and basis for the self-assessment of the infrastructure, the INIR-RR review process, and to discuss and agree on the terms of reference of the main INIR-RR mission, including the list of documents that are expected to be provided to the IAEA and the timeframe for their submission, a preliminary agenda, the team composition, all logistical arrangements, interpretation requirements and arrangements for interaction with the media.

4.4.2. INIR-RR main mission

The INIR-RR main mission will review the overall situation in the country regarding the development of the national infrastructure. It is a prerequisite that the Member State has already performed a self-assessment of its national infrastructure following the guidance provided in this publication before implementing the INIR-RR main mission and that the corresponding SER, including a preliminary IAP, has been made available in English. The IAP is expected to be finalized by the Member State within a reasonable period of time, in response to the recommendation of the INIR-RR main mission and made available to the IAEA. It is recommended that a Member State request an INIR-RR main mission to take place at the end of Phase 1 and at the end of Phase 2 of the programme.

The Member State, prior to an INIR-RR main mission, can also request the IAEA to provide review comments on the submitted SER. In general, the IAEA will provide such a review through the services of international experts.

4.4.3. INIR-RR follow-up mission

An INIR-RR follow-up mission is based on the progress in the implementation of the IAP. An INIR-RR follow-up mission would focus on the response to the INIR-RR main mission and, if applicable, other IAEA missions' recommendations and suggestions, and on the activities accomplished since the last INIR-RR main mission. Each INIR-RR follow-up mission builds upon the previous one and provides direction for planning further activities. It is recommended that a Member State request at least one INIR-RR follow-up mission to take place 18–24 months after the INIR-RR main mission.

4.5. INIR-RR MISSION REQUEST AND IMPLEMENTATION PROCESS

Member States interested in requesting INIR-RR missions (both main and follow-up missions) should address their request through the IAEA Department of Nuclear Energy or the Department of Technical Cooperation. Guidelines for planning and implementing INIR-RR missions during Phase 1 and Phase 2 can be obtained, upon request, from the IAEA Department of Nuclear Energy, Research Reactor Section. The scope of these guidelines includes the activities to be undertaken by the IAEA for implementing INIR-RR missions and by the requesting Member State for preparing and making the necessary arrangements for hosting these missions.

4.6. CONDUCT OF THE MISSION

Upon receipt of a Member State request to host an INIR-RR mission, a pre-INIR-RR mission may be arranged with the purpose of clearly defining, with the host counterpart, the INIR-RR mission specific scope and logistical arrangements. This is also used to identify the advanced information package (e.g. SER, feasibility study report, preliminary strategic plan) and schedule their submission to the IAEA for the preparation of the mission. The IAEA proposes the team members (IAEA staff as well as external international experts) for the INIR-RR mission and allocates infrastructure issues to each one. The final decision on the composition of the INIR-RR team will be made in consultation with the host counterpart during the pre-INIR-RR mission. Figure 3 provides an overview of the main steps for conducting INIR-RR missions.

Team members are expected to have at least 15 years of experience in one or several of the nuclear infrastructure issues and to have held senior positions in relevant organizations. The INIR-RR team will not include a member from the host Member State, or experts who may have conflicts of interest. A team coordination meeting is arranged during the first day of the INIR-RR mission. The purpose is that all team members will have a common understanding of the background and objectives of the mission, the basis for the review, the type of information needed and the way it will be evaluated.

As a first activity together with the counterparts, an entrance meeting will be conducted with senior representatives from the host Member State and possible observers. At the meeting, both the INIR-RR team and the host Member State representatives will be expected to present their primary objectives for the review. The INIR-RR team leader will provide an outline of the methodology, expectations and conduct for the mission. In the case of follow-up missions, the host Member State will be expected to present a progress report on the implementation of the IAP, including a summary of the work carried out to address the suggestions and recommendations identified in the previous INIR-RR and in any other relevant IAEA missions.

The performance of the review itself predominantly concentrates on evaluating the fulfilment of the conditions for the corresponding infrastructure issue development phase as described in this publication. During all review activities, frank and open communication between all participants is to be promoted. The prime objective of the mission discussions and presentations is to gather information not covered by the written material and, where necessary, to seek clarification of the written information provided.

Direct observation of infrastructure activities is complementary to the review of written material and the interviews and round table discussions.

During the latter part of the mission, the team leader compiles an executive summary of the mission based on inputs from the team members to capture the review results, including recommendations, suggestions and good practices. The host counterpart is invited to comment on this executive summary during the mission to ensure technical accuracy and a common understanding of the reported results. The review mission concludes with the exit meeting during which the main results of the mission are presented by the team.

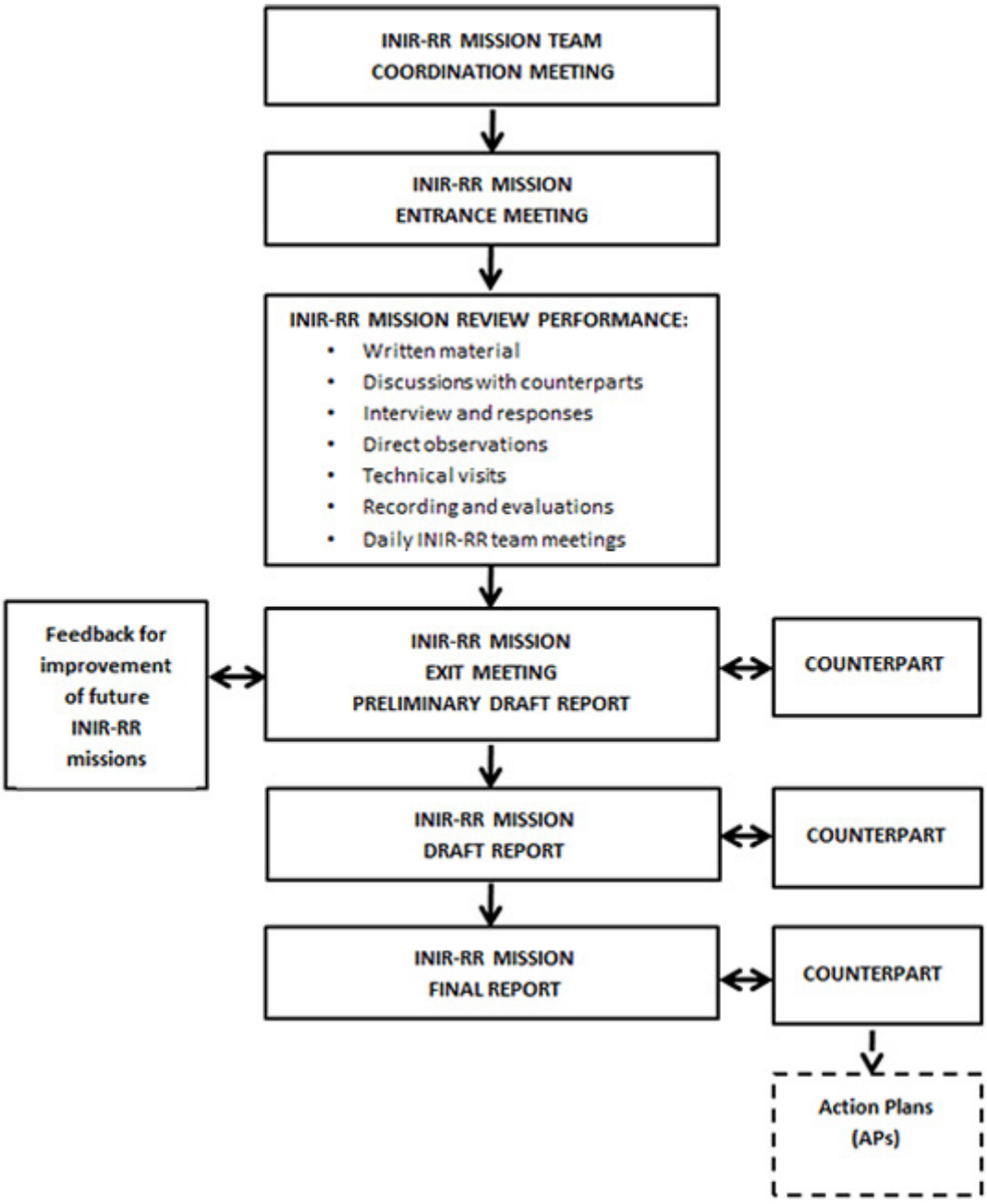

FIG. 3. Conduct of INIR-RR missions.

A draft of the INIR-RR mission report will be provided to the main counterpart for comments within eight weeks of the end date of the mission. The report is expected to have the following structure:

(1) Executive summary;
(2) Introduction;
(3) Objectives of the mission;
(4) Scope of the mission;
(5) Work done;
(6) Main conclusions;
(7) Evaluation results for the phase under analysis;
(8) Attachment 1: Review observations, recommendations and suggestions for the phase under analysis;
(9) Attachment 2: Lists of the INIR-RR mission team and counterparts;
(10) Attachment 3: References;
(11) Attachment 4: Acronyms.

The main conclusion will include a list of identified good practices, recommendations and suggestions, which are defined as follows:

- Good practices: the term is a recognition of an outstanding practice or arrangement, superior to those generally observed elsewhere. It is more than the fulfilment of the conditions or expectations and is worthy of the attention of other countries involved in the development of nuclear infrastructure as a model in the drive for excellence.
- Recommendations: these are proposed when aspects related to the fulfilment of conditions of nuclear infrastructure development are discrepant, incomplete or inadequately implemented. Recommendations are specific, realistic and designed to result in tangible improvement. Recommendations are based on the Milestones Approach and, as applicable, state the relation with the specific issue. The recommendations are formulated so they are succinct and self-explanatory.
- Suggestions: these propose consideration of new or different approaches to develop infrastructure and enhance performance, or to point out better alternatives to current work. Suggestions are formulated so they are succinct and self-explanatory.

A tabular format will be used to summarize the status resulting from the assessment carried out for each condition related to each infrastructure issue (an example is provided in Fig. 4). Three options are envisaged:

(a) Significant actions needed — the review observations indicate that important work still needs to be initiated or completed to meet the condition.
(b) Minor actions needed — the review observations indicate that some addition work or steps are needed to meet the condition or that plans for the next phase need to be enhanced.
(c) No actions needed — the available evidence indicates that all the work to meet the condition has been completed.

The judgement as to whether the ‘actions needed’ to be undertaken by the Member State are significant or minor is based on the importance of the work to the overall programme and/or the resources needed to complete it. The classification is made by consensus within the INIR-RR team and is not based solely upon the judgement of any individual team member. It should be noted that if the mission is conducted early in a milestones’ phase, typically most of the conditions will be classified as ‘significant actions needed’.

Attachment 1 will include the detailed results of the assessment for each condition and each infrastructure issue also presented in a tabular form (see Fig. 5).

The main counterpart should coordinate the collection of the comments with all the relevant organizations involved in the mission and submit the comments to the IAEA within four weeks of the date of receiving the draft mission report. These comments will be considered by the INIR-RR mission team and their resolution will be incorporated in the final INIR-RR mission report that is transmitted to the Member State, through IAEA official channels, within eight weeks of receiving the comments.

The final mission report will be classified as confidential but the hosting Member State may wish to make the report publicly available.

The main counterpart, with input from all relevant organizations, is expected to finalize the IAP after the mission to address the INIR-RR mission's recommendations and suggestions included in the INIR-RR mission report. The IAP should be transmitted to the IAEA, no later than two months from the date of receipt of the INIR-RR final report if possible.

1. National position	**Phase 1**		
Condition	**Actions needed**		
	SIGNIFICANT	**MINOR**	**NONE**
1.1. Long term commitment made, and importance of safety, security and non-proliferation recognized			
1.2. AMPT and RRPIC established			
1.3. Comprehensive feasibility study performed, documented and the necessary commitments understood			

FIG. 4. Example of a summary form for a selected infrastructure issue.

1. National position **Condition 1.1**. Long term commitment made, and importance of safety, security and non-proliferation recognized		**Phase 1**
Summary of the condition to be demonstrated	A clear statement adopted by the government of its intent to establish a new research reactor and of its commitment to safety, security and non-proliferation, with evidence that their importance is embedded in the ongoing work programme.	
Review observations		
Areas for further action	**Significant**	
	Minor	
RECOMMENDATIONS		
R-1.1.1. …		
SUGGESTIONS		
S-1.1.1 …		
GOOD PRACTICES		
GP-1.1.1 …		

FIG. 5. Example of assessment form for a selected infrastructure issue (1) and condition (1.1).

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Specific Considerations and Milestones for a Research Reactor Project, IAEA Nuclear Energy Series No. NP-T-5.1, IAEA, Vienna (2012).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Evaluation of the Status of National Nuclear Infrastructure Development, IAEA Nuclear Energy Series No. NG-T-3.2 (Rev. 1), IAEA, Vienna (2016).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Feasibility Study Preparation for New Research Reactor Programmes, IAEA Nuclear Energy Series No. NG-T-3.18, IAEA, Vienna (2018).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Applications of Research Reactors, IAEA Nuclear Energy Series No. NP-T-5.3, IAEA, Vienna (2014).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Use of a Graded Approach in the Application of the Safety Requirements for Research Reactors, IAEA Safety Standards Series No. SSG-22, IAEA, Vienna (2012).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Research Reactors, IAEA Safety Standards Series No. SSR-3, IAEA, Vienna (2016).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Code of Conduct on the Safety of Research Reactors, IAEA, Vienna (2006).

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

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Strategic Planning for Research Reactors, IAEA Nuclear Energy Series No. NG-T-3.16, IAEA, Vienna (2017).

[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Technical Requirements in the Bidding Process for a New Research Reactor, IAEA Nuclear Energy Series No. NP-T-5.6, IAEA, Vienna (2014).

[11] EUROPEAN ATOMIC ENERGY COMMUNITY, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, WORLD HEALTH ORGANIZATION, Fundamental Safety Principles, IAEA Safety Standards Series No. SF-1, IAEA, Vienna (2006).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY, Implementation of a Management System for Operating Organizations of Research Reactors, Safety Reports Series No. 75, IAEA, Vienna (2013).

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

[14] Convention on Early Notification of a Nuclear Accident, INFCIRC/335, IAEA, Vienna (1986).

[15] Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, INFCIRC/336, IAEA, Vienna (1986).

[16] Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, INFCIRC/546, IAEA, Vienna (1997).

[17] Convention on the Physical Protection of Nuclear Material, INFCIRC/274/Rev.1, IAEA, Vienna (1980) and Amendment thereto, INFCIRC/274/Rev.1/Mod.1, IAEA, Vienna (2005).

[18] Vienna Convention on Civil Liability for Nuclear Damage, INFCIRC/500, IAEA, Vienna (1996).

[19] Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, INFCIRC/566, IAEA, Vienna (1998).

[20] Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention, INFCIRC/402, IAEA, Vienna (1988).

[21] Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/140, IAEA, Vienna (1970).

[22] The Structure and Content of Agreements Between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons, INFCIRC/153 (Corrected), IAEA, Vienna (1972).

[23] Model Protocol Additional to the Agreement(s) Between States(s) and the International Atomic Energy Agency for the Application of Safeguards, INFCIRC/540 (Corrected), IAEA, Vienna (1998).

[24] Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA, IAEA, Vienna (2002).

[25] STOIBER, C., BAER, A., PELZER, N., TONHAUSER, W., Handbook on Nuclear Law, IAEA, Vienna (2003).

[26] STOIBER, C., CHERF, A., TONHAUSER, W., DE LOURDES VEZ CARMONA, M., Handbook on Nuclear Law: Implementing Legislation, IAEA, Vienna (2012).
[27] INTERNATIONAL ATOMIC ENERGY AGENCY, Guidance for States Implementing Comprehensive Safeguards Agreements and Additional Protocols, IAEA Services Series No. 21, IAEA, Vienna (2016).
[28] INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Guide for States with Small Quantities Protocols, IAEA Services Series No. 22, IAEA, Vienna (2013).
[29] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Material Accounting Handbook, IAEA Services Series No. 15, IAEA, Vienna (2008).
[30] INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Practices Guide on Facilitating IAEA Verification Activities, IAEA Services Series No. 30, IAEA, Vienna (2014).
[31] INTERNATIONAL ATOMIC ENERGY AGENCY, ISSAS Guidelines: Reference Report for IAEA SSAC Advisory Service, IAEA Services Series No. 13, Vienna (2005).
[32] INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Practices Guide on Establishing and Maintaining State Safeguards Infrastructure, IAEA Services Series No. 31, IAEA, Vienna (2018).
[33] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, IAEA Safety Standards Series No. GSR Part 1 (Rev. 1), IAEA, Vienna (2016).
[34] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection of the Public and the Environment, IAEA Safety Standards Series No. GSG-8, IAEA, Vienna (2018).
[35] INTERNATIONAL ATOMIC ENERGY AGENCY, The Operating Organization and the Recruitment, Training and Qualification of Personnel for Research Reactors, IAEA Safety Standards Series No. NS-G-4.5, IAEA, Vienna (2008).
[36] INTERNATIONAL ATOMIC ENERGY AGENCY, Site Evaluation for Nuclear Installations, IAEA Safety Standards Series No. NS-R-3 (Rev. 1), IAEA, Vienna (2016).
[37] INTERNATIONAL ATOMIC ENERGY AGENCY, Site Survey and Site Selection for Nuclear Installations, IAEA Safety Standards Series No. SSG-35, IAEA, Vienna (2015).
[38] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CIVIL AVIATION ORGANIZATION, INTERNATIONAL LABOUR ORGANIZATION, INTERNATIONAL MARITIME ORGANIZATION, INTERPOL, OECD NUCLEAR ENERGY AGENCY, PAN AMERICAN HEALTH ORGANIZATION, PREPARATORY COMMISSION FOR THE COMPREHENSIVE NUCLEAR-TEST-BAN TREATY ORGANIZATION, UNITED NATIONS ENVIRONMENT PROGRAMME, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, WORLD METEOROLOGICAL ORGANIZATION, Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015).
[39] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR OFFICE, PAN AMERICAN HEALTH ORGANIZATION, WORLD HEALTH ORGANIZATION, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-2, IAEA, Vienna (2011).
[40] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL LABOUR OFFICE, PAN AMERICAN HEALTH ORGANIZATION, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, Arrangements for Preparedness for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GS-G-2.1, IAEA, Vienna (2007).
[41] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, INTERNATIONAL ATOMIC ENERGY AGENCY, INTERNATIONAL CIVIL AVIATION ORGANIZATION, INTERNATIONAL LABOUR OFFICE, INTERNATIONAL MARITIME ORGANIZATION, INTERPOL, OECD NUCLEAR ENERGY AGENCY, UNITED NATIONS OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, WORLD HEALTH ORGANIZATION, WORLD METEOROLOGICAL ORGANIZATION, Arrangements for the Termination of a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018).
[42] INTERNATIONAL ATOMIC ENERGY AGENCY, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme, IAEA Nuclear Security Series No. 19, IAEA, Vienna (2013).
[43] INTERNATIONAL ATOMIC ENERGY AGENCY, Available Reprocessing and Recycling Services for Research Reactor Spent Nuclear Fuel, IAEA Nuclear Energy Series No. NW-T-1.11, IAEA, Vienna (2017).
[44] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for Radioactive Waste Management, IAEA Nuclear Energy Series No. NW-G-1.1, IAEA, Vienna (2009).

[45] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste from Nuclear Power Plants and Research Reactors, IAEA Safety Standards No. SSG-40, IAEA, Vienna (2016).
[46] INTERNATIONAL ATOMIC ENERGY AGENCY, Guidelines and Format for Preparation and Submission of Declarations Pursuant to Articles 2 and 3 of the Model Protocol Additional to Safeguards Agreements, IAEA Services Series No. 11, IAEA, Vienna (2004).
[47] INTERNATIONAL ATOMIC ENERGY AGENCY, International Safeguards in Nuclear Facility Design and Construction, IAEA Nuclear Energy Series No. NP-T-2.8, IAEA, Vienna (2013).
[48] INTERNATIONAL ATOMIC ENERGY AGENCY, Safeguards Implementation Practices Guide on Provision of Information to the IAEA, IAEA Services Series No. 33, Vienna (2016).
[49] INTERNATIONAL ATOMIC ENERGY AGENCY, Establishing the Safety Infrastructure for a Nuclear Power Programme, IAEA Safety Standards Series No. SSG-16, IAEA, Vienna (2011).
[50] INTERNATIONAL ATOMIC ENERGY AGENCY, Development, Use and Maintenance of the Design Basis Threat, IAEA Nuclear Security Series No. 10, IAEA, Vienna (2009).
[51] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 13, IAEA, Vienna (2011).
[52] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Recommendations on Radioactive Material and Associated Facilities, IAEA Nuclear Security Series No. 14, IAEA, Vienna (2011).
[53] INTERNATIONAL ATOMIC ENERGY AGENCY, Security of Nuclear Information, IAEA Nuclear Security Series No. 23-G, IAEA, Vienna (2015).
[54] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Security Culture, IAEA Nuclear Security Series No. 7, IAEA, Vienna (2008).
[55] INTERNATIONAL ATOMIC ENERGY AGENCY, Advancing Implementation of Decommissioning and Environmental Remediation Programmes, IAEA Nuclear Energy Series No. NW-T-1.10, IAEA, Vienna (2016).
[56] INTERNATIONAL ATOMIC ENERGY AGENCY, Guidelines for Preparing and Conducting an Integrated Nuclear Infrastructure Review (INIR), IAEA Service Series No. 34, IAEA, Vienna (2017).

ABBREVIATIONS

AMPT	assessment, marketing and programme team
BIS	bid invitation specification
EIA	environmental impact assessment
EPR	emergency preparedness and response
IAP	integrated action plan
INIR-RR	Integrated Nuclear Infrastructure Review for a new Research Reactor Programme
RRPIC	research reactor programme implementing commission
SER	self-evaluation report
SSAC	state system of accounting for and control of nuclear material
TC	technical cooperation
TSO	technical support organization

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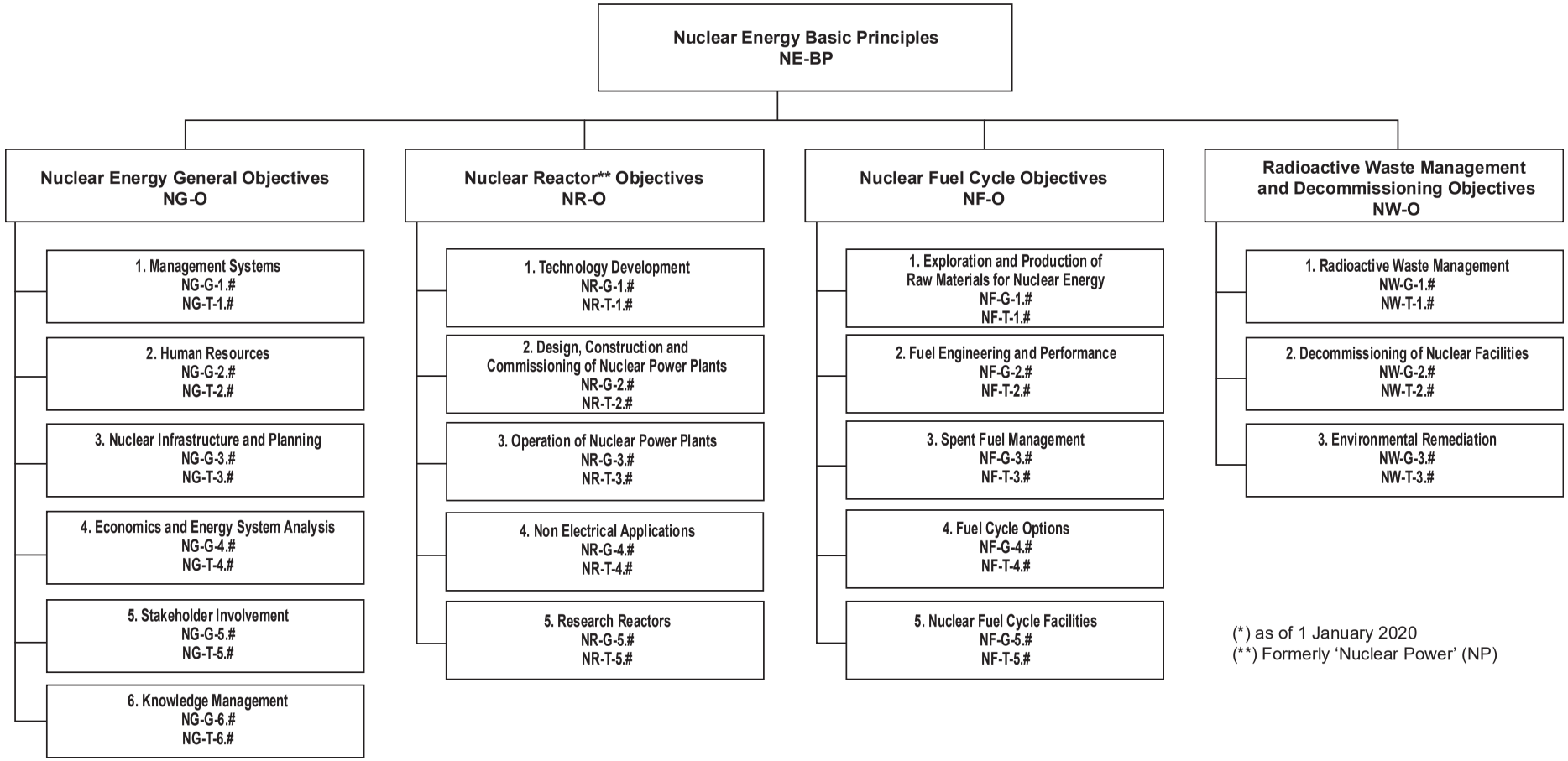

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Key

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