

IAEA Safety Standards

Establishing the Safety Infrastructure for a Nuclear Power Programme

Specific Safety Guide

IAEA SAFETY STANDARDS AND RELATED PUBLICATIONS

IAEA SAFETY STANDARDS

Under the terms of Article III of its Statute, the IAEA is authorized to establish or adopt standards of safety for protection of health and minimization of danger to life and property, and to provide for the application of these standards.

The publications by means of which the IAEA establishes standards are issued in the **IAEA Safety Standards Series**. This series covers nuclear safety, radiation safety, transport safety and waste safety. The publication categories in the series are **Safety Fundamentals**, **Safety Requirements** and **Safety Guides**.

Information on the IAEA's safety standards programme is available at the IAEA Internet site <http://www-ns.iaea.org/standards/>

The site provides the texts in English of published and draft safety standards. The texts of safety standards issued in Arabic, Chinese, French, Russian and Spanish, the IAEA Safety Glossary and a status report for safety standards under development are also available. For further information, please contact the IAEA at PO Box 100, 1400 Vienna, Austria.

All users of IAEA safety standards are invited to inform the IAEA of experience in their use (e.g. as a basis for national regulations, for safety reviews and for training courses) for the purpose of ensuring that they continue to meet users' needs. Information may be provided via the IAEA Internet site or by post, as above, or by email to Official.Mail@iaea.org.

RELATED PUBLICATIONS

The IAEA provides for the application of the standards and, under the terms of Articles III and VIII.C of its Statute, makes available and fosters the exchange of information relating to peaceful nuclear activities and serves as an intermediary among its Member States for this purpose.

Reports on safety and protection in nuclear activities are issued as **Safety Reports**, which provide practical examples and detailed methods that can be used in support of the safety standards.

Other safety related IAEA publications are issued as **Radiological Assessment Reports**, the International Nuclear Safety Group's **INSAG Reports**, **Technical Reports** and **TECDOCs**. The IAEA also issues reports on radiological accidents, training manuals and practical manuals, and other special safety related publications.

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

The **IAEA Nuclear Energy Series** comprises informational publications to encourage and assist research on, and the development and practical application of, nuclear energy for

peaceful purposes. It includes reports and guides on the status of and advances in technology, and on experience, good practices and practical examples in the areas of nuclear power, the nuclear fuel cycle, radioactive waste management and decommissioning.

ESTABLISHING THE
SAFETY INFRASTRUCTURE FOR A
NUCLEAR POWER PROGRAMME

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The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

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ESTABLISHING THE SAFETY INFRASTRUCTURE FOR A NUCLEAR POWER PROGRAMME

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GUIDE

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For protecting people and the environment

Establishing the Safety **Infrastructure for a Nuclear**

Power Programme

Revision of publication SSG-16

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FOREWORD

by Yukiya Amano Director General

The IAEA's Statute authorizes the Agency to "establish or adopt... standards of safety for protection of health and minimization of danger to life and property" — standards that the IAEA must use in its own operations, and which States can apply by means of their regulatory provisions for nuclear and radiation safety. The IAEA does this in consultation with the competent organs of the United Nations and with the specialized agencies concerned. A comprehensive set of high quality standards under regular review is a key element of a stable and sustainable global safety regime, as is the IAEA's assistance in their application.

The IAEA commenced its safety standards programme in 1958. The emphasis placed on quality, fitness for purpose and continuous improvement has led to the widespread use of the IAEA standards throughout the world. The Safety Standards Series now includes unified Fundamental Safety Principles, which represent an international consensus on what must constitute a high level of protection and safety. With the strong support of the Commission on Safety Standards, the IAEA is working to promote the global acceptance and use of its standards.

Standards are only effective if they are properly applied in practice. The IAEA's safety services encompass design, siting and engineering safety, operational safety, radiation safety, safe transport of radioactive material and safe management of radioactive waste, as well as governmental organization, regulatory matters and safety culture in organizations. These safety services assist Member States in the application of the standards and enable valuable experience and insights to be shared.

Regulating safety is a national responsibility, and many States have decided to adopt the IAEA's standards for use in their national regulations. For parties to the various international safety conventions, IAEA standards provide a consistent, reliable means of ensuring the effective fulfilment of obligations under the conventions. The standards are also applied by regulatory bodies and operators around the world to enhance safety in nuclear power generation and in nuclear applications in medicine, industry, agriculture and research.

Safety is not an end in itself but a prerequisite for the purpose of the protection of people in all States and of the environment — now and in the future. The risks associated with ionizing radiation must be assessed and controlled without unduly limiting the contribution of nuclear energy to equitable and sustainable development. Governments, regulatory bodies and operators everywhere must ensure that nuclear material and radiation sources are used beneficially, safely and ethically. The IAEA safety standards are designed to facilitate this, and

Encourage all Member States to make use of them.

NOTE BY THE SECRETARIAT

The IAEA safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. The process of developing, reviewing and establishing the IAEA standards involves the IAEA Secretariat and all Member States, many of which are represented on the four IAEA safety standards committees and the IAEA Commission on Safety Standards.

The IAEA standards, as a key element of the global safety regime, are kept under regular review by the Secretariat, the safety standards committees and the Commission on Safety Standards. The Secretariat gathers information on experience in the application of the IAEA standards and information gained from the follow up of events for the purpose of ensuring that the standards continue to meet users' needs. The present publication reflects feedback and experience accumulated until 2010 and it has been subject to the rigorous review process for standards.

Lessons that may be learned from studying the accident at the Fukushima Daiichi nuclear power plant in Japan following the disastrous earthquake and tsunami of 11 March 2011 will be reflected in this IAEA safety standard as revised and issued in the future.

THE IAEA SAFETY STANDARDS

BACKGROUND

Radioactivity is a natural phenomenon and natural sources of radiation are features of the environment. Radiation and radioactive substances have many beneficial applications, ranging from power generation to uses in medicine, industry and agriculture. The radiation risks to workers and the public and to the environment that may arise from these applications have to be assessed and, if necessary, controlled.

Activities such as the medical uses of radiation, the operation of nuclear installations, the production, transport and use of radioactive material, and the management of radioactive waste must therefore be subject to standards of safety.

Regulating safety is a national responsibility. However, radiation risks may transcend national borders, and international cooperation serves to promote and enhance safety globally by exchanging experience and by improving capabilities to control hazards, to prevent accidents, to respond to emergencies and to mitigate any harmful consequences.

States have an obligation of diligence and duty of care, and are expected to fulfil their national and international undertakings and obligations:

International safety standards provide support for States in meeting their obligations under general principles of international law, such as those relating to environmental protection. International safety standards also promote and assure confidence in safety and facilitate international commerce and trade.

A global nuclear safety regime is in place and is being continuously improved. IAEA safety standards, which support the implementation of binding international instruments and national safety infrastructures, are a cornerstone of this global regime. The IAEA safety standards constitute a useful tool for contracting parties to assess their performance under these international conventions:

THE IAEA SAFETY STANDARDS

The status of the IAEA safety standards derives from the IAEA's Statute, which authorizes the IAEA to establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property, and to provide for their application:

With a view to ensuring the protection of people and the environment from harmful effects of ionizing radiation, the IAEA safety standards establish fundamental safety principles, requirements and measures to control the radiation exposure of people and the release of radioactive material to the environment, to restrict the likelihood of events that might lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation, and to mitigate the consequences of such events if they were to occur. The standards apply to facilities and activities that give rise to radiation risks, including nuclear installations, the use of radiation and radioactive sources, the transport of radioactive material and the management of radioactive waste.

Safety measures and security measures[†] have in common the aim of protecting human life and health and the environment. Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security.

The IAEA safety standards reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. They are issued in the IAEA Safety Standards Series, which has three categories (see Fig. 1):

Safety Fundamentals

Safety Fundamentals present the fundamental safety objective and principles of protection and safety, and provide the basis for the safety requirements:

Safety Requirements

An integrated and consistent set of Safety Requirements establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future. The requirements are governed by the objective and principles of the Safety Fundamentals. If the requirements are not met, measures must be taken to reach or restore the

[†] See also publications issued in the IAEA Nuclear Security Series.

required level of safety. The format and style of the requirements facilitate their use for the establishment, in a harmonized manner, of a national regulatory framework. Requirements, including numbered ‘overarching’ requirements, are expressed as ‘shall’ statements. Many requirements are not addressed to a specific party, the implication being that the appropriate parties are responsible for fulfilling them.

Safety Guides

Safety Guides provide recommendations and guidance on how to comply with the safety requirements, indicating an international consensus that it is necessary to take the measures recommended (or equivalent alternative measures). The Safety

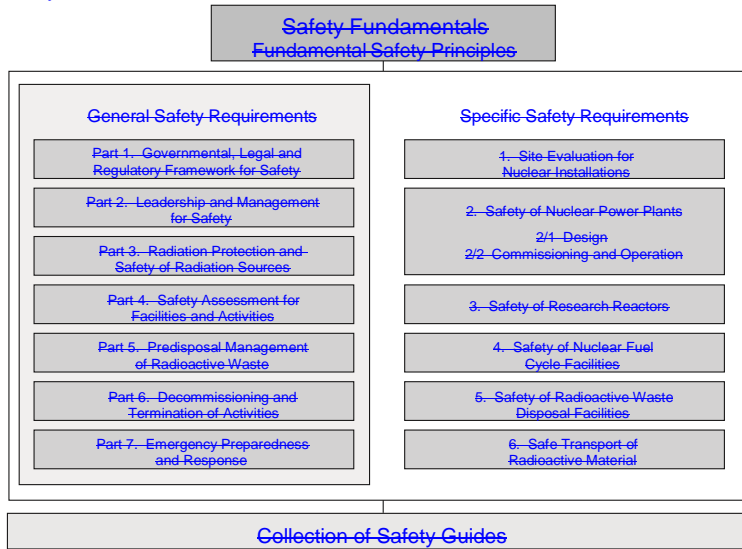


FIG-1. The long-term structure of the IAEA Safety Standards Series.

Guides present international good practices, and increasingly they reflect best practices, to help users striving to achieve high levels of safety. The recommendations provided in Safety Guides are expressed as ‘should’ statements.

APPLICATION OF THE IAEA SAFETY STANDARDS

The principal users of safety standards in IAEA Member States are regulatory bodies and other relevant national authorities. The IAEA safety standards are also used by co-sponsoring organizations and by many organizations that design, construct and operate nuclear facilities, as well as organizations involved in the use of radiation and radioactive sources.

The IAEA safety standards are applicable, as relevant, throughout the entire lifetime of all facilities and activities — existing and new — utilized for peaceful purposes and to protective actions to reduce existing radiation risks. They can be used by States as a reference for their national regulations in respect of facilities and activities.

The IAEA’s Statute makes the safety standards binding on the IAEA in relation to its own operations and also on States in relation to IAEA-assisted operations.

The IAEA safety standards also form the basis for the IAEA’s safety review services, and they are used by the IAEA in support of competence building, including the development of educational curricula and training courses.

International conventions contain requirements similar to those in the IAEA safety standards and make them binding on contracting parties. The IAEA safety standards, supplemented by international conventions, industry standards and detailed national requirements, establish a consistent basis for protecting people and the environment. There will also be some special aspects of safety that need to be assessed at the national level. For example, many of the IAEA safety standards, in particular those addressing aspects of safety in planning or design, are intended to apply primarily to new facilities and activities. The requirements established in the IAEA safety standards might not be fully met at some existing

facilities that were built to earlier standards. The way in which IAEA safety standards are to be applied to such facilities is a decision for individual States.

The scientific considerations underlying the IAEA safety standards provide an objective basis for decisions concerning safety; however, decision makers must also make informed judgements and must determine how best to balance the benefits of an action or an activity against the associated radiation risks and any other detrimental impacts to which it gives rise.

DEVELOPMENT PROCESS FOR THE IAEA SAFETY STANDARDS

The preparation and review of the safety standards involves the IAEA Secretariat and four safety standards committees, for nuclear safety (NUSSC), radiation safety (RASSC), the safety of radioactive waste (WASSC) and the safe transport of radioactive material (TRANSSC), and a Commission on Safety Standards (CSS) which oversees the IAEA safety standards programme (see Fig. 2).

All IAEA Member States may nominate experts for the safety standards committees and may provide comments on draft standards. The membership of the Commission on Safety Standards is appointed by the Director General and includes senior governmental officials having responsibility for establishing national standards.

A management system has been established for the processes of planning, developing, reviewing, revising and establishing the IAEA safety standards. It articulates the mandate of the IAEA, the vision for the future application of the

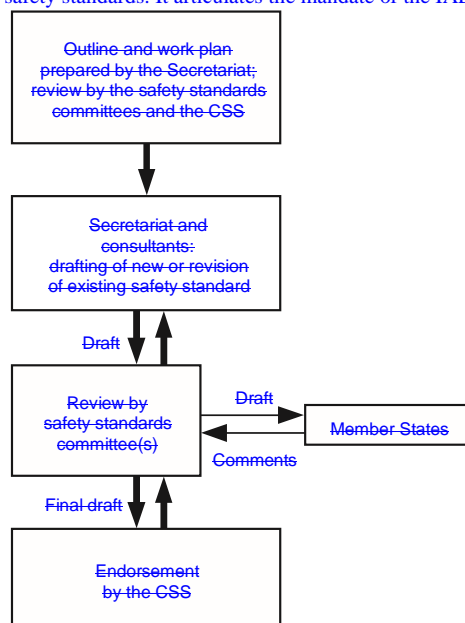


FIG. 2. The process for developing a new safety standard or revising an existing standard.

safety standards, policies and strategies, and corresponding functions and responsibilities.

INTERACTION WITH OTHER INTERNATIONAL ORGANIZATIONS

The findings of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the recommendations of international expert bodies, notably the International Commission on Radiological Protection (ICRP), are taken into account in developing the IAEA safety standards. Some safety standards are developed in cooperation with other bodies in the United Nations system or other specialized agencies, including the Food and Agriculture Organization of the United Nations, the United Nations Environment Programme, the International Labour Organization, the OECD Nuclear Energy Agency, the Pan American Health Organization and the World Health Organization.

INTERPRETATION OF THE TEXT

Safety related terms are to be understood as defined in the IAEA Safety Glossary (see <http://www-ns.iaea.org/standards/safety-glossary.htm>). Otherwise, words are used with the spellings and meanings assigned to them in the latest edition of The Concise Oxford Dictionary. For Safety Guides, the English version of the text is the authoritative version.

The background and context of each standard in the IAEA Safety Standards Series and its objective, scope and structure are explained in Section 1, Introduction, of each publication.

Material for which there is no appropriate place in the body text (e.g. material that is subsidiary to or separate from the body text, is included in support of statements in the body text, or describes methods of calculation, procedures or limits and conditions) may be presented in appendices or annexes.

An appendix, if included, is considered to form an integral part of the safety standard. Material in an appendix has the same status as the body text, and the IAEA assumes authorship of it. Annexes and footnotes to the main text, if included, are used to provide practical examples or additional information or explanation. Annexes and footnotes are not integral parts of the main text. Annex material published by the IAEA is not necessarily issued under its authorship; material under other authorship may be presented in annexes to the safety standards. Extraneous material presented in annexes is excerpted and adapted as necessary to be generally useful.

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1-INTRODUCTION

BACKGROUND

1.1. THE IAEA BACKGROUND

IAEA Safety Standards Series No. SF-1, Fundamental Safety ~~General Conference encouraged the Secretariat to develop approaches to supporting the development of infrastructure for nuclear power in States either considering the introduction of nuclear power or expanding an existing nuclear power programme. A number of States have requested guidance on how to apply the IAEA Safety Standards in the development of a nuclear power programme.~~

~~1.2. The IAEA Safety Fundamentals publication on Fundamental Safety~~

1.1. Principles [1] provides a coherent set of ten safety principles that constitute the basis for establishing safety requirements to achieve the fundamental safety objective of protecting people and the environment from harmful effects of ionizing radiation. The safety principles form a set that is applicable in its entirety; although, in practice, different principles ~~may~~ might be more or less important in relation to particular circumstances, the appropriate application of all relevant principles is ~~required~~ necessary. When a State is considering embarking on a nuclear power programme, Principle 1, Responsibility for safety; Principle 2, Role of government; Principle 3, Leadership and management for safety; ~~and~~ Principle 4, Justification of facilities and activities; ~~and Principle 9 on Emergency preparedness and response~~ are crucial to preparing properly for the future safe operation of ~~a nuclear power plants~~ plant.

~~1.2. 1.3.~~ A considerable period of time is necessary to acquire the necessary competences and ~~to foster~~ a strong safety culture before ~~constructing and~~ operating a nuclear power plant. While ~~the~~ prime responsibility for safety ~~must rest~~ rests with the operating organization, the State has the responsibility, upon committing itself to a nuclear power programme that demands significant investment, to create a robust framework for safety. ~~This responsibility is incumbent on those who live and work within the State and it cannot be outsourced. [1].~~ Establishing a sustainable safety infrastructure is a long process, and it has been internationally acknowledged that a period of ~~10-15~~ years under optimum conditions would generally be ~~needed~~ necessary between the consideration of nuclear power as part of the national energy strategy and the commencement of operation of the first nuclear power plant.

~~1.3. 1.4.~~ In 2007, the IAEA published a brochure ~~entitled~~, Considerations to Launch a Nuclear Power Programme [2], and a ~~report entitled~~ guide that was revised in 2015 as IAEA Nuclear Energy Series No. NG-G-3.1 (Rev. 1), Milestones in the Development of a National Infrastructure for Nuclear Power (Rev. 1) [3].

1.4. In 2008, a report was published by the International Nuclear Safety Group ~~on Nuclear Safety Infrastructure for a National Nuclear Power Programme Supported by the IAEA Fundamental Safety Principles (INSAG 22) [4]. This INSAG report (INSAG) [4], which~~ defines ‘nuclear safety infrastructure’ as “the set of institutional, organizational and technical elements and conditions established in a State to provide a sound foundation for ensuring a sustainable high level of nuclear safety”~~”.~~

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1.5. In 2010, the IAEA Board of Governors approved for publication an IAEA Safety Requirements publication on the Standards Series No. GSR Part 1 (Rev. 1). Governmental, Legal and Regulatory Framework for Safety [5], which establishes requirements in respect of the infrastructure for safety. Reference GSR Part 1 (Rev. 1) [5] covers the essential aspects of the governmental and legal framework for establishing a regulatory body and for taking other actions necessary to ensure the effective regulatory control of facilities and activities — existing and new — utilized for peaceful purposes. GSR Part 1 (Rev. 1) [5] applies to all facilities and activities; from the use of a limited number of single radiation source, to a nuclear power programme. This framework for safety is essentially the governmental part of the ‘nuclear safety infrastructure’ defined in Ref. [4].

1.6. As stated in para. 2.2 of GSR Part 1.6. In INSAG 22 [4], consistent with Refs [2, 3], (Rev. 1) [5]:

“The government establishes national policy for safety by means of different instruments, statutes and laws. Typically, the regulatory body, as designated by the government, is charged with the implementation of policies by means of a regulatory programme and a strategy set forth in its regulations or in national standards. The government determines the specific functions of the regulatory body and the allocation of responsibilities. For example, the government establishes laws and adopts policies pertaining to safety, whereas the regulatory body develops strategies and promulgates regulations in implementation of such laws or policies. In addition, the government establishes laws and adopts policies specifying the responsibilities and functions of different governmental entities in respect of safety and emergency preparedness and response, whereas the regulatory body establishes a system to provide effective coordination.”

1.7. Reference [4] (consistently with Refs [2, 3]) divides the lifetime of a nuclear power plant is divided into five phases from a nuclear safety standpoint. These phases, and their indicative average durations are provided for each of these phases. The presents as follows (see also Fig.1):

“Phase 1: Safety Guide uses the same approach in considering Phases 1, 2 and 3:

- “Phase 1 is ‘Safety infrastructure considerations before deciding a decision to launch a nuclear power programme’ (average programme is made.” Average duration: 1–3 years);
- “Phase 2 is ‘Safety infrastructure preparatory work for the construction of a nuclear power plant after a policy decision has been taken’ (average taken.” Average duration: 3–7 years);
- “Phase 3 is ‘Safety infrastructure during implementation of the activities to implement a first nuclear power plant’ (average plant.” Average duration: 7–10 years);
- “Phase 4 is ‘Safety infrastructure during the operation phase of the nuclear power plant’ (average plant.” Average duration: 40–60 years);
- “Phase 5 is ‘Safety infrastructure during the decommissioning and waste management phases of the nuclear power plant’ (average plant.” Average duration: 20 to more than 100 years); as shown in Fig.1.

1.7. This Safety Guide uses the same approach in considering Phases 1, 2 and 3.

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1.8. This Safety Guide provides recommendations, presented in the form of sequential actions, on progressively meeting all applicable safety requirements progressively established in the IAEA safety standards during Phases 1, 2 and 3 of the development of the safety infrastructure. The actions set out in this Safety Guide are not reformulations of safety requirements; they provide recommendations, expressed as 'should' statements, on when to implement the relevant requirements. (see Fig. This Safety Guide does not diminish the application of, or provide a synopsis of or a substitute for, the IAEA Safety Fundamentals and Safety Requirements publications and the associated Safety Guides.

1.9. Figure 2 provides an indicative time frame and some important milestones expected in each of the phases. At the end of Phase 1, the country is ready to make a knowledgeable commitment to a nuclear power programme. At the end of Phase 2, the country is ready to invite bids or negotiate a contract for the first nuclear power plant. At the end of Phase 3, a country is ready to commission and operate the first nuclear power plant.

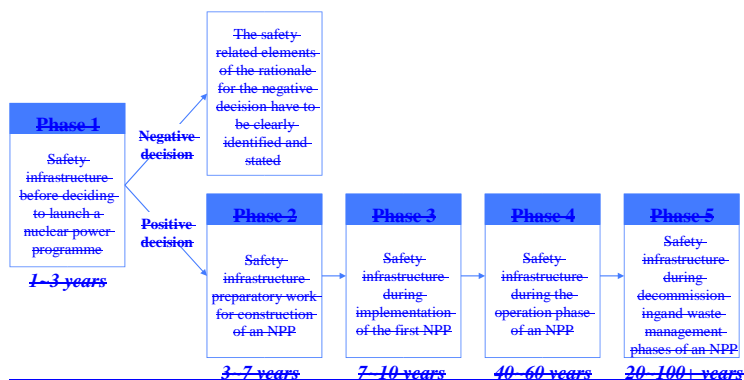
1.10. Figure 3 utilizes the time frame shown in Fig. 2 to provide insights on the progressive involvement of the regulatory body and the operating organization in nuclear power related activities, as well as the progressive allocation of responsibilities from the government to these organizations and other organizations involved in, for example, emergency preparedness and response or radioactive waste management. This also reflects the development of sufficient human resources with the competence to perform the necessary activities. In addition, Fig. 2)-3 identifies, for each relevant IAEA Safety Requirements publication, at which stages:

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- There should be awareness of the requirements;
- Implementation of the requirements should be started;

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- The requirements should be fully implemented.

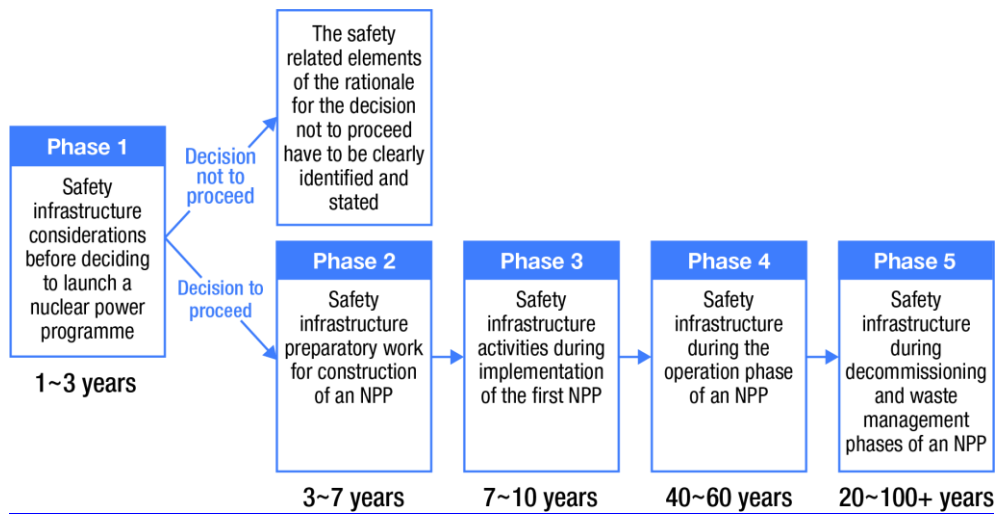
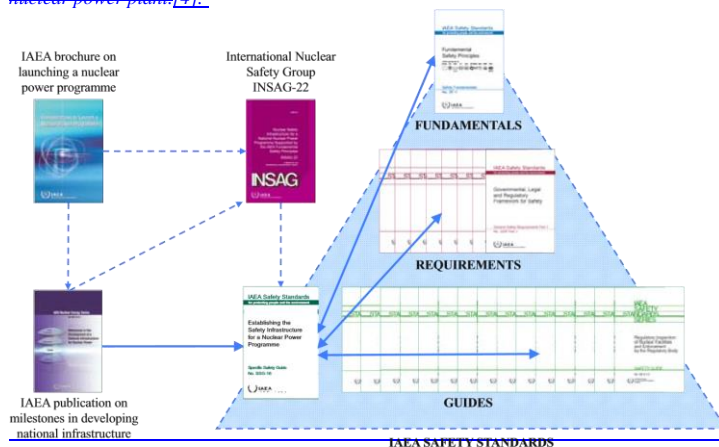


FIG. 1. Main phases of safety infrastructure development over the lifetime of a nuclear power plant (based on INSAG-22 [4]). NPP- nuclear power plant [4].



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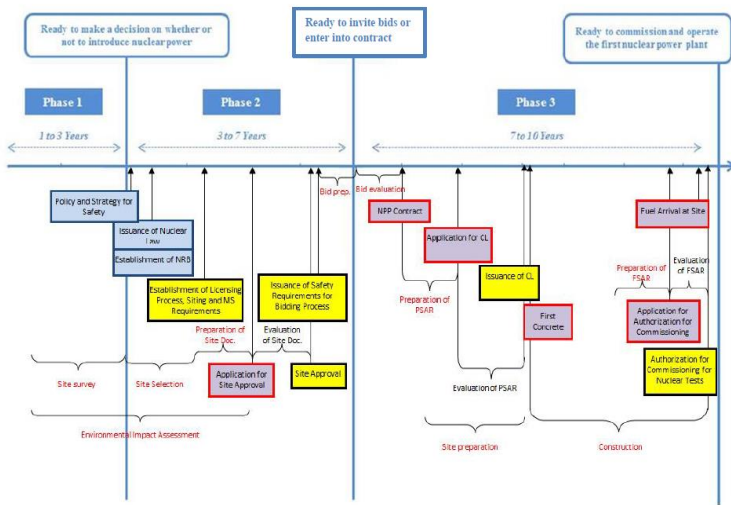
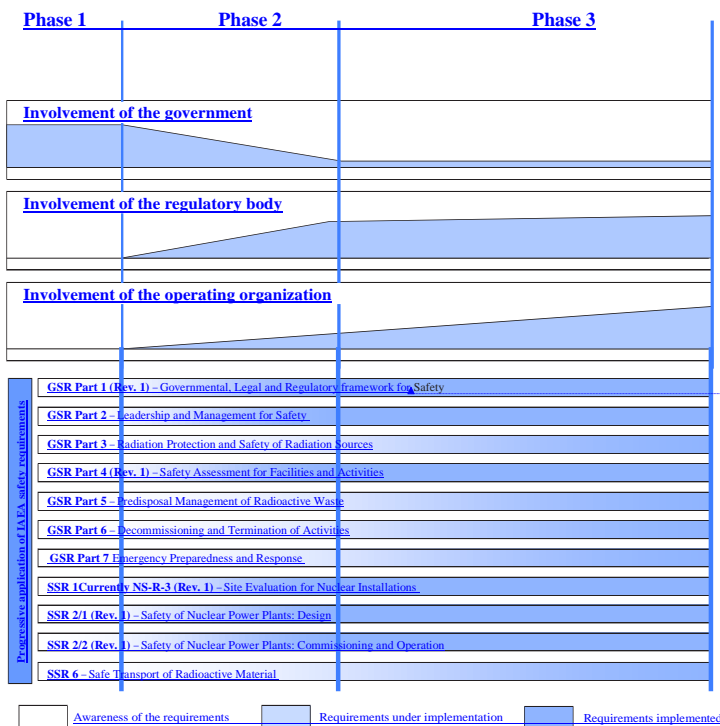


FIG. 2. This Indicative time frame and some important milestones for the development of a nuclear safety infrastructure.

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The initial degree of application of these requirements will vary from State to State depending on the use of radioactive sources and/or nuclear installations (other than NPPs) before considering the nuclear power option.

FIG. 3. Progressive involvement of the main organizations in a nuclear power programme and progressive implementation of the IAEA safety standards. Safety Requirements (indicative only, to be used with flexibility).

1.8. The use of the IAEA Safety Requirements publications alone is not considered sufficient to

1.11. In addition to meeting safety requirements, in order to fully understand the need for or to develop a safety infrastructure.~~It, it~~ is expected that the organizations or persons using this Safety Guide will understand and use~~follow~~ the recommendations provided in the Safety Guides supporting that support the respective Safety Requirements publications ~~in the respective subject areas~~. The IAEA promotes national ‘self-assessments’ and provides for the application of its safety standards through safety review services such as the Integrated Regulatory Review Service ~~or (IRRS)~~, the Operational Safety Review Team service (OSART) or the Emergency Preparedness Review service (EPREV) upon request by the State, to guide and/or to peer review a national ~~self-assessment~~self-assessment in specific areas.

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1.12. ~~1.9.~~ States have different legal structures, and therefore the term ‘government’ as used in the IAEA safety standards is to be understood in a broad sense, and is accordingly interchangeable with the term ‘State’.

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1.13. In identifying actions to be conducted, this Safety Guide tries to specify, as far as practicable, the entity responsible for taking the action. However, since States have different legal structures, it is not possible to specify in general which entity within the State (such as the government as a whole, an executive body the judicial body or the regulatory body) is responsible for a given action. In such cases, the general term ‘State’ or ‘government’ is used.~~1.10.~~

1.14. The IAEA website provides access to copies of all relevant IAEA Safety Requirements and Safety Guides, as well as other key safety related publications such as INSAG reports. In addition, the IAEA Nuclear Safety and Security Online User Interface provides easy access to the content of all current safety standards.

OBJECTIVE

1.15. The objective of this Safety Guide is to provide recommendations on the establishment of a framework for safety in accordance with the IAEA safety standards for States deciding on and preparing to embark on a nuclear power programme. In this regard, it proposes 197 safety related actions to be taken in the first three phases of the development of the nuclear power programme, to achieve the foundation for a high level of safety throughout the entire lifetime of the nuclear power plant, including safety in the associated management of radioactive waste and spent fuel, and safety in decommissioning.

1.16. This Safety Guide is also intended to contribute to the building of leadership and management for safety and of an effective safety culture. It is intended for use as guidance for self-assessment by all organizations involved in the development of a safety infrastructure.

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1.17. The recommendations made in this Safety Guide are to be understood in the context of the respective functions of the government and the regulatory body described in para. 1.6, although some flexibility might be necessary in following the recommendations, depending on the particular national circumstances.

1.18. This Safety Guide is intended for use by persons or organizations participating in the preparation and implementation of a nuclear power programme. Such persons or organizations are referred to collectively in the text as ‘all relevant organizations’. This includes the following:

— Governmental officials;

- Legislative bodies;
- Organizations that are given an explicit governmental mandate to assess the feasibility of or to coordinate the development of a nuclear power programme²;
- Regulatory bodies;
- Operating organizations (Owner operators);
- External expert support entities, including technical and scientific support organizations³;
- Industrial organizations, including plant vendors, manufacturers, designers and constructors;
- Organizations for radioactive waste management and spent fuel management;
- Organizations involved in preparedness for and response to a nuclear or radiological emergency;
- Organizations involved in the transport of nuclear material;
- Competent authorities for matters relating to nuclear security;
- Education and training organizations;
- Research centres (both government and private sector).

1.19. International organizations may use this Safety Guide to help determine the progress accomplished by a State in developing and establishing the infrastructure necessary for executing a nuclear power plant project, so that assistance can be provided in a meaningful and timely manner.

1.20. Other relevant organizations, as well as the news media and the public, may also use this Safety Guide for assurance that the State has established the safety infrastructure necessary for commencing the construction of a nuclear power plant. These organizations may also use it for assurance that the State has commenced preparations for the commissioning, operation, maintenance and eventual decommissioning of the plant, as well as for properly managing the radioactive waste generated during plant operation and decommissioning.

SCOPE

1.21. This Safety Guide covers all the relevant IAEA safety requirements to be incorporated into an effective safety infrastructure for the first three phases of a nuclear power programme. The recommendations are presented for ease of use in the form of 197 actions suggested to achieve a high level of safety throughout the entire lifetime of the nuclear power plant, including safety in the associated management of radioactive waste and spent fuel, and safety in decommissioning.

~~The actions set out in this Safety Guide are not reformulations of safety requirements; they provide recommendations, expressed as 'should' statements, on when to implement the relevant requirements. The Safety Guide does not diminish the application of, or provide a synopsis of or a substitute for, the IAEA Safety~~

² Such organizations are called 'governmental project management organizations' or 'nuclear energy programme implementing organizations' in other publications of the IAEA and the International Nuclear Safety Group. For the purpose of this Safety Guide, such organizations are referred to by the general term 'the government'. ²

The term 'external support organization' is used throughout this text to include external experts and external expert support entities, including technical and scientific support organizations.

³ The term 'external support organization' is used throughout this text to include external experts and external expert support entities, including technical and scientific support organizations.

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Fundamentals and Safety Requirements publications and the associated Safety Guides.

1.22. 1.11. This Safety Guide is applicable for States with various levels of experience with nuclear activities. While some States seeking to establish a nuclear power programme ~~may~~ have few or no nuclear activities already established, others ~~may~~ have extensive experience from the operation of research reactors and other applications of ionizing radiation. For the purpose of this Safety Guide, it is assumed that the State has little or no experience with a nuclear power programme. In the scenario presented in this Safety Guide, the State has no regulatory body and no operating organization at the beginning of the process (Phase 1); this Safety Guide is therefore to be used with flexibility by States that are in a different initial situation. The IAEA welcomes feedback from States for a future revision of this Safety Guide.

1.12. This Safety Guide is intended for use by ~~any persons or organizations participating in the preparation and implementation of a nuclear power programme. Such persons or organizations are referred to collectively in the text as 'all relevant organizations'~~. This includes:

- ~~— Governmental officials;~~
- ~~— Legislative bodies;~~
- ~~— Organizations that are given an explicit governmental mandate to assess the feasibility of or to coordinate the development of a nuclear power programme⁴;~~
- ~~— Regulatory bodies;~~
- ~~— Operating organizations;~~
- ~~— External expert support entities, including technical and scientific support organizations²;~~
- ~~— Industrial organizations, including designers and constructors;~~
- ~~— Organizations for radioactive waste management and spent fuel management;~~
- ~~— Organizations involved in preparedness for and response to a nuclear or radiological emergency;~~
- ~~— Organizations involved in the transport of nuclear material;~~
- ~~— Competent authorities for matters relating to nuclear security;~~ ~~— Education and training organizations;~~ ~~— Research centres.~~

~~1.1. 1.13. International organizations may use this Safety Guide to help determine the progress accomplished by a State in developing and establishing the infrastructure necessary for executing a nuclear power plant project, so that assistance can be provided in a meaningful and timely manner.~~

1.14. Any other relevant organizations, as well as the news media and the public, may also use this Safety Guide for assurance that the State has established the safety infrastructure necessary for commencing the construction of a nuclear power plant. They may also use it for assurance that the State has commenced preparations for the commissioning, operation, maintenance and eventual decommissioning of the plant, as well as for properly managing the radioactive waste generated during plant operation and decommissioning.

1.15. In identifying actions to be conducted, this Safety Guide tries to specify as far as practicable the entity responsible for taking the action. However, since States have different legal structures, it is not possible to specify in general which entity within the State (the government as a whole, executive body, the legal system, regulatory body, etc.) is responsible for a given action. ~~In such cases, the general term 'State' or 'government' is used.~~

⁴ Such organizations are called 'governmental project management organizations' or 'nuclear energy programme implementing organizations' in other publications of the IAEA and the International Nuclear Safety Group. For the purpose of this Safety Guide, such organizations are referred to by the general term 'the government'.²

The term 'external support organization' is used throughout this text to include external experts and external expert support entities, including technical and scientific support organizations.

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OBJECTIVE

1.16. The objective of this Safety Guide is to provide guidance on the establishment of a framework for safety in accordance with the IAEA safety standards for States deciding on and preparing to embark on a nuclear power programme. In this regard, it proposes 200 safety related actions to be taken in the first three phases of the development of the nuclear power programme, to achieve the foundation for a high level of safety throughout the entire lifetime of the nuclear power plant, including safety in the associated management of radioactive waste and spent fuel, and safety in decommissioning.

~~1.1. 1.17. This Safety Guide is intended to contribute to the building of leadership and management for safety and of a safety culture. It is intended for use as guidance for self assessment by all organizations involved in the development of a safety infrastructure.~~

1.18. The government, through the legal system, establishes national policy for safety by means of different instruments, statutes and laws. The regulatory body, as designated by the government, is charged with the implementation of policies through a regulatory programme or a strategy set forth in its regulations or standards. The government, through the legal system, determines the specific functions of the regulatory body and the allocation of responsibilities. For example, the government establishes laws and adopts policies pertaining to safety, whereas the regulatory body develops plans and promulgates regulations in execution of such laws or policies. In addition, the government establishes laws and adopts policies specifying the responsibilities and functions of different governmental entities in respect of safety and emergency preparedness and response, whereas the regulatory body establishes a system to provide for effective coordination. The recommendations made in this Safety Guide are to be understood in the context of these respective functions, although some flexibility may be necessary in following them, depending on the particular national circumstances.

SCOPE

1.19. The scope of this Safety Guide covers all the relevant IAEA safety requirements to be incorporated into an effective safety infrastructure for the first three phases of a nuclear power programme. The recommendations are presented for ease of use in the form of 200 actions.

1.20. This Safety Guide addresses the necessary safety infrastructure before a decision to launch a nuclear power programme is taken (Phase 1), the safety infrastructure for preparatory work for the construction of a nuclear power plant (Phase 2), and the safety infrastructure during construction and commissioning of the first nuclear power plant (Phase 3) (see Fig. 3).

1.21. Figure 3 provides an indicative time frame with some steps important to safety in establishing a safety infrastructure for a nuclear power programme. Figure 4 utilizes this time frame to provide insights on the progressive involvement of the regulatory body and the operating organization in nuclear power related activities, as well as the progressive allocation of responsibilities from the government to these organizations. ~~This also reflects the development of sufficient human resources with the competence to perform the necessary activities. In addition, Fig. 4 identifies, for each relevant IAEA Safety Requirements publication, at which stages, respectively:~~

1.23. — This Safety Guide addresses the progressive application of IAEA safety standards during the development of the safety infrastructure during the first three phases of a nuclear power programme. During Phase 1, the country will analyse all issues that would be involved in introducing nuclear power, so that at the end of Phase 1 it is in a position to make a knowledgeable decision on whether or not to introduce nuclear power. During Phase 2, the country will carry out the work necessary to prepare for the regulating, contracting, financing and construction of a nuclear power plant. For countries using competitive bidding, Phase 3 starts with the bidding and subsequent negotiation of the contract for the design, construction and commissioning of the nuclear power plant. For other countries, Phase 3 starts directly with the negotiation of the contract. Much of the work on infrastructure development will be well advanced by the beginning of Phase 3, but the greatest capital expenditure for the nuclear power plant will occur during Phase 3.

~~There should be awareness of the requirements; Implementation of the requirements~~

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~~should be started;~~ Requirements should be fully implemented.

1.24. 1.22. Research reactors and nuclear fuel cycle facilities are not explicitly covered in this Safety Guide, which concentrates on the nuclear power programme.

1.23. The Fundamental Safety Principles [1] stateSF-1 [1] states that: “Safety measures and security measures have in common the aim of protecting human life and health and the environment.” This Safety Guide does not address nuclear security considerations and the actions that need to be taken to incorporate security elements progressively into an effective nuclear security regime for a nuclear power programme. Considerations of nuclear security matters are covered in IAEA Nuclear Security Series publications. Specific recommendations on security for nuclear power plants are provided in IAEA Nuclear Security Series No. 13, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5) [6]. Implementing Guides are also issued in the IAEA Nuclear Security Series. The scope of this

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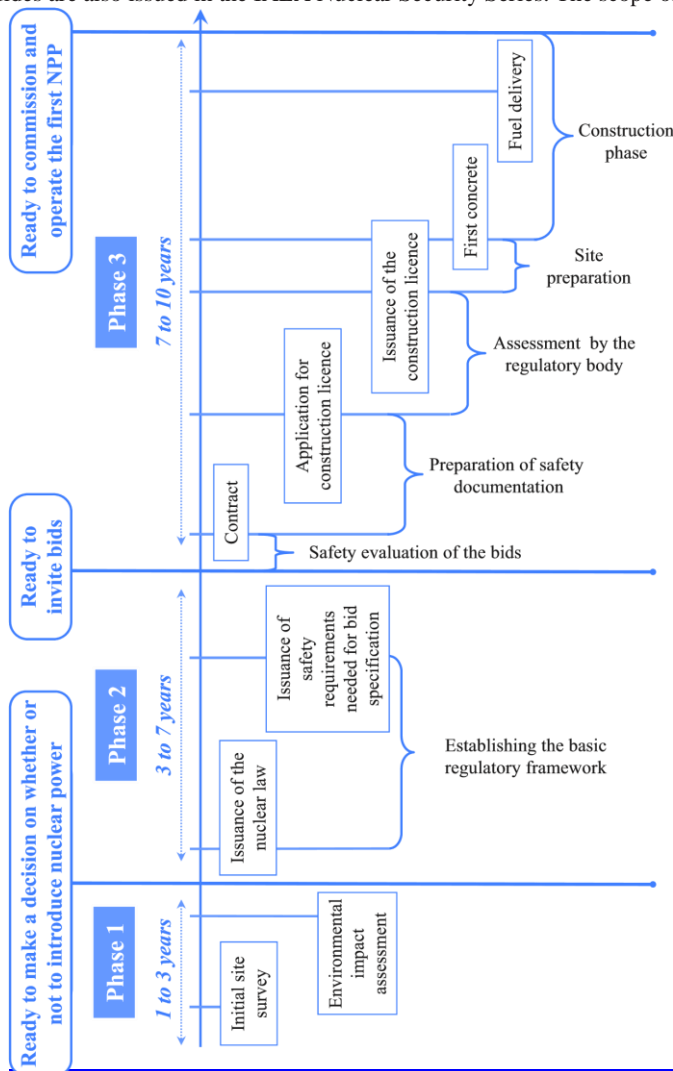


FIG. 3. Some steps important to the development of the safety infrastructure (indicative only, to be used with flexibility; see also Fig. 7 for siting).

GSR Part 1	Government, Legal and Regulatory Framework for Safety
GSR Part 2	Leadership and Management for Safety (current GSR-2)
GSR Part 3	Radiation Protection and Safety of Radiation Sources (revised BSS: GSR Part 3 (Interim Edition) (2011))
GSR Part 4	Safety Assessment for Facilities and Activities
GSR Part 5	Predisposal Management of Radioactive Waste
GSR Part 6	Decommissioning and Termination of Activities (current WS-R-5)
GSR Part 7	Emergency Preparedness and Response (current GSR-2)
SSR 1	Site Evaluation for Nuclear Installations (current SSR-1)
SSR 2/1	Safety of Nuclear Power Plants: Design
SSR 2/2	Safety of Nuclear Power Plants: Commissioning and Operation
SSR 6	Safe Transport of Radioactive Material (current TS-R-1)

☐ Awareness of the requirements
 ☐ Requirements under implementation
 ☐ Requirements implemented

The initial degree of application of these requirements may vary from State to State depending on the use of radioactive sources and/or nuclear installations (other than NPPs) before considering the nuclear power option.

FIG. 4. Progressive involvement of the main organizations in a nuclear power programme and progressive application of the IAEA Safety Requirements (indicative only, to be used with flexibility).

1.25. Safety Guide includes consideration of the interface between nuclear safety and nuclear security. Further information on this issue can be found in [the INSAG report on The Interface Between Safety and Security at Nuclear Power Plants](#) Ref. [7].

1.26. 1.24. The IAEA's statutory mandate concerns risks associated with ionizing radiation. Conventional risks such as risks associated with chemical hazards are not within the ~~purpose and~~ scope of this Safety Guide; however, they also have to be regulated by the State.

STRUCTURE

1.25. STRUCTURE

1.27. Sections 2 and 3 provide guidance on the development of a nuclear safety infrastructure in line with the IAEA safety standards during Phases 1, 2 and 3. Section 2 addresses the 'general safety ~~requirements~~ ~~of requirements relevant to~~ this infrastructure (elements 1–14), while Section 3 addresses the 'specific safety ~~requirements~~ ~~of requirements relevant to~~ the infrastructure (elements 15–20), in accordance with the structure of the IAEA ~~Safety Standards Series~~ ~~safety standards~~ (see [Fig. 5 Table 1](#)). For each of the elements considered, this Safety Guide identifies the main actions that should be taken in Phases 1, 2 and 3, respectively, and also specifies the IAEA Safety Requirements to be complied with.-

1.26.-

	20 ELEMENTS OF THE SAFETY INFRASTRUCTURE	MAIN SUPPORTING IAEA SAFETY REQUIREMENTS IDENTIFIED
SECTION 2 General Safety Requirements	1 - National policy and strategy for safety	GSR Part 1 (Rev 1)
	2 - Global nuclear safety regime	
	3 - Legal framework	
	4 - Regulatory framework	
	5 - Transparency and openness	
	6 - Funding and financing	
	7 - External support organizations and contractors	
	8 - Leadership and management for safety	GSR Part 2
	9 - Human resources development	
	10 - Research for safety and regulatory purposes	

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Specific Safety Requirements	SECTION 2	11 - Radiation protection	GSR Part 3
		12 - Safety assessment	GSR Part 4 (Rev 1)
		13 - Safety of radioactive waste, spent fuel management and decommissioning	GSR Part 5 GSR Part 6 SSR-5
		14 - Emergency preparedness and response	GSR Part 7
		15 - Operating organization	SSR 2/2 (Rev 1)
	SECTION 3	16 - Site survey and site selection	NS-R-3 (Rev 1)
		17 - Design safety	SSR 2/1 (Rev 1)
		18 - Preparation for commissioning	SSR 2/2 (Rev 1)
		19 - Transport safety	SSR- 6
		20 - Interfaces with nuclear security	GSR Part 1 (Rev 1) SSR 2/1 (Rev 1) SSR 2/2 (Rev 1)

TABLE. 1. Structure of Sections 2 and 3 of this Safety Guide, in accordance with the structure of the IAEA Safety Standards Series.

1.28. In the text, for each of the elements considered, numbered actions appear as ‘should’ statements, and then the following paragraphs provide the user with further background on, and the rationale for, these numbered actions.

1.27. This Safety Guide specifies, for each phase, the IAEA Safety Requirements publications that serve as a basis for the actions.

1.29. 1.28. The appendix consists of a summary of all the actions (as ‘should’ statements) which that should be taken in Phases 1, 2 and 3, respectively, as well as the bases for these actions.

1.29. The IAEA’s web sites provide a comprehensive list of relevant IAEA Safety Requirements and Safety Guides, as well as other key safety related publications such as INSAG reports (<http://www-ns.iaea.org/standards>, <http://www-pub.iaea.org/books>).

20 ELEMENTS OF THE SAFETY INFRASTRUCTURE		MAIN SUPPORTING IAEA SAFETY REQUIREMENTS IDENTIFIED	CORRESPONDING NUMBER IN THE LONG-TERM STRUCTURE
SECTION 2 General Safety Requirements	1—National policy and strategy	GSR-Part 1	GSR-Part 1
	2—Global nuclear safety regime		
	3—Legal framework		
	4—Regulatory framework		
	5—Transparency and openness		
	6—Funding and financing		
	7—External support organizations and contractors		
	8—Leadership and management for safety	GSR-2	GSR-Part 2
	9—Human resources development		
	10—Research for safety and regulatory purposes		
	11—Radiation protection	Current BSS (GSR-Part 3- (Interim) 2011)	GSR-Part 3-
	12—Safety assessment	GSR-Part 4	GSR-Part 4

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SECTION 3 Specific Safety Requirements	13—Safety of radioactive waste, spent fuel management and decommissioning	GSR Part 5 WS-R-5	GSR Part 5 GSR Part 6
	14—Emergency preparedness and response	GS-R-2	GSR Part 7
	15—Operating organization	NS-R-2 (being revised)	SSR 2/2
	16—Site survey, site selection and evaluation	NS-R-3	SSR 1
	17—Design safety	NS-R-1 (being revised)	SSR 2/1
	18—Preparation for commissioning	NS-R-2 (being revised)	SSR 2/2
	19—Transport safety	TS-R-1	SSR 6
	20—Interfaces with nuclear security	GSR Part 1	GSR Part 1

FIG. 5. Structure of Sections 2 and 3 of this Safety Guide, in accordance with the structure of the IAEA Safety Standards Series.

1.30. The IAEA web site provides a listing of current IAEA safety standards as well as downloadable files for all standards and information on IAEA safety standards being drafted or reviewed: <http://www-ns.iaea.org/downloads/standards/status.pdf>

1.31. The IAEA has set up a web site for this Safety Guide to provide users with hyperlinks to the applicable Safety Requirements (<http://www-ns.iaea.org/techareas/safety-infrastructure>).

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2.- IMPLEMENTING IAEA GENERAL SAFETY REQUIREMENTS FOR THE ESTABLISHMENT OF THE SAFETY INFRASTRUCTURE

ACTIONS 1–10: NATIONAL POLICY AND STRATEGY FOR SAFETY

General

2.1 ~~2.1.~~ A nuclear power programme is a major national undertaking requiring careful planning and preparation, and a major investment in time and human and financial resources. While nuclear power is not unique in this respect, it is considered to be different because of the safety issues associated with the possession and handling of nuclear material and the long term commitment to ensuring safety after the decision to embark on a nuclear power programme has been made.

2.2 ~~2.2.~~ The national strategy for embarking on a nuclear power programme needs to recognize the possibility of a nuclear emergency, including one resulting from a severe accident, and the country's ability to respond to such an emergency.

2.3 Given the wide spectrum of issues to be considered and the implications and duration of the commitments associated with a nuclear power programme, the decision to embark on a nuclear power programme has to come from the government. The prime importance of safety has to be recognized and reflected in policy decisions as well as in the strategy adopted by the government.

2.4 ~~2.3.~~ Past experience shows that there are many possible ways to establish a nuclear power programme. States wishing to embark on a first

nuclear power plant project ~~may~~might be at various levels of capability with regard to safety, ranging from no experience, to experience with laboratory scale nuclear facilities and industrial applications, the operation of research reactors, or the handling of large quantities of radioactive material ~~in large amounts.~~ In this Safety Guide, ~~for the sake of generality,~~ it is assumed that the State does not have an institution or organization that would be ready to assess the feasibility of the nuclear power option as part of a national energy policy and ~~that could~~ present its findings to the government's decision makers at the highest level ~~decision makers of the~~ government.

2.5 ~~2.4.~~ From the earliest phase of the development of safety infrastructure, the prime responsibility for safety will rest with the ~~prospective facility operating organization, and the government is required to establish an effective governmental, legal and regulatory framework to support a high level of safety [5].~~ of the prospective facility. The prime responsibility for safety cannot be delegated or outsourced ~~(see Principle 1);~~ of SF-1 [1]); it ~~must be~~is discharged by the operating organization through leadership, adequate funding, sufficient expertise ~~and legal, training and education. The government is required to establish an effective governmental, legal and regulatory framework to support a high level of safety, in accordance with Requirement 2 of GSR Part 1 (Rev. 1) [5]. Regulatory oversight is important to verify that the operating organization discharges its responsibility for safety completely and effectively and to enforce compliance with applicable safety standards.~~

2.6 ~~2.5.~~ Having prime responsibility for safety, the person or organization responsible for a facility or an activity, should actively evaluate progress in science and technology as well as relevant information

from the feedback of experience, in order to identify and to make safety improvements that are considered practicable. Implementation of such improvements may require prior notification to or authorization from the regulatory body.

2.7 The implementation of safety improvements cannot detract the operating organization of the nuclear power plant or the regulatory body from the day-to-day work of ensuring that existing safety requirements are met.

2.8 A State that is considering launching a nuclear power programme is likely to look for proven existing technologies rather than developing a specific new design. Nevertheless, the choice will be made from among various available technologies. Such a choice ~~may~~might be made at different times depending on the overall policy, but in any case, the policy should emphasize the need for the effective ~~transfer~~building of competence in safety to the State. If there is a strategy of the State to establish an early partnership with ~~a certain other~~another State, that is a provider of the technology, then the selection of a specific technology can take place in Phase 1 as part of the decision making process to move forward with the nuclear option, ~~or early in~~. However, the selection of the technology is normally not made until Phase 2 after a State has formally made the decision — independent of the type of technology — to establish a nuclear power programme. In such a case, the partnership between the State providing the technology and the State embarking on a nuclear power programme should include agreements at the governmental level to establish the framework for and objectives of such cooperation. An alternative strategy — the strategy that is described in this Safety Guide — ~~would be~~is to first ~~to~~ develop a national knowledge base through a large

network of international contacts during Phase 2, and then to open a bidding process—or start contract negotiations.

2.9 ~~2.6.~~—The government will decide on the level of national participation in the nuclear power programme and the necessary resources to be allocated to develop the nuclear safety infrastructure. In any circumstance, a vigorous programme for the development of a national workforce with the ~~required~~necessary competence to manage the nuclear technology and to safely conduct nuclear activities is ~~an~~-essential requisite for a sustainable programme. This development programme for the workforce should be planned and progressively implemented through the three initial phases of the nuclear power programme.

Phase 1

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirement 1 of GSR Part 1 (Rev. 1) [5];
- Requirements 10 and 29 of IAEA Safety Standards Series No. GSR Part 3, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards [8];—
- Requirement 2 of IAEA Safety Standards Series No. GSR Part 5, Predisposal Management of Radioactive Waste [9];
- Requirement 2 of IAEA Safety Standards Series No. GSR Part 7, Preparedness and Response for a Nuclear or Radiological Emergency [10].

Action 1. The government should consider the necessary elements of a national policy and strategy for safety to meet the fundamental safety

objective and the safety principles established in ~~the IAEA Safety Fundamentals~~SF-1 [1].

Action 2. The government should provide for the coordination of all activities to establish the safety infrastructure.

Action 3. The government should ensure that the status of the safety infrastructure in relevant areas is assessed and that radiological radiation protection considerations are adequately taken into account.

Action 4. The government should take due account of the assessment of the elements of the safety infrastructure and of the fundamental principle of justification when making a decision on whether or not to introduce a nuclear power programme.

2.10 2.7. In aThe national policy and strategy for safety, should reflect an understanding of the fundamental safety objective and the fundamental safety principles established in ~~the IAEA Fundamental Safety Principles~~ [SF-1] apply [1], in particular:

— Principle 2 of ~~the IAEA Fundamental Safety Principles~~ [1], ‘Role of government’, SF-1 [1], which states that:

“The government is responsible for the adoption within its national legal system of such legislation, regulations, and other standards and measures as may be necessary to fulfil all its national responsibilities and international obligations effectively...”

— The national position should reflect an understanding of the principles expressed in the IAEA’s Fundamental Safety Principles [1], in particular Principle 4: Justification of facilities and activities, of SF-1 [1], which states that “Facilities and activities that give rise to radiation risks must

yield an overall benefit^{2.8}.

Therefore, a full and proper evaluation should be undertaken before deciding to introduce a nuclear power programme in the State. At this first stage, the assessment of the balance between risks and benefits may be of a general nature.

^{2.11} ^{2.8} For the preparation of the information that the government needs as a basis for its decision and for the coordination of all the work that is ~~needed~~ necessary to facilitate a knowledgeable decision regarding a prospective nuclear power programme, it may be appropriate for the government to appoint a project organization that is given an explicit governmental mandate.

^{2.12} ^{2.9} The government should also take into account:

— Binding international instruments and other international instruments (see also paras ^{2.48}¹⁹–^{2.32}³⁵ on the global nuclear safety regime);

— The necessary scope and elements of the governmental, legal and regulatory framework for safety (see also paras ^{2.33}³⁶–^{2.47}⁵¹ on the legal framework and paras ^{2.48}⁵²–^{2.83}⁸⁹ on the regulatory framework);

— The need for and provision for a vigorous competence building programme and the associated human and financial resources (see also paras ^{2.45}⁸¹⁷²–^{2.47}⁷¹⁹⁰ on human resources development and paras ^{2.97}¹⁰⁵–^{2.40}⁶¹¹⁴ on funding and financing);

— The provisions and framework for research and development (see also paras ^{2.47}⁸¹⁹¹–^{2.48}⁹²⁰² on research for safety and regulatory purposes);

— The promotion of leadership and management for safety, including

~~safety~~promotion of a strong culture for safety (see also paras 2.442151–2.457171, on leadership and management for safety);

— ~~The need for and provision for~~ the management of spent fuel ~~management~~ and radioactive waste ~~management~~, including the disposal of radioactive waste (see also paras 2.222236–2.238252, on safety of radioactive waste management, spent fuel management and decommissioning’); ~~and~~

— ~~Potential~~The potential environmental, ~~social~~societal and economic impacts of a prospective nuclear power programme;

— ~~2.10. The need for the establishment of – or an upgrade to – the supporting infrastructure, including, for example, the infrastructure necessary to support the arrangements for emergency preparedness and response.~~

2.13 Although the State ~~may~~might already have experience in the ~~management~~operation of research reactors ~~or~~and/or management of radioactive sources, there are new activities that should be commenced in a timely manner, and that will require the corresponding resources (human, organizational and financial).

2.14 Principle 7 of the IAEA Fundamental Safety Principles [1] states that “People and the environment, present and future, must be protected against radiation risks”.~~2.11.~~ In most States, major projects are subject to environmental restrictions and ~~their promoters~~the organizations responsible for such projects have ~~the~~an obligation to ~~demonstrate~~determine the environmental impacts ~~of their project~~ (including the impacts of the different alternatives considered and the baseline environmental conditions prior to construction against which the impacts of the plant can later be compared) by means of a document ~~generally called~~usually referred to as

the environmental impact assessment report. The authority to which such a report should be submitted is typically a ministry of the environment or an environmental authority. Interfaces, The roles and coordination among other of the organizations involved in the environmental impact assessment, and the interfaces and coordination between these organizations, should also be taken into consideration. For a nuclear power plant project, such a the environmental impact assessment report is likely to be very broad in scope and the radiological environmental impact analysis assessment is only a part of the overall environmental impact assessment. Non-radiological impacts to be assessed typically include: significant environmental impacts on water, air, flora and fauna; land use, population aspects, residues and emissions (all types, i.e. water, air and soil pollution, noise, vibration, light, and heat, ~~radiation~~). This Safety Guide deals only with the radiological impacts, in accordance with the statutory mandate of the IAEA ⁵. Principle 7 of the IAEA Fundamental Safety Principles [1] states that “People and the environment, present and future, must be protected against radiation risks”. The radiological environmental impact analysis (which in most States constitutes one section of the environmental impact assessment) is further addressed in paras 2.190-203–2.201-214 on radiation protection, and paras 3.24-25–3.48-53 on site survey and site evaluation. In the event that the State already has a regulatory body that is responsible for radiation protection and nuclear safety, this body should contribute to the review of the environmental impact assessment in its field of responsibility.

2.15 2.12. Before making a knowledgeable decision regarding the

⁵ ~~Although non-radiological aspects of safety (e.g. industrial safety, fire safety) and environmental protection are not explicitly considered in this Safety Guide, States are expected to fulfil their international undertakings and obligations in relation to these.~~

introduction of a nuclear power programme, the government should ensure that ~~the all~~ expected ~~environmental impact is~~ impacts of the decision are thoroughly understood, and that an adequate assessment of the State's safety infrastructure and associated needs has been conducted. At the end of Phase 1, the government should be fully aware that embarking on a nuclear power programme implies a firm and long term commitment to maintaining activities that are necessary for ensuring safety.-

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirement 1 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements 10 and 29 of GSR Part 3 [8]; ~~—~~
- ~~—~~ Requirement 2 of GSR Part 5 [9];
- ~~—~~ Requirement 2 of GSR Part 7 [10].

Action 5. The government should establish a clear national policy and strategy for meeting safety requirements in order to achieve the fundamental safety objective and to apply the fundamental safety principles established in ~~the IAEA Safety Fundamentals~~ SF-1 [1].

Action 6. The government should establish a policy for knowledge transfer for ensuring safety by means of contracts and agreements with organizations in other States that may be involved in the nuclear power programme.

Action 7. The government should ensure identification of responsibilities and their progressive allocation to the relevant organizations involved in the development of the safety infrastructure.

Action 8. The government should ensure that all the necessary organizations and other elements of the safety infrastructure are developed efficiently and that their development is adequately coordinated.

~~2.16~~ ~~2.13.~~ After the State has decided to introduce a nuclear power programme, the implementation of ~~activities~~actions begins in Phase 2. In Phase 2, the government gradually reduces its involvement, in parallel with the development of other organizations such as the regulatory body, the operating organization and relevant permanent structures within ministries. This transition should be carefully considered and prepared with a view to preventing any break in the effectiveness of the process and in the national commitment to nuclear safety. The crucial role of coordinating the development of the safety infrastructure among the various permanent organizations continues to be ensured by the government until all organizations and elements are in place and functioning, with a clear definition of roles and responsibilities.

~~2.17~~ ~~2.14.~~ The government should establish a clear national policy and strategy for safety and demonstrate a firm commitment to safety by providing its support and the necessary resources for the implementation of an effective safety infrastructure.

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— ~~Requirement 1 of GSR Part 1~~ (Rev. 1) [5];

— ~~Requirements 10 and 29 of GSR Part 3~~ [8]; —

— Requirement 2 of GSR Part 5 [9];

— Requirement 2 of GSR Part 7 [10].

Action 9. The government should continue to implement the national policy and strategy for safety.

Action 10. The government should ensure that the regulatory body and the operating organization are fulfilling their responsibilities.

~~2.18 2.15.~~—The government should ensure that the ~~coordination~~ mechanisms put in place for coordination among all the organizations involved in the nuclear power programme are efficient and effective, and should improve them as necessary.-

~~2.16. Other actions to be taken by the government are described in the following sections of this Safety Guide.~~

ACTIONS 11–19: GLOBAL NUCLEAR SAFETY REGIME

General

~~2.19 2.17.~~—A nuclear power programme in ~~any~~ State cannot be ~~treated~~considered in isolation; A nuclear accident could have harmful effects beyond national borders owing to the potential transboundary ~~effects~~consequences of a radioactive ~~release. A nuclear accident could have consequences anywhere through the releases, and~~ impact on worldwide public opinion. States have a shared need for ~~universal~~the safe operation of nuclear facilities and the safe conduct of activities. The national safety policy and the strategy adopted by the government should therefore take full ~~benefit~~advantage of effective participation in the global nuclear safety regime. However, the prime responsibility for safety rests within each State and with the ~~licensed operators~~operating organization of each nuclear ~~facilities~~power plant.

Phase 1

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirements 1, 14 and ~~1436~~ of GSR Part 1 (Rev. 1) [5]

— Requirements 7 and 17 of GSR Part 7 [10].

Action 11. The government should prepare for participation in the global nuclear safety regime.

Action 12. The government should begin a dialogue with neighbouring States regarding its projects for establishing a nuclear power programme.

Action 13. The government and relevant organizations, ~~— (if they already~~such organizations exist,) should establish contact with organizations in other States and international organizations to seek advice on safety related matters.

2.20 2.18.— Specific ~~considerations~~consideration should be given to neighbouring States whose interests could be affected by the State's nuclear power programme, both in normal operation and in the event of an accident. The government should implement a consultation mechanism that would allow neighbouring States to express their views and concerns. Such a process should be continued during all phases of development of the State's nuclear power programme.

2.21 2.19.— States embarking on a nuclear power programme should cooperate particularly with those States that might be directly impacted by an emergency (i.e. States with territories within emergency planning zones

and emergency planning distances [10]), with the aim of ensuring the exchange of information relevant to emergency preparedness and response in relation to the nuclear power programme. Such coordination and cooperation should be undertaken at all levels: from local authorities and response organizations, to national authorities and response organizations, including the regulatory body, as necessary.

2.22 International cooperation and assistance is an opportunity to share and benefit from the experience of States that have already implemented, or are ~~also~~ in the process of implementing, a nuclear power programme. In Phase 1, States embarking on the development of a nuclear power programme will find it useful to establish contact with States that have advanced nuclear power programmes, and with international organizations, to seek advice on safety related matters, and to derive benefit from international operating experience and regulatory experience and from the dissemination of lessons ~~learned~~ identified. Liaising with other States with similar objectives for nuclear power programmes should also be considered.

2.23 ~~2.20~~ The State should prepare for involvement in the global nuclear safety regime, which is promoted by the IAEA on the basis of the following elements:-

- ~~— The international~~ International conventions that establish robust common principles and obligations for ensuring safety in the use of radiation, radioactive material and nuclear energy, and ~~to provide~~ for an effective coordinated response to emergencies;
- ~~— Codes of conduct that promote good practices in the relevant operations~~ activities;
- ~~— Internationally agreed IAEA safety standards that support the~~

development of harmonized national safety requirements, guides and practices;

- International peer reviews of safety ~~levels~~ that ~~aim for~~ provide mutual learning by participating ~~Member~~ States;
- Knowledge networks and expert networks;
- Multinational and bilateral cooperation in safety matters ~~that is~~ aimed at enhancing safety by means of harmonized approaches and the increased quality and effectiveness of safety reviews and inspections.

2.24 ~~2.21~~. In this phase, the government ~~gives~~ should give consideration to becoming ~~party a~~ Party to international conventions and codes of conduct such as:

- The Convention on Nuclear Safety⁶ ~~40~~ [11];
- The Convention on Early Notification of a Nuclear Accident [4] ~~12~~];
- The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency [4] ~~13~~];
- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [4] ~~14~~];
- The Convention on the Physical Protection of Nuclear Material [14]; ~~— and its Amendment~~ [15];
- The Code of Conduct on the Safety and Security of Radioactive

⁶ ~~The Convention on Nuclear Safety, which was developed to promote and harmonize nuclear safety, is a legally binding international agreement that was ratified by all States with operating nuclear power plants. The Convention sets up a system of national reporting and peer reviews to ensure that States are complying with their obligations to meet recognized international safety standards and to apply good practices.~~

Sources [~~45~~16].

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1 and 14 of GSR Part 1 (Rev. 1) [5]; ~~—~~
- ~~—~~ Requirement 13 of IAEA Safety Standards Series No. GSR Part 2, Leadership and Management for Safety [17];
- ~~—~~ Requirements ~~6.3–6.6~~7 and 17 of ~~GS-R-3~~ [16] GSR Part 7 [10].
- ~~—~~ Requirement 24 of IAEA Safety Standards Series No. SSR-2/2 (Rev. 1), Safety of Nuclear Power Plants: Commissioning and Operation [18];

Action 14. All the relevant organizations should participate in the global nuclear safety regime.

Action 15. The State should become a ~~party~~ Party to the relevant international conventions, as identified in Phase 1.

Action 16. All relevant organizations should strengthen their cooperation on safety related matters with States with advanced nuclear power programmes.

2.25 ~~2.22~~. One important consideration in the ~~successive~~ decision making processes ~~in~~ for a nuclear power programme is the interdependence of activities relating to nuclear power between ~~all~~ States. In Phase 2, activities that are required ~~in~~ by the international agreements and conventions identified in Phase 1 should ~~therefore~~ be commenced. This will help to promote safety nationally and globally, as well as enhancing international confidence and trust. ~~The consent of a State to be bound by international~~

~~instruments may be expressed by means of signature, ratification, acceptance, approval or accession in accordance with the provisions of the respective instrument.~~

~~2.26~~ ~~2.23.~~ Activities and participation in the global nuclear safety regime that were identified and planned during Phase 1 should be progressively implemented by those parties who were identified and were assigned the responsibility to carry them out. The operating organization and the regulatory body should participate, ~~although for different reasons,~~ in their respective international networks. An important part of international cooperation ~~would be~~ and assistance is the exchange of construction, operating and emergency management experience ~~and operating experience.~~ The regulatory body should assess whether experience indicates that modifications ~~are needed into~~ the regulatory requirements are necessary and/or whether more attention ~~will~~ should be given to certain ~~safety~~-issues in the safety assessment and during inspections. The operating organization should ~~participate to be alerted to be aware of NPP operating experience that may indicate~~ indicates the need for design changes or the reconsideration of operation or maintenance practices, ~~so as~~ to provide continued assurance of future safe operation.

~~2.27~~ ~~2.24.~~ Effective participation of the regulatory body, operating organization and other relevant entities in international activities and networks promotes the transfer of knowledge on lessons learned and best practices from other States; on nuclear power plant operation and regulation. It also facilitates the provision of support by States with advanced nuclear power programmes. Such support could include the two- way long term assignments of experts; whether consultants from other States coaching the developing organizations or experts sent to other States

for on the job training.-

2.28 ~~2.25. Commitment~~ The commitment to complying with ~~the~~ IAEA safety standards and to participation in international safety reviews and safety services on the basis of safety standards should be reaffirmed. Consideration should also be given to other international safety standards and to codes of conduct as well as to INSAG publications.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1 and 14 of GSR Part 1 (Rev. 1) [5]; ~~—~~
- Requirement 13 of GSR Part 2 [17];
- Requirements 6.3–6.6/7 and 17 of GS-R-3 [16]; ~~—~~ GSR Part 7 [10].
- Requirement 24 of Ref. [17]. SSR-2/2 (Rev. 1) [18];

Action 17. All the relevant organizations should ensure continued participation in international activities and international networks for strengthening safety.

Action 18. The operating organization should implement a cooperation programme with the vendor and with other organizations operating nuclear power plants of the same type as that selected, for the purpose of strengthening safety.

Action 19. The regulatory body should implement a cooperation programme with the vendor State and with other regulatory bodies that have experience of oversight of nuclear power plants of the same type as that selected.

2.29 ~~2.26.~~ The State should participate in the review meetings of the relevant international conventions to which it has become a ~~party.~~ Party and fulfil other obligations.

2.30 ~~2.27.~~ The regulatory body, the operating organization and other relevant entities should strengthen their cooperation with their respective counterparts in other States and with international networks.

2.31 ~~2.28.~~ To gain feedback from regulatory bodies in other States, the regulatory body should extend its contacts, in particular through its participation in bilateral, multilateral and international cooperation and assistance on the subject of a nuclear power programme.

2.32 ~~2.29.~~ Assistance from the regulatory body of the ~~supplier~~ vendor State, as well as from other regulatory bodies that have oversight experience with other nuclear power plants of the same type as that selected, including temporary assignments of staff, should be sought to the extent possible.

2.33 ~~2.30. Exchange~~ An exchange of the results of safety reviews, peer reviews and joint inspections with regulatory bodies in other States having oversight experience with nuclear power plants of the type selected could be used for increasing the understanding of important safety issues, for experience sharing and for transparency among interested parties and the public.

2.34 ~~2.31.~~ The operating organization should establish professional cooperation arrangements with operating organizations in other States, especially those using similar technology, as well as with international operator organizations such as the World Association of Nuclear Operators (WANO).

~~2.35~~ ~~2.32.~~ External support organizations, research organizations and academic bodies should also work in close cooperation with their counterparts in other States.

ACTIONS 20–23: LEGAL FRAMEWORK

~~General~~

~~General~~ ~~2.33.~~

~~2.36~~ Principle 2 of ~~the IAEA’s Fundamental Safety Principles [SF-1], ‘Role of government’, [1],~~ states that:-

“An effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained.”

~~2.37~~ ~~2.34.~~ The legal framework usually includes several levels of documents. The nuclear law itself typically does not contain detailed technical requirements. ~~Instead:~~ instead, it usually specifies the safety goals and general rules and procedures for licensing nuclear facilities and the tasks and authorities of the parties involved in licensing and regulation. The technical safety requirements will usually be established by the regulatory body in the form of regulations and ~~licenee~~license conditions.

~~Phase 1~~

~~Phase 1~~

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirements ~~1, 2, 3 and~~ 4 of GSR Part 1 (Rev. 1) [5];

~~— Requirement 2 of GSR Part 3 [8];~~

~~— Requirement 1 of GSR Part 5 [9];~~

~~— Requirement 4 of IAEA Safety Standards Series No. GSR Part 6, Decommissioning of Facilities [19];~~

~~— Requirements 3.32 and 3.420 of WS-R-5 [18]; GSR Part 7 [10].~~

Action 20. The government should identify all necessary elements of a legal framework for the safety infrastructure, and should plan how to structure it and develop this framework.

Action 21. The government should consider the process that should be employed to license nuclear facilities in the later stages of the programme.

~~2.38 2.35.~~ Establishing a nuclear power programme requires dedicated legislation that has not usually been enacted in a State when entering Phase 1. However, some of the needs for legislation ~~may~~might have been met in respect of other activities~~).~~ The State should therefore perform a complete assessment of the need for legislation and a regulatory framework to support the safe operation and effective licensing and oversight ~~and licensing~~ of a nuclear power plant~~— as well as to support the establishment and maintenance of emergency arrangements.~~

~~2.39 2.36.~~ On the basis of such an assessment, the State should develop a plan to enhance its existing legal and regulatory framework to incorporate all elements ~~of nuclear legislation.~~ The IAEA's Handbook on Nuclear Law [4920] provides detailed guidance on this subject.-

~~2.40 2.37.~~ A nuclear law, which should ensure transparency and should be clearly understandable, is prepared in Phase 1 so as to be enacted ~~as a starting point of Phase 2. As established in GSR Part 1 [5], para. 2.5, a~~

~~governmental, legal and regulatory framework for safety is required to set out the following:~~ early in Phase 2. As stated in para. 2.5 of GSR Part 1 (Rev. 1) [5]:

“The government shall promulgate laws and statutes to make provision for an effective governmental, legal and regulatory framework for safety. This framework for safety shall set out the following:

- (1) “Safety principles for protecting people — individually and collectively — society and the environment from radiation risks, both at present and in the future (see also paras 2.490203–2.204214 on radiation protection);”
- (2) “The types of facilities and activities that are included in the scope (of the framework for safety [and that should be licensed in connection with nuclear power production];”
- (3) “The type of authorization⁷ that is required for the operation of facilities and the conduct of activities, in accordance with a graded approach;
- (4) “The rationale for the authorization of new facilities and activities and the applicable decision making process;
- (5) “Provision for the involvement of interested parties and for their input into decision making (see also paras 2.8490–2.96104 on transparency and openness);”
- (6) “Provision for assigning legal responsibility for safety to the

⁷ Authorization to operate a facility or to conduct an activity may be granted by the regulatory body or by another governmental body to an operating organization or to a person. ‘Authorization’ includes approval, written permission, licensing, certification or registration (see Ref. [SF-1]); [1]).

persons or organizations responsible for the facilities and activities, and for ensuring the continuity of responsibility where activities are carried out by several persons or organizations successively (see also paras 3.1–3.2324 on the operating organization);

- (7) “The establishment of a regulatory body (see also paras 2.4852–2.8389 on the regulatory framework);
- (8) “Provision for the review and assessment of facilities and activities, in accordance with a graded approach (see also paras 2.202215–2.22+235 on safety assessment);
- (9) “The authority and responsibility of the regulatory body for promulgating (or preparing for the enactment of) regulations and preparing guidance for their implementation (see also paras 2.4852–2.8389 on the regulatory framework);
- (10) “Provision for the inspection of facilities and activities and for the enforcement of regulations, in accordance with a graded approach (see also paras 2.4852–2.8389 on the regulatory framework);
- (11) “Provision for appeal against decisions of the regulatory body;
- (12) “Provision for preparedness for and response to a nuclear or radiological emergency (see also paras 2.239253–2.250269 on emergency preparedness and response);
- (13) “Provision for the interface with nuclear security (see also paras 3.94104–3.408115 on interfaces with nuclear security);
- (14) “Provision for the interface with the system of accounting for and control of nuclear material (this is not further addressed further in this Safety Guide);
- (15) “Provision for acquiring and maintaining the necessary

competence nationally for ensuring safety (see also paras 2.458172–2.477190 on human resources development and paras 2.478191–2.489202 on research for safety and regulatory purposes);

- (16) “Responsibilities and obligations in respect of financial provision for the management of radioactive waste and of spent fuel, and for decommissioning of facilities and termination of activities (see also paras 2.222236–2.238252 on safety of radioactive waste management, spent fuel management and decommissioning, and paras 2.97105–2.106114 on funding and financing);
- (17) “The criteria for release from regulatory control;
- (18) “The specification of offences and the corresponding penalties;
- (19) “Provision for controls on the import and export of nuclear material and radioactive material and for their tracking within, and to the extent possible, outside, national boundaries, such as tracking of the authorized export of radioactive sources.” (this is not further addressed in this Safety Guide).

2.38.2.41 For drafters of legislation who are unfamiliar with nuclear law and nuclear technology, an option for consideration in preparing nuclear legislation is to apply models provided by the IAEA and other international organizations or the text of laws adopted by States with developed legal frameworks. This approach could be practicable and should be considered for a number of reasons. FirstlyFirst, it reduces the amount of new legal texts to be drafted. SecondlySecond, it takes advantage of the technical or legal expertise of experienced organizations or States. ThirdlyThird, in the case of incorporation of IAEA models, it can help a State to comply with the requirements of the IAEA and to receive

IAEA technical assistance.

~~2.39-2.42~~ 2.42 ~~These~~The advantages described in para. 2.41 are accompanied by difficulties that should be given careful consideration; ~~however. Firstly, there are concerns about.~~ First, it should be considered whether and how international requirements or the requirements of adopted by another State will fit into a State's legal structure. Secondly, Second, it should be considered whether standards or guidelines prepared elsewhere ~~may~~ contain provisions that are inconsistent with or contradictory to important features of a State's legal structure. ~~Thirdly, Third, difficulties associated with~~ translation ~~might raise other concerns, since~~ should be considered: terms relating to nuclear energy that are ~~derived~~translated from another language ~~may be~~might become meaningless or confusing to persons expected to apply the national law or to comply with it. ~~In addition~~Fourth, difficulties ~~may~~might arise ~~from the fact that the~~when external requirements (e.g. international instruments) ~~may be~~are subject to change, ~~even on a regular basis.~~

~~2.40-2.43~~ 2.43 There is a relationship between the development of nuclear legislation and the consideration of becoming ~~partya~~ Party to the international conventions in the field of nuclear energy. The State should therefore ensure that the nuclear law is consistent with, and reflects the provisions of, the relevant international instruments.

~~2.41-2.44~~ 2.44 After preparation of a reasonably detailed initial draft of the nuclear law, many governments have found it useful to ~~subject the draft nuclear law to an independent review, to assess its adequacy~~seek IAEA assistance in further drafting and public acceptability reviewing, as appropriate, of their national nuclear legislation.

~~2.42-2.45~~ 2.45 To ensure consistency of legislation and to avoid conflicts

and ambiguity in the application of nuclear law, the State should also identify correlated laws to be prepared or amended, both safety related and those not directly safety related. Such laws concern: radiation protection and safety, emergency management and civil protection, industrial safety and fire safety, environmental protection, occupational health and safety, waste management, nuclear liability, criminal law enforcement, land use planning regulations, and international trade law and customs law, as relevant.

2.46 States usually have specific laws and organizations for the management of crises and/or conventional emergencies, such as fires, earthquakes, floods and release of hazardous chemicals, and to provide for the protection of the public. In many States, these organizations are usually referred to as civil protection authorities or civil defence authorities and have the responsibility to protect the public in an emergency. For a nuclear emergency, they may also be given a role in implementing public protective actions but this might require some amendments to the law to harmonize with the nuclear law.

2.43-2.47 In Phase 1, the government should recognize that the effective licensing of a nuclear power plant requires a sound legal and governmental infrastructure, including a regulatory body with well-defined responsibilities and functions. To conduct licensing effectively, the general process to be utilized should be considered and communicated to all interested parties as early as possible in the development of the nuclear power programme. This provides the applicant with the information that will be necessary to support licensing submissions, as well as information on the stages of development that will require licensing. Further information Guidance on this topic is given in Ref. [20]IAEA Safety

[Standards Series No. SSG-12, Licensing Process for Nuclear Installations \[21\]](#).

Phase 2

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, ~~2, 3 and~~ 4 of GSR Part 1 ([Rev. 1](#)) [5];
- ~~—~~ Requirement 2 of GSR Part 3 [8];
- ~~—~~ Requirement 1 of GSR Part 5 [9];
- ~~—~~ Requirement 4 of GSR Part 6 [19];
- ~~—~~ Requirements ~~3.32~~ and ~~3.420~~ of ~~WS-R-5 [18]~~GSR Part 7 [10].

Action 22. The government should enact and implement the ~~essential~~appropriate elements of the legal framework for the safety infrastructure.

2.44-2.48 During Phase 2, all essential legislation identified during the assessment process of Phase 1 should be enacted.

2.45-2.49 To ensure consistency of legislation, the State should also complement or amend the related laws identified in Phase 1.

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, ~~2, 3 and~~ 4 of GSR Part 1 ([Rev. 1](#)) [5];
- ~~—~~ Requirement 2 of GSR Part 3 [8];

— Requirement 1 of GSR Part 5 [9];

— Requirement 4 of GSR Part 6 [19];

— Requirements 3.32 and 3.420 of WS-R-5 [18] GSR Part 7 [10].

Action 23. The government should ensure that the legal framework for the safety infrastructure is fully in place and that the legislation is complied with by the relevant organizations.-

2.46:2.50 In Phase 3, the role of the government is to ensure that the legal framework is fully in place, and that the legislation is implemented, complemented and amended, as appropriate.

2.47:2.51 Many States have established mechanisms for helping to determine whether legislation is being implemented in a manner consistent with its objectives. This can help to maintain confidence in the regulatory process. Periodic reports by the regulatory bodies or body and audits conducted under an appropriate quality management system are examples in this regard.

ACTIONS 24–38: REGULATORY FRAMEWORK

General

General

2.52 Principle 2 of the IAEA's Fundamental Safety Principles [SF-1], 'Role of government', [1], states that

2.48. “An effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained.”

2.49:2.53 In a nuclear power programme, the regulatory body should is required to verify that the site evaluation, design, construction,

commissioning, operation and decommissioning of a nuclear power plant comply with the relevant safety standards. ~~The~~ (see para. 4.3 of GSR Part 1 (Rev. 1) [5]). As established in GSR Part 1 (Rev. 1) [5], the core functions of the regulatory body, ~~as allocated in the legislation~~, include the following:

- Preparation of regulations and guides;
- Authorization of facilities and activities;
- Review and assessment of information relevant to safety;
- Inspection of facilities and activities;
- Enforcement of compliance with regulations and standards.

2.50:2.54 The regulatory body's responsibilities also include:

- Ensuring that on site emergency ~~preparedness~~ arrangements ~~and including~~ emergency plans and procedures are in place ~~to protect workers, and provide for an effective response and that they are integrated with the public and the environment;~~ emergency arrangements of other response organizations and other plans as appropriate (see paras 4.11–4.15 of GSR Part 7 [10];
- Establishing appropriate means ~~offer~~ providing information to interested parties in a transparent manner; (see Requirement 36 of GSR Part 1 (Rev. 1) [5]).
- Promoting a culture for safety ~~culture~~; (see Requirement 12 of GSR Part 2 [17]).
- Promoting the necessary coordination with other national bodies and with international bodies.

2.51:2.55 The regulatory structures and approaches ~~currently in use~~ vary significantly from one State to another. The approaches used in States with large nuclear power programmes may differ from those in States with

small nuclear power programmes. Also, the approaches in States with a nuclear power plant vendor may differ from ~~those~~the approaches in States that import nuclear power plants.

~~2.52-2.56~~ Requirements for an effective regulatory body are provided in GSR Part 1 (Rev. 1) [5], and the implementation of the requirements is supported by IAEA Safety Series No. GSG-12 [22], Organization, Management and Staffing of a Regulatory Body for Safety, and IAEA Safety Series No. GSG-13, Functions and Processes of the Regulatory Body for Safety [23]. To be effective, the regulatory body ~~should~~is required to have adequate authority; (including the right to suspend operation and/or to impose penalties on licensees), independence, financial resources and technically competent staff; (see Requirement 4 of GSR Part 1 (Rev. 1) [5]). The regulatory body should make use of the services of external support organizations (see actions 61–71) in areas where it needs additional expertise. ~~Requirements for an effective regulatory body are provided in GSR Part 1 [5], and the implementation of the requirements is supported by Safety Guides [21–25].~~

~~2.57 Development~~The development of the human resources of the regulatory body and the development of ~~its~~the management system of the regulatory body are addressed in paras 2.158172–2.177 ~~on human resources development~~190 and paras 2.142151–2.157 ~~on leadership and management of~~171.

~~2.53-2.58~~ The regulatory body should determine safety, ~~respectively~~ objectives to be achieved by the licensees and should verify the implementation of the necessary safety measures. The necessary safety measures need to be implemented by licensees within stipulated deadlines and be subject to regulatory verification. Inadequate regulatory verification

will have a negative impact on safety, particularly if the licensee fails to take the required safety actions in a timely manner.

Phase 1

Phase 1

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, 3, 4, 7 and 11 of GSR Part 1 (Rev. 1) [5]; ~~—~~
- ~~—~~ Requirements 2 and 3 of GSR Part 3 [8]; ~~—~~
- ~~—~~ Requirement 1 of GSR Part 5 [9].

Action 24. The government should recognize the need for an effectively independent and competent regulatory body, and should consider the appropriate position of the regulatory body in the State's governmental and legal framework for safety.

Action 25. The government should seek advice from the regulatory body on radiation safety issues relating to a nuclear power programme.

Action 26. The government should identify the prospective senior managers of the regulatory body.

2.59 2.54. In Phase 1, there may already be a regulatory body for the regulation of radiation safety. In this case, advice from the existing regulatory body should be obtained and consideration should be given to whether the scope of tasks of the existing regulatory body will be extended or whether a new regulatory body will be created. If different authorities are to coexist, then ~~clarity of~~ their respective roles and responsibilities should be ensured. Inclearly defined while avoiding any ~~ease,~~

~~emphasis~~conflict of interest. Emphasis should be given to assessing and understanding the appropriate position of the regulatory body in the governmental structure of the State.-

2.60 ~~2.55.~~ The prospective senior manager of the regulatory body and other senior staff should be identified. These individuals should begin acquiring knowledge of nuclear regulatory matters.

2.61 ~~2.56.~~ The development of the regulatory framework involves maintaining a balance between prescriptive approaches and more flexible goal setting approaches. This balance might depend upon the State's legal system and regulatory approach. Since the approach chosen will have a major influence on the resources needed by the regulatory body, ~~and the decision on the approach should be made in Phase 2,~~ the persons expected to be in charge of the regulatory body should start learning and considering various regulatory approaches in Phase 1. A strategy ~~is envisioned~~should be developed to determine which regulatory approach will be chosen.

2.62 ~~2.57. IAEA Safety Standards Series No. GS-G-1.4, Documentation for Use in Regulating Nuclear Facilities [24], GSG-13 [23]~~ presents some advantages and disadvantages of different regulatory approaches and provides further guidance on this topic.

Phase 2

~~Phase 2~~

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~— Requirements 1, 3, 4, 7, 11, 16, 17, 18, 15–19, 21, 22, 23, 24, 25, 26,~~

30 and 32 of GSR Part 1 (Rev. 1) [5];

~~— Requirement 3 of GSR Part 2 [17];~~

~~— Requirements 2 and 3 of GSR Part 3 [8];~~

~~— Requirements 1 and 3 of GSR Part 5 [9]; — Requirements 3.~~

~~— Requirement 5 and 3 of GSR Part 6 of WS-R-5 [18]; — [19];~~

~~— Requirement 3.2 of GSR Part 7 of GS-R-3 [16][10].~~

Action 27. The government should establish an effectively independent regulatory body and should empower it with adequate legal authority, and ensure it has technical and managerial competence, and human and financial resources, to discharge its responsibilities in the nuclear power programme.

Action 28. The government should appoint senior managers and key experts to the regulatory body and should assign to them the responsibility for developing the organization.

Action 29. The regulatory body should consider the various regulatory approaches that are applied for nuclear power programmes of the same size, and should ~~tentatively plan~~ decide its approach, taking into account the State's legal and industrial practices and the guidance provided in the IAEA safety standards.

Action 30. The regulatory body should ~~issue~~ establish a process for developing and issuing regulations and guides specifying the documentation and procedures necessary in the various steps of the licensing process and inspections to be conducted.

Action 31. The regulatory body should ~~specify the~~ develop and issue those safety ~~requirements~~ regulations that ~~should be known~~ are needed for the bidding process or contract negotiations.

Action 32. The regulatory body should begin establishing a suitable

working relationship with the operating organization and with other relevant national and international organizations.

2.63 ~~2.58.~~ The regulatory body's core functions (see GSR Part 1 (Rev. 1) [5]) should be clearly defined in the legislation, ~~and as stated in GSR Part 1 [5].~~ Specific ~~guidance~~ recommendations to assist the regulatory body in establishing its regulatory framework ~~can be found in Safety Guides Nos GS-G-1.1 to GS-G-1.5 [21-25]~~ are provided in GSG-12 [22] and GSG-13 [23].

2.64 ~~2.59.~~ The regulatory body should be functionally separate from and effectively independent of all entities ~~—(including parts of the government —) that have responsibilities or interests that could unduly influence its safety related decision making, or~~ that promote the development of the nuclear industry. The regulatory body should have the legal authority, technical competence and resources to fulfil its statutory obligation to regulate facilities and activities, and its regulatory decisions should be free from undue political and economic influence.

2.65 ~~2.60.~~ In establishing the regulatory body, a knowledgeable decision should be made on whether to expand the existing regulatory body or whether to create a new regulatory body. If the regulatory body consists of more than one authority, there should be formal arrangements to ensure that regulatory responsibilities and activities are clearly specified and coordinated, to avoid any omissions or unnecessary duplication and to avoid conflicting requirements being placed upon the operating organization.-

2.66 ~~2.61.~~ The organizational structure and size of the regulatory body could be influenced by many factors, such as the number of authorities involved in the regulatory process, the legal system, the regulatory

approach selected, and the role and capability of external support organizations.

~~2.67~~ ~~2.62~~ The organization of the regulatory body, its structure and size, and the technical skills of its staff, will change as the regulatory body goes through various stages in Phase 2, starting with its early organization and the preparation of its regulatory framework, to the stage where it is able to specify regulations and to make safety assessments as part of the licensing process. The regulatory body ~~therefore~~thereby develops competences in managing growth and change.

~~2.68~~ ~~2.63~~ One of the first things that the regulatory body should consider before starting the recruitment of its staff is its future regulatory approach. The type of approach chosen can have a major impact on the necessary number and qualifications of the regulatory staff. Notwithstanding the approach chosen, an approach should be developed and enough staff should be recruited to cover all core competences necessary for understanding all relevant safety issues of the nuclear power programme. The regulatory approach also has implications for the need for external expert support for the regulatory body.-

~~2.69~~ ~~2.64~~ In Phase 2, before the State decides which reactor technology is going to be deployed, the regulatory body should be aware of the two main alternative regulatory approaches: a prescriptive approach with a large number of regulations; or an approach that focuses on performance, functionfunctions and outcome-oriented approachoutcomes. Each regulatory approach has benefits and disadvantages associated with it, and there are also approaches that combine features of these two main alternatives. When a decision is made in Phase 3 on the reactor technology to be deployed, the regulatory body should ~~be ready to~~ adopt a

~~regulatory~~the approach that best suits the ~~State's~~needs of the State. The regulatory body should have its chosen approach approved by the government, since there will be resource implications. Specific features of these two alternatives are listed below:

— A prescriptive regulatory approach places a great deal of importance on the adequacy of the regulations for safety and requires detailed development. The regulations establish clear requirements and expectations for the regulatory body as well as for the operating organization, and thus can be used to promote systematic interaction between the regulatory body and other parties. The regulations could ~~set~~establish detailed technical requirements, or could identify specific issues that the operating organization and its suppliers should address and present for assessment by the regulatory body. ~~Specific~~For the latter approach, specific technical requirements can then be taken from relevant international industrial standards (including nuclear specific standards) or industrial standards of other States, as agreed by the regulatory body at an early stage of the licensing process for nuclear power plants. Issuing The development and updating of detailed regulations places a high demand on the regulatory body's resources ~~for their development and updating, which adds to the administrative burden.~~

— A performance based regulatory approach allows the operating organization more flexibility in determining how to meet the established safety goals and ~~may require~~necessitates fewer, ~~and~~ less detailed regulations. However, this approach requires the establishment of specific safety goals and targets. Verifying that appropriate measures to ensure safety have been identified by the

operating organization ~~may/might~~ be difficult unless the regulatory body's staff, the staff of its external support organization and the staff of the operating organization all have a high level of professional competence and are able to interact to determine whether established safety objectives ~~for each topic~~ are met.

2.70 ~~2.65~~. Besides the general alternatives ~~just~~ described in para. 2.69, the regulatory approaches in different States vary with respect to the scope and depth of ~~safety~~ the regulatory functions of review and assessment and inspection. The scope of issues that are under regulatory control ~~may/might~~ include all structures, systems and components classified as safety relevant or ~~may/might~~ be limited only to the most safety relevant ~~parts-only~~ aspects. The targets of the comprehensive and systematic regulatory control and inspections are then specified in a deterministic manner, on the basis of a safety classification, or they can be chosen on the basis of a probabilistic assessment of risks. As to the depth of the review, and assessment: in some States the regulatory body puts the main emphasis on the assessment and auditing of the management system and the operations of the operating organizations and their suppliers. ~~In; in~~ in other States the regulatory body prefers to make its own comprehensive independent analyses (audit calculations) and inspections ~~of its own~~.

2.71 ~~2.66~~. Throughout Phase 2, the regulatory body should have a firm strategy for prioritizing the development of regulations. Regulations governing the management of safety, site evaluation, design, (including decommissioning aspects), construction and manufacturing should be prepared ~~early in Phase 2 so as to be~~ and taken into account in the bidding process ~~or contract negotiations~~. In setting its requirements, the regulatory body should adopt ~~as a reference~~ the IAEA safety standards as a reference.

which express an international consensus and are neutral towards different vendors. The regulatory body may complement these with a well—
established set of requirements and with industrial standards (including nuclear safety standards) that are in use in States with extensive experience of nuclear power plant operation. If the regulatory body decides on this complementary option, the entire set of standards should be carefully reviewed ~~so as~~ to avoid conflicts, inconsistencies or incompleteness.-

2.72 ~~2.67.~~ Regulations that could have an impact on the choice of technology should be established early in the process. The plan and schedule for the development of other regulations should be prepared. In developing regulations and guides, the regulatory body should take into consideration information from the feedback of experience and comments from interested parties.-

2.73 ~~2.68.~~ The practical arrangements of the licensing process should be specified by the regulatory body in such a way that applicants are aware of the requirements. Typically, licensing will be required for major activities such as construction and operation. The regulatory body should specify what documents are required for a licence application, as well as the depth of review and assessment for each document submitted in support of a licence application. Separate hold points should be specified for certain steps in design, manufacturing, construction and commissioning, as necessary, for the purpose of verifying the results of the work so far and the preparedness to proceed. Whichever process is chosen, it should be established in Phase 2.

2.74 ~~2.69.~~ The regulatory body should issue basic guidance on the format and content of the documents to be submitted by the operating organization in support of an application for licensing. Later, at the beginning of Phase

3, this basic guidance on the content of documents to be submitted in support of a licence application could be further specified and supplemented in more detail- (see para. 4.34 of GSR Part 1 (Rev. 1) [5]).

~~2.75~~ ~~2.70~~. Further guidance on ~~this topic~~ the licensing process is provided in ~~Ref.~~ SSG-12 [21].

~~2.76~~ ~~2.71~~. The ~~relation~~ relationship between the regulatory body and the operating organization should be based on mutual understanding and respect as well as frank and open communication. ~~The relation should apply, providing constructive liaison on safety related issues and in-depth technical dialogue between experts. The relationship should reflect~~ the principle that the prime responsibility for safety rests with the operating organization and the primary role of the regulatory body is to ensure that the operating organization fulfils its responsibilities.

~~2.77~~ ~~2.72~~. The regulatory body should establish links with the regulatory bodies of other States whose expertise is well established and recognized, and also with regional and international forums and networks. The regulatory body should have staff capable of absorbing the knowledge ~~that should be~~ transferred.

Phase 3

The following actions are recommended to be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirements 1, 3, 4, 7, 11, 16, 17, 18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32 and 21–33 of GSR Part 1 (Rev. 1) [5];~~
- ~~— Requirement 3 of GSR Part 2 [17]; [moved for numerical order]~~
- ~~— Requirements 2 and 3 of GSR Part 3 [8];~~

~~— Requirements 1 and 3 of GSR Part 5 [9]; — Requirements 3.~~
~~— Requirement 5 and 3 of GSR Part 6 of WS-R 5 [18]; — [19];~~
~~— Requirement 3.2 of GSR Part 7 of GS-R 3 [16][10].~~

Action 33. The regulatory body should maintain suitable working relationships with the operating organization.

Action 34. The regulatory body should plan and conduct all the required licensing and oversight activities ~~to be conducted~~ during the licensing process, including during siting, construction, commissioning and operation, consistent with the regulatory approach that was selected.

Action 35. The regulatory body should establish a consistent procedure for issuing, revising and revoking regulations and guides.

Action 36. The regulatory body should ensure that a full and comprehensive set of regulations and guides is in place for regulating construction, commissioning and operational activities at the appropriate time.

Action 37. The regulatory body should implement its programme for inspection and enforcement during construction including, as applicable, the design and manufacture of safety related components.

Action 38. The regulatory body should review and assess programmes to be implemented by the operating organization, as appropriate.

2.78 ~~2.73.~~ Once the vendor has been chosen through the bid evaluation process or through contract negotiations, the regulatory body should consider cooperation with the regulatory bodies of those States in which the same vendor has supplied similar plants, and especially ~~of the~~ regulatory body of the State of the vendor, if possible. The ~~possible~~ benefits of sharing

information on the experience of other States are clear and this could influence the ~~tentatively~~ planned regulatory approach.

~~2.79 2.74.~~ In many cases, it is helpful to accept the use of technical standards of the vendor State or of a State having oversight experience with a reactor of the same type as that selected. It is also useful to learn from the earlier independent analyses and safety assessments of this technology performed in other States. Furthermore, other regulatory bodies can give insights into the levels of quality achieved by key manufacturers and other suppliers, and this allows for better focusing of the auditing and evaluation of these organizations.

~~2.80 2.75.~~ A common option for regulation chosen in the past ~~for regulation~~ by States into which a first nuclear power plant was being imported was to use the regulations and standards of the supplier/vendor State. This had an advantage in that the supplier knew in detail which requirements it had to meet, and it was ~~easier~~ more straightforward for the regulatory body because ~~of the criterion that~~ such a plant was already licensed in the supplier/vendor State. However, this approach has a significant disadvantage. The importing State's regulatory approach should be aligned with the approach of the regulations adopted, and keeping abreast of all changes in these regulations is difficult. If the State subsequently purchases a plant from a supplier with a different regulatory approach or a different licensing system, or if a major backfitting programme is implemented, the two systems would have to be reconciled.-

~~2.81 2.76.~~ If the option chosen by the State is to use and/or to further ~~to~~ develop its own regulatory system, the State could continue to base its regulatory framework on the approach found most suitable ~~in Phase 2~~. The State could make the necessary adjustments throughout Phase 2 or Phase 3,

depending on the state of readiness of the regulatory body, and on the basis of the experience gained during implementation of the first nuclear power plant project. The regulatory body should have a clear understanding of the basis for the regulations so that subsequent regulatory actions or changes can be fully and knowledgeably evaluated.

2.82 ~~2.77.~~ Experience has shown that periodic meetings between high level officials as well as technical staff of the regulatory body and the operating organization are essential.

2.83 ~~2.78.~~ In Phase 3, the regulatory oversight should cover the following broad areas: construction, manufacturing of components, training and qualification, technical specifications, maintenance, surveillance testing, management of modifications, fire protection, radiation protection, emergency preparedness, and the management systems ~~of both~~ (including safety culture) of the operating organization and the various suppliers. In some States, ~~it is the practice for~~ the regulatory body ~~to approve~~ approves the various suppliers involved; following audits and inspections of their management systems. The regulatory body should ensure that there is appropriate planning for all these oversight activities in Phase 3. Once the construction license is issued and other necessary pre-approvals are given by the regulatory body ~~issues the construction licence,~~ construction starts ~~may start~~, including the manufacture of ~~important safety (and~~ safety related) structures, systems and components. The construction should proceed in a manner that ensures quality and safe operation. In this phase, the operating ~~organizations~~ organization, and the regulatory body as applicable, should ~~monitor~~ continuously monitor the construction of safety related structures, systems and components, both at the site and at manufacturing facilities, to ensure that the construction is in accordance

with the approved design. Provision should also be made to allow appropriate regulatory oversight of activities relating to the manufacture of some components that will commence before the construction licence has been issued, as well as for the procurement and infrastructure needed for training.

2.84 2.79. The ~~regulatory body's~~ management system of the regulatory body should cover the ~~activity of~~ production of ~~regulation~~regulations and guides. A consistent procedure for establishing, revising and revoking regulations and guides should be established in accordance with the State's legal system. The periodic review of regulations and guides should be established to keep these up to date. ~~Too frequent~~Frequent changes should be avoided as they can affect the stability of the regulatory system. Further guidance on the revision of regulations and guides is provided in ~~Ref.~~Ref. [24GSG-13 [23].

2.85 2.80. Licensing, is a major regulatory activity in Phase 3, and should be based on independent regulatory review and assessment of the documents that are submitted by the operating organization, and the results of inspections. It is the practice in many States to issue a construction licence and an operation licence in this phase. ~~Next to~~As well as the procedure for granting a licence, a procedure for any subsequent amendment, suspension or revocation of the licence ~~is therefore~~should also ~~issued~~be developed and implemented.

2.86 2.81. As the regulatory body ~~should~~needs to conduct inspections, it should ensure that it has the technical knowledge and skills and the statutory power to enforce compliance with its requirements as specified in the applicable regulations and in licence conditions; this also applies during the construction phase ~~also.~~ The legislation should include provisions to

grant access to the plant for staff of the regulatory body to perform inspections, including unannounced inspections, at any time.

2.87 2.82.—The regulatory body should develop a comprehensive inspection programme to carry out its inspection ~~duties~~function. Consideration should be given to obtaining support from States that have regulatory oversight experience ~~with~~of the selected reactor type. The overall inspection programme may comprise three aspects:

- ▲ Routine inspections ~~of the plant status and operations~~(including unannounced inspections) conducted by resident or non-resident inspectors;
- ▲ Topical inspections conducted by inspectors with relevant expertise, in accordance with a scheduled programme;
- ▲ Reactive inspections conducted after abnormal events.

2.88 2.83.—The extent to which the regulatory body does its own testing and measurement work independently of the operating organization should be defined and included in the regulatory ~~philosophy~~approach, with account taken of the ~~qualification~~qualifications of the personnel required as well as the instruments and laboratory facilities available (within the regulatory body and through external expert support). The conduct of tests and measurements by the regulatory body or its external support organization does not relieve the operating organization of its prime responsibility for safety.

2.89 A list of programmes that the operating organization should have in place before and during operation is provided in SSG-12 [21]. The regulatory body should review, assess, inspect and, as appropriate, approve such programmes.

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ACTIONS 39–47: TRANSPARENCY AND OPENNESS

General

General

2.90 ~~2.84~~. Societal acceptance is a prerequisite for the implementation of a nuclear power programme. Societal acceptance should be confirmed before major investments and organizational arrangements are made. For gaining true acceptance, the decision makers and the public should be given an opportunity to gain a realistic and credible picture of the benefits as well as the risks involved, and of the environmental impacts of the operation of the nuclear power plant and the associated activities (such as activities in radioactive waste management, spent fuel management and emergency preparedness). Involvement of the public and other interested parties is a continuous process.

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1 and 36 of GSR Part 1 (Rev. 1) [5]; ~~—~~
- ~~—~~ Requirements ~~3.65~~ and ~~5.26~~ 12 of ~~GS-R-3~~ [16]; ~~—~~ GSR Part 2 [17];
- ~~—~~ Requirement 1 of GSR Part 5 [9].

Action 39. The government should establish a policy and guidance to inform the public and other interested parties of the benefits and risks of nuclear power to facilitate their involvement in the decision making process on a prospective nuclear power programme.

Action 40. The government should establish a process to ensure that

the comments arising from consultation with ~~relevant~~the public and other interested parties are considered, and it should communicate the results of these considerations to the interested parties.

2.91 ~~2.85~~. Principle 4 of ~~the IAEA Fundamental Safety Principles [SF-1], on Justification of facilities and activities, [1],~~ states that “Facilities and activities that give rise to radiation risks must yield an overall benefit.” A decision to launch a nuclear power programme requires a broad societal acceptance ~~in society~~ that such a programme is justified. The government should establish a clear decision making process to justify a nuclear power programme, and this process should be communicated to the interested parties. The public should be involved in the early stages of the decision making process regarding nuclear power.

2.92 ~~2.86~~. The government should ensure that ~~at~~the public and other interested parties have ready access to general and easily understood information on radiation safety and nuclear safety and that there are opportunities to express opinions. ~~This range of audiences~~These parties may have a range of concerns, levels of knowledge and experience, which will therefore call for communication at different levels of technical detail, via different channels. Public opinions and comments should be properly summarized and should be considered as an input to the process that is intended to lead to a decision on launching a nuclear power programme.

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirements 1, 21, 34 and 36 of GSR Part 1 (Rev. 1) [5];

- Requirements 3.6, 5.26 and 5.27 [14] of GS-R-3 [16] GSR Part 2 [17];
- Requirement 3 of GSR Part 3 [8];
- Requirements 1 and 3 of GSR Part 5 [9];
- Requirement 10 and 13 of GSR Part 7 [10].
- Requirement 2 of SSR-2/2 [17] (Rev. 1) [18];

Action 41. The government should inform all the public and other interested parties regarding the safety implications of the decision on the implementation of a nuclear power programme.

Action 42. All relevant organizations should continue to inform the public and other interested parties on safety issues, including the expected health and environmental impacts of a nuclear power programme.

2.93 2.87.—The government, the regulatory body, the operating organization and various other entities have responsibilities in communicating on a responsibility to communicate the risks and benefits to of a nuclear power programme to the public and other interested parties in a clear and transparent manner.

2.94 2.88.—Requirements on transparent communication and the involvement of the public and other interested parties should be incorporated into the nuclear legislation that is enacted during Phase 2. The legislation should require that the operating organization to disseminate public disseminates information to the public on the planned facilities and their safety features and their expected environmental impacts.-

2.95 2.89.—The government should inform all the public and other interested parties regarding decisions on the implementation of a nuclear power programme, including the long term national and international

commitments to maintain ~~nuclear safety~~safety and adequate preparedness to effectively respond to emergencies in relation to the nuclear power plant (including severe accidents with a very low probability of occurrence) and the necessity of measures such as establishing new organizations, building new national infrastructure and making financial provision for radioactive waste management and spent fuel management, and the transport of nuclear and other radioactive material. Information should be provided to the public, local governments, committees representing local interests, industry, news media, non-governmental organizations and neighbouring States.

2.96 ~~2.90~~. The involvement of the public and other interested parties, including public hearings, and the resolution of ~~the~~ issues expressed in those hearings, should be made part of the licensing process.-

2.97 ~~2.91~~. The regulatory body should communicate ~~on its activities with the public~~ and ~~its role with other~~ interested parties on its role and its activities, explaining the following:

- ~~— Its~~The responsibility of the regulatory body for the establishment and enforcement of regulations and requirements on nuclear safety;
- ~~— Its~~The authority of the regulatory body to give binding orders for ensuring safety;
- ~~— Its~~The independence of the regulatory body from undue influences in decision making;
- ~~— Its~~The technical competence of the regulatory body and the available human resources; ~~— Its neutrality (without bias).~~
- ~~— 2.92.~~ The independence of the regulatory body.

2.98 The operating organization should explain to the public and other interested parties its responsibility for safety, its competence and its

compliance with regulatory requirements.

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirements 1, 21, 34 and 36 of GSR Part 1 (Rev. 1) [5];~~
- ~~— Requirements 3.6, 5.26 and 5.27 [14] of GS-R-3 [16]~~GSR Part 2 [17];
- ~~— Requirement 3 of GSR Part 3 [8];~~
- ~~— Requirements 1 and 3 of GSR Part 5 [9];~~
- ~~— Requirements 4.53 to 4.54, 4.82 to 4.84 [10] and 13 of~~
~~GS-R-2 [26];~~GSR Part 7 [10];
- ~~— Requirement 2 of SSR-2/2 [17]~~(Rev. 1) [18].

Action 43. All relevant organizations should seek to establish and maintain the confidence and trust of the public and other interested parties, ~~including the public,~~ on safety issues.

Action 44. All relevant organizations, as appropriate to their role, should continue to explain to the public and other interested parties the risks and benefits of the introduction of nuclear power and the measures taken to limit the risks.

Action 45. The regulatory body should communicate with the public and other interested parties about the licensing process, safety requirements and regulatory oversight.

Action 46. The operating organization and the regulatory body should communicate with the public and other interested parties about safety issues in construction and the commissioning programme.

Action 47. The operating organization and the regulatory body should maintain a transparent approach on safety issues with ~~all~~the public and other interested parties ~~involved~~regarding any problems and difficulties encountered in the construction programme, including problems and difficulties of suppliers, ~~regarding the problems and difficulties encountered.~~

~~2.99 2.93.~~ Communication should be continued on a regular basis and in a structured manner.

~~2.100 2.94.~~ The regulatory body and the operating organization should inform the public about the possible radiation risks arising from operational states and from accident conditions (including events with a very low probability of occurrence but with high consequences) that are associated with the operation of a facility.

~~2.101~~ The operating organization should explain to the public the technology that is deployed in ~~its~~the nuclear power ~~plants~~plant and the expected environmental ~~impacts~~impact from the plant. This could be done ~~in~~via a permanent public information centre near the nuclear power plant and ~~occasionally/or~~ in temporary public information events in other locations. The operating organization should also inform the news media ~~on~~about the progress of construction activities, including possible problems of general interest.-

~~2.102 2.95.~~ Likewise, the regulatory body should keep the public and the news media informed on experience from construction and commissioning. The regulatory body should communicate with the public and other interested parties on ~~abnormal events and on~~ safety concerns that ~~may~~might arise during construction and commissioning.

2.103 2.96.— The regulatory body, the operating organization and emergency response organizations should provide information on emergency preparedness and response arrangements, particularly to the public who might be potentially affected by an emergency associated with the nuclear power programme. This should include information on the potential for an emergency and the associated hazards, on how the public will be warned and notified and on the actions to be taken (see Requirement 10 of GSR Part 7[10].

2.104 Both the regulatory body and the operating organization should learn how to use the International Nuclear Event Scale [24] before the commissioning stage~~[27].~~

ACTIONS 48–60: FUNDING AND FINANCING

General

2.105 2.97.—Sustainable funding of safety related activities including the emergency arrangements of the respective response organizations should be provided for the entire lifetime of a nuclear power plant. After the initial investment for construction of the plant, continued investments are ~~needed~~necessary for ~~its~~ regular refurbishment, ~~because~~ most equipment ~~is~~ ofhas a limited lifetime and should be replaced with new equipment as part of the ageing management programme, or as a result of enhanced regulatory requirements resulting from safety research or operating experience. Also, technologies have certain design lifetimes, and equipment should be modernized as necessary to ensure the availability of spare parts. Training needs will be continuous over the lifetime of the plant, and need to be planned and funded in a systematic fashion. In addition, the costs ~~for~~of decommissioning and the management of radioactive waste and

spent fuel ~~management~~ represent a significant part of the total costs of a nuclear power programme, ~~and~~; funding should be planned for ~~this purpose~~ these purposes from the beginning of the operation of a plant. As stated in Principle 7 of SF-1 [1]:

“Radioactive waste must be managed in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long term management.”

This principle should be applied from the initial stage of development of the nuclear power programme.

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, 3, 10 and 11 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement 4.1.9 of GS-R-3 [16] GSR Part 2 [17];
- ~~—~~ Requirement 1 of GSR Part 5 [9]; ~~Requirements~~
- ~~—~~ Requirement 9 of GSR Part 6.1 to 6.5 [19];
- ~~—~~ Requirement 2 of WS-R-5 [18]; ~~GSR Part 7 [10];~~
- ~~—~~ Requirements 1, 3 and 4 of SSR-2/2 [17] (Rev. 1) [18].

Action 48. The government should plan funding for education and training, and for research centres and other national infrastructure, to support the safe operation of nuclear power plants including on-site and off-site emergency arrangements.

Action 49. The government should ~~consider the long term economic~~

~~conditions of nuclear power plant operation, to ensure~~require that the operating organization ~~is able~~allocates the necessary financial resources to ensure the safety of its nuclear power plants until the end of their planned operating lifetime.

Action 50. The government should consider the various possible sources for the funding of the regulatory body.

Action 51. The government should consider the various possible sources and mechanisms of funding for radioactive waste management and spent fuel management, the decommissioning of nuclear power plants and the disposal of radioactive waste.

~~2.106 2.98.~~ Means of ensuring funding for safety for the entire duration of the nuclear power programme should be considered in the early planning stages and should be confirmed with appropriate legislation and government decisions as well as in licence conditions. The government should also take into account the costs of the regulatory body and the financing of the national infrastructure for supporting the safe operation and regulation of nuclear power plants including adequate emergency arrangements in relation to the nuclear power programme.

~~2.107 2.99.~~ The government should consider the financial aspects that are necessary for establishing and maintaining the safety infrastructure of the nuclear power programme for its entire duration, and which ~~should ensure that safety is not compromise safety-compromised~~ at any stage.

~~2.108 2.100.~~ Financial aspects should also be considered for basic education and training in subjects relevant to nuclear safety, for research that supports the development of the national knowledge base on the safe use of nuclear safetyenergy, and for ~~nuclear~~the regulation of nuclear

installations. A systematic and structured approach to training is strongly encouraged for nuclear power plants.

2.109 2.101. Funding mechanisms should be considered for radioactive waste management and spent fuel management, for the decommissioning of the nuclear power plant and for the disposal of radioactive waste, including considerations related to the transport of radioactive material. Funding should be ~~well secured~~protected to avoid its depletion through being used for other purposes or through monetary inflation. In Phase 1, basic decisions should be made on establishing such funds, on the principal mechanism for the collection of funds and on the organization responsible for managing the funds.

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, 3, 10 and 11 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement ~~4.19~~ of ~~GS-R-3 [16]~~GSR Part 2 [17];
- ~~—~~ Requirement 1 of GSR Part 5 [9]; ~~Requirements 6.1 to 6.5~~
- ~~—~~ Requirement ~~9~~ of ~~WS-R-5 [18];~~ GSR Part 6 [19];
- ~~—~~ Requirement 2 of GSR Part 7 [10];
- ~~—~~ Requirements 1, 3 and 4 of SSR-2/2 ~~[17]~~(Rev. 1) [18].

Action 52. The government should make provision for long term funding for education and training, and for research centres and other national infrastructure to support the safe operation of nuclear power plants including on-site and off-site emergency arrangements.

Action 53. The government should decide on the mechanism for

sustainable funding of the regulatory body.

Action 54. The operating organization should establish a policy for ensuring adequate funding so as not to compromise safety at any stage of the nuclear power programme.

Action 55. The government should enact legislation that requires financial provision for the funding of long term radioactive waste management, spent fuel management and decommissioning.

2.110 2.102. All the necessary arrangements should be made to ensure that adequate resources will be allocated in a sustainable manner for developing and maintaining the national knowledge base commensurate with the national strategy.

2.111 2.103. The funding mechanism ~~should be decided on~~ for the oversight of the safety of nuclear facilities by the regulatory body should be decided. Depending on government policy, the regulatory body's oversight could be funded entirely from the State budget, or at least part of the costs could be collected from operating organizations. In the latter case, the regulatory body could be given the right to charge actual costs directly to the operating organizations, or the funds could be collected by the government and rendered to the regulatory body through the State budget. Whatever the funding mechanism, the adequacy and assurance of the funding should be mandated in legislation, and the funding should be flexible to accommodate variations in the workload of the regulatory body.

2.112 2.104. ~~The Financial assurance mechanisms and plans for the allocation of decommissioning funds and waste management funds should be in place before granting a license to operate a nuclear power plant. In addition, the~~ mechanism ~~and~~, timing, and plans for funding for the long

term management and disposal of radioactive waste, and for decommissioning and the management of spent fuel should be planned with account taken of reviewed periodically to ensure the availability of necessary funds. This periodic review should take into account the fact that the plant might be forced to stop operation before the end of its design lifetime.-

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, 3, 10 and 11 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement ~~4.19~~ of ~~GS-R-3~~ [16] GSR Part 2 [17];
- ~~—~~ Requirement 1 of GSR Part 5 [9]; ~~— Requirements~~
- ~~—~~ Requirement 9 of GSR Part ~~6.1 to 6.5~~ of WS-R-5 [18]; ~~— [19];~~
- ~~—~~ Requirement 2 of GSR Part 7 [10];
- ~~—~~ Requirements 1, 3 and 4 of SSR-2/2 ~~[17]~~ (Rev. 1) [18].

Action 56. The government should provide ~~appropriate~~sustainable funding for the efficient and effective conduct of the regulatory body's activities and for the emergency arrangements of respective response organizations.

Action 57. The operating organization should ensure that funding is sufficient for ensuring the safe operation of the nuclear power plant.

Action 58. The operating organization should ensure that arrangements are in place for the funding of radioactive waste management and decommissioning.

Action 59. The regulatory body should verify, as part of the licensing

process, that the operating organization has sufficient financial resources.

Action 60. The government or the regulatory body should verify that a system for the funding of decommissioning activities, radioactive waste management, and spent fuel management including disposal is in place.

~~2.113 2.105.~~ By the end of Phase 3, the operating organization should establish rates for electricity generated, ~~as allowed by~~ with due consideration to the national tariff structure. The rate fixed should ~~be set to provide take into consideration the~~ funding required for the sustainable safe operation of the nuclear power plant.

~~2.114 2.106.~~ Funding for decommissioning and for the management and disposal of radioactive waste and spent fuel, as necessary ~~is, should be~~ established as per in accordance with legislative requirements in the legislation or regulations. Provision should be made to ensure that ~~these funds are~~ the full amount of required funding is raised and is not depleted later by unauthorized use or by monetary inflation. ~~In the early stage of operation, adequate funds should be secured until the full amount has been raised.~~

ACTIONS 61–71: EXTERNAL SUPPORT ORGANIZATIONS AND CONTRACTORS

General

~~2.115 2.107.~~ The operating organization and the regulatory body should have ~~full~~ the competence to fully understand the basis of all the safety related decisions that they are responsible for making. However, it may/might not be feasible ~~to conduct within for~~ these organizations all to

conduct for themselves all the detailed assessments of design information and inspection results, or ~~verification of~~verify the correctness of all the safety analyses. Such assessments and verification are necessary to ensure that sound decisions are taken. Technical or other expert professional support may therefore be sought from external organizations or individuals through formal partnerships or contracts. This approach ~~would provide~~provides the operating organization and the regulatory body with ready access to scientists, engineers and other experts.

2.116 2.108. As an example, the regulatory body ~~may~~might have a need for services such as those for developing safety analysis tools, conducting independent safety ~~analysis~~analyses and assessments, and conducting experimental research. The operating organization should liaise with various suppliers, both for construction of the nuclear power plant and for its operation and maintenance. In particular, contractor personnel may be used to perform tasks that are of a specialized or temporary nature for which it is not feasible to ~~hire or deploy~~use full time plant ~~employee.~~employees.

2.117 2.109. Organizations from which the regulatory body ~~may~~might obtain support typically include:-

- Advisory bodies;
- Dedicated external support organizations;
- Research centres;
- Academic institutions;
- Regulatory bodies of other countries;
- International and regional organizations;
- Consultants with experience in specific technical or scientific topics.

2.118 2.110. Further guidance on ~~this topic~~the use of external expert

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support by the regulatory body is provided in Ref. [28]GSG-12 [22].

2.119 2.111. Organizations and contractors with which the operating organization should liaise typically include:

- Plant vendors;
- Suppliers of equipment and services;
- External maintenance organizations;
- Organizations conducting material testing and inspections;
- Dedicated external support organizations;
- Research centres;
- Academic institutions;
- Consultants with experience in specific technical or scientific topics.

2.120 2.112. Further information about this topic the interface between the operating organization and external supporting organizations can be found in Ref. [29]IAEA Safety Standards Series No. NS-G-2.4, The Operating Organization for Nuclear Power Plants [25].

2.121 2.113. The roles and functions of universities and other academic institutions may differ from those of other external support organizations, as the former organizations will be best used in providing basic training for engineers and scientists, for specialized analysis of specific problems, for longer term safety related research, and to support in the development of longer term regulatory approaches.

2.122 2.114. The functions of dedicated external support organizations can include: conducting independent confirmatory analyses or research; technical assistance in the resolution of specific regulatory issues; and the development of technical bases for safety policy and regulations. External

support organizations can also fulfil a longer term function of serving as a technical training centre and maintaining expertise in nuclear safety and radiation safety. The size, scope and responsibilities of external support organizations are best determined in accordance with the specific needs of the organizations ~~supported that they support~~. The external support organizations should be flexible enough to allow changes over time, as the needs of the organizations ~~supported will that they support~~ evolve.

2.123 2.115. Independent standing bodies or temporary advisory bodies, with membership drawn from other national institutions, regulatory bodies of other States, scientific organizations and the nuclear industry, may be established to provide broad-based independent advice to the regulatory body over the long term on ~~all~~ issues relevant to the regulatory decision making process. Advisory bodies ~~would~~ could, for example, confirm ~~and advise in licensing reviews~~ that the regulatory body has properly addressed relevant safety issues ~~in licensing reviews~~. They could also support the development of regulations. ~~Moreover, they could bring, as well as providing a broad perspectives to bear~~ perspective on the formulation of regulatory policy ~~and regulations~~. Members of advisory bodies should be independent, highly experienced, and respected by their peers in their respective fields.

2.124 2.116. Short term external support could ~~suitably~~ be provided by suitable highly specialized consultants, private engineering companies and other industrial organizations. However, in the longer term more permanent in-house expertise should be developed and relied on.

2.125 2.117. External experts or contractor personnel should be trained and qualified for the task to be performed. It should be the responsibility of the organizations obtaining external support to ensure that safety related

activities are performed by personnel with proven skills and competence. For ~~instance~~example, documented assurance that contractor personnel have the necessary qualifications could be requested prior to their involvement in safety related work. This should be assessed, tracked and evaluated through the organization's systematic approach to training.

2.126 2.118.—When external expertise or advice is provided to the regulatory body, it should be ensured that such support is independent of ~~the any~~ support provided to the operating organization.

2.127 2.119.—The roles and responsibilities of external support organizations should be clearly defined and understood. ~~Where~~ When the work of external support organizations ~~play a significant role in~~ can affect the ~~operation or regulatory controls~~ safety of ~~the~~ plant, the management system of the operating organization or the regulatory body, as appropriate, should provide for the proper supervision of their activities.

2.128 2.120. The regulatory body and the operating organization need to keep a questioning attitude on safety matters and avoid over-reliance on advice from external experts, in particular in cases of conflicting conclusions regarding the analysis of low probability/high consequences events. This is particularly relevant in the analysis of external hazards that are associated with large uncertainties. Therefore, the regulatory body should make conservative decisions in these instances.

2.129 Any support obtained by the regulatory body or the operating organization will not relieve them of their responsibilities. The regulatory body and the operating organization should have an adequate core competence to make informed decisions. This requires ~~that there are~~ an adequate number of personnel having the knowledge and experience necessary to supervise and to evaluate the work of external support

organizations and contractors. Adequate contractual arrangements should be made to specify the roles and responsibilities of external support organizations.

2.130 2.121. Domestic organizations should participate in the construction of nuclear power plants, sincebecause competences will be needed within the State to ensure adequate support for safe long term operation.

2.131 2.122. Certain technical services, such as dosimetry services and environmental monitoring services, in-service testing and inspection, and metrological activities, are needed within a State introducing a nuclear power programme. Such services could be set up within the operating organization, taking into account the need to avoid apparent(perceived, potential or real-conflictactual) conflicts of interest related to such services, or they could be outsourced.

Phase 1

The following actions are recommended toshould be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirements 4, 11, 13 and 20 of GSR Part 1 (Rev. 1) [5];
- Requirements 3.14 and 5.2311 of GS-R-3 [16]; — GSR Part 2 [17];
- Requirement 2 of GSR Part 3 [8]; —
- Requirement 3 of SSR-2/2 [17(Rev. 1) [18].

Action 61. The government should consider the availability of expertise, industrial capability and technical services that could support the safety infrastructure in the long term.

Action 62. The government should assess the need to create or to enhance national organizations to provide technical support to the

regulatory body and the operating organization for the safe operation of nuclear power plants.

~~2.132~~ ~~2.123.~~ ~~Expertise may, at~~At the beginning of the nuclear power programme, expertise may be acquired from expert organizations in other States, but subsequently the support available within the State will be of increasing importance in ensuring the safe long term operation of nuclear power plants.-

~~2.133~~ ~~2.124.~~ In Phase 1, efforts should therefore be made to identify national and international expert organizations that could provide support either to the regulatory body or to the operating organization. If new national organizations or capabilities need to be established, or if the existing organizations or capabilities need to be enhanced, then the necessary planning should be started.

~~2.125.~~ The government should start to identify and encourage industrial organizations that possibly could participate ~~both~~ in civil construction and in supplying structures, systems and components. During operation, these organizations could provide support in maintenance of the plant and of the equipment that they have supplied.

~~2.134~~ This would help to ensure the availability in the State of professional and high quality maintenance over the lifetime of the plant.-

~~2.135~~ ~~2.126.~~ Even though there ~~may~~might not be the necessary industrial capability in the State in Phase 1, the government could adopt a strategy for national participation and could decide to build and develop local industrial, educational and research organizations. For the coordinated development of industry in the State and for training the industry to deal with nuclear projects, the ~~means for building~~development of a dedicated engineering organization that specifically incorporates a systematic approach to training should be considered. Such an organization should

acquire broad knowledge in the nuclear field and should subsequently support manufacturers and other industrial organizations in their nuclear projects.

2.136 2.127. Operation of a nuclear power plant may/might require the provision of external technical services such as:

- ~~— Personal radiation dosimetry~~ Individual monitoring and environmental ~~radiation~~ monitoring;
- ~~—~~ In-service testing and inspection;
- ~~—~~ Maintenance of special technical equipment; ~~—~~
- ~~—~~ Metrological activities.

2.137 2.128. The availability of technical services, whether in the State or in other States, should be considered in Phase 1, and gaps should be identified. Consideration should be given to strategies for filling the gaps.

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 4, 11, 13, 17 and 20 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements 3.14, 5.14, 5.23, and 5.24 ~~11~~, of GS-R-3 [16]; ~~—~~ GSR Part 2 [17];
- ~~—~~ Requirements 2 and 3 of GSR Part 3 [8]; ~~—~~
- ~~—~~ Requirements 3 and 31 of SSR-2/2 ~~47~~ (Rev. 1) [18].

Action 63. The operating organization and the government should encourage industrial organizations in the State to develop their capabilities with the objective of participating in the construction of nuclear power plants and supporting their safe long term operation.

Action 64. The government, and the operating organization, if applicable, should establish organizations to provide expertise and engineering support or other external support for regulatory oversight and for the safe operation of nuclear power plants, as identified in Phase 1.

Action 65. External support organizations and potential contractors should begin to build competence and quality management systems for ensuring safety.

Action 66. The regulatory body and the operating organization should plan arrangements for overseeing the activities performed by their respective external support organizations and contractors.

2.138 2.129. From Phase 2, external support organizations should start developing their technical capabilities and competences, as well as the experimental and analytical tools that will be necessary for providing technical justification for nuclear safety. Universities and other academic institutions should establish proper curricula and should start providing basic training in nuclear engineering and other disciplines relevant for nuclear safety. External support organizations should develop their readiness for making independent confirmatory analyses and conducting research, and for providing technical assistance for the resolution of nuclear safety issues.

2.139 2.130. The operating organization and the government, if applicable, should promote the building of a network of industrial organizations in the State that are interested in entering and remaining in the nuclear businessindustry. Such independent competences will support the safe long term operation of nuclear power plants in the State. The independence of the regulatory body from this process should be preserved, and the public

should be informed that this is the case.

2.140 2.131. In Phase 2, the operating organization should conduct a realistic assessment of the national and local capabilities to supply commodities, components and services for the nuclear facility, giving due consideration to requirements for the management system in the evaluation criteria. The operating organization will need to ensure that the providers of equipment and services follow good management practices, taking into account the entire chain of possible subcontractors.

2.141 2.132. Application The application of quality standards for nuclear equipment and services is generally more stringent than for other industrial operations. ~~If the national policy supports industrial involvement in construction or support services, then a plan for the development of appropriate management systems should be prepared.~~ The operating organization needs to ensure that contractors and service providers develop management systems and verify compliance with requirements for quality management.

~~Compliance with requirements for quality management and the safety of future nuclear power plants should then be ensured.~~

2.142 2.133. One or more engineering organizations allied with the operating organization should be in the process of acquiring broad competences in the nuclear field. These competences ~~may~~could be used to supply engineering services directly to the operating organization or to support construction industries and manufacturing industries in learning aspects of the nuclear industry. The engineering organizations dedicated to the nuclear industry should also be prepared to support the constructors, manufacturers and other suppliers in making bids or negotiating contracts to the vendor or to the operating organization. Due consideration should be given to the establishment of appropriate management systems (including

quality management) in such organizations so as to meet the level of quality required for nuclear installations.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirements 4, 11, 13, 17 and 20 of GSR Part 1 (Rev. 1) [5];~~
- ~~— Requirements 3.14, 5.14, 5.15–5.20, 5.23, 5.24, 10 and 5.25 [1], of GS-R-3 [16];~~ GSR Part 2 [17];
- ~~— Requirements 2, 3 and 3.20 [as in appendix] of GSR Part 3 [8];~~
- ~~— Requirements 3 and 31 of SSR-2/2 (Rev. 1) [18].~~

Action 67. The regulatory body should establish a framework for the qualification of technical services that are significant for nuclear safety.

Action 68. External support organizations should continue the recruitment of staff and the building of competence in safety related matters.

Action 69. All the relevant organizations should ensure clarity in specifying the roles and responsibilities of external support organizations.

Action 70. All the relevant organizations should make appropriate arrangements to avoid conflicts of interest when obtaining external support.

Action 71. The regulatory body and the operating organization should oversee the activities performed by their respective external support organizations and contractors, and should assess the quality of the

services provided, in accordance with their management systems.

2.143 ~~2.134.~~ In Phase 3, external support organizations should be well established and should be ready to fulfil their roles as determined by the regulatory body or the operating organization.-

2.144 ~~2.135.~~ External personnel providing a service or providing advice to the operating organization cannot have direct authority over plant personnel, ~~although they may be responsible for the quality of the service or advice provided.~~ As the operating organization retains the prime responsibility for the safety of the plant, it should always remain responsible for making decisions. Knowledgeable and skilled personnel of the operating organization should be clearly identified and should be assigned to the supervision of contractors or temporary support staff. The specific training needs of the contractors for the operating organization should be assessed, tracked and evaluated through a systematic approach to training.

2.145 ~~2.136.~~ Areas in which the operating organization should be supported by the vendor include:

- Training of operating staff;
- Preparation of documentation, including that required for licensing;
- Commissioning of the plant;
- Maintenance and in-service inspection;
- Technical assistance during operation;
- Preparation of normal operating procedures and emergency operating procedures.

2.146 ~~2.137.~~ Roles ~~The roles~~ of different external support organizations should be studied carefully, to avoid conflicts of interest, such as if the

same organization provides support to both the regulatory body and the operating organization- [\(see also para. 2.126\)](#)

[2.147](#) ~~2.138~~. The construction of a nuclear power plant involves numerous contractors, and it is incumbent on the operating organization to ensure that this complex chain of contractors is adequately managed so that the end products are acceptable from a safety standpoint. The responsibility of the operating organization in this respect is the same no matter which option is selected for the nuclear power plant supply contract. The operating organization should verify from the very beginning the quality of equipment and services supplied by the vendor and its subcontractors under contracts of all types, including ‘~~turnkey~~’⁶~~turnkey~~’⁸ and ‘super ~~turnkey~~’⁷~~turnkey~~’⁹ projects’.

[2.148](#) ~~2.139~~. The operating organization should reassess the [local and national](#) capabilities ~~nationally and locally~~ to supply commodities and components and to provide services for the nuclear ~~facility~~[power plant](#). It should give primary importance to the management system and to safety culture in allocating the supply of spare parts, consumable supplies, maintenance services and calibration services.-

[2.149](#) ~~2.140~~. Supplier qualification requirements are normally issued by the operating organization and included in contracts. The operating organization should promote a common understanding of the key aspects of safety culture and design requirements among the suppliers.-

⁸ [In a turnkey project, a single contractor or a consortium of contractors takes the overall technical responsibility for the entire works.](#)

⁹ [In a super turnkey project, a single contract is placed for the entire nuclear power plant. This implies that the prime responsibility for the technical success of the project, and therefore for the design of the plant, is placed upon the contractor.](#)

~~2.150 2.141.~~ The operating organization has prime responsibility for the quality (and thus the safety) of the products ~~of~~ for the technical services provided. However, depending on the system in the State, the regulatory body, or some other national certifying body, may establish certification requirements for the providers of technical services that have implications for safety. Management systems, including safety culture and training, should be considered in the evaluation criteria.

ACTIONS 72–84: LEADERSHIP AND MANAGEMENT FOR SAFETY

General

~~2.151 2.142.~~ Principle 3 of ~~the IAEA's Fundamental Safety Principles [SF-1], on Leadership and Management for Safety, [1]~~ states that:-

“Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to, radiation risks.”-

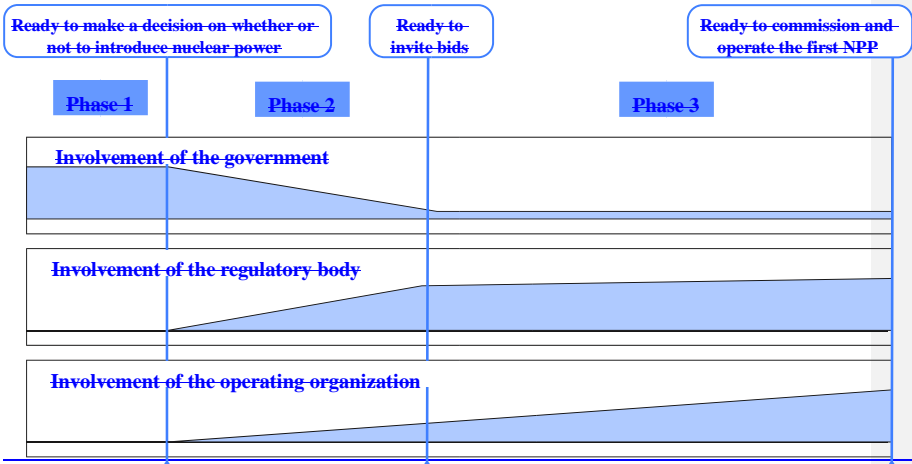
~~2.152 2.143. Safety culture is defined as “the~~In all the relevant organizations, leadership for safety, management for safety, an integrated management system and a systemic approach (in which the interactions between technical, human and organizational factors are duly considered) are essential to the specification and application of adequate safety measures and the fostering of a strong safety culture. The managers at all levels are required to demonstrate leadership that gives an overriding priority to safety and fosters a strong safety culture. (see GSR Part 2 [17])

2.153 The operating organization retains responsibility for safety when contracting any processes and receiving any item, product or service.

Effective arrangements should be put in place with suppliers to specify, monitor and control the supply of items, products and services that might affect safety.

2.154 Safety culture is defined as “The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance” [3026].

- 6-
In a turnkey project, a single contractor or a consortium of contractors takes the overall technical responsibility for the entire works.
- 7-
In a super turnkey project, a single contract is placed for the entire nuclear power plant. This implies that the prime responsibility for the technical success of the project, and therefore for the design of the plant, is placed upon the contractor.



2.155 A management system needs to integrate all elements of management including safety, health, environmental, security, quality, human and organizational factors, societal and economic elements so that safety is not compromised.

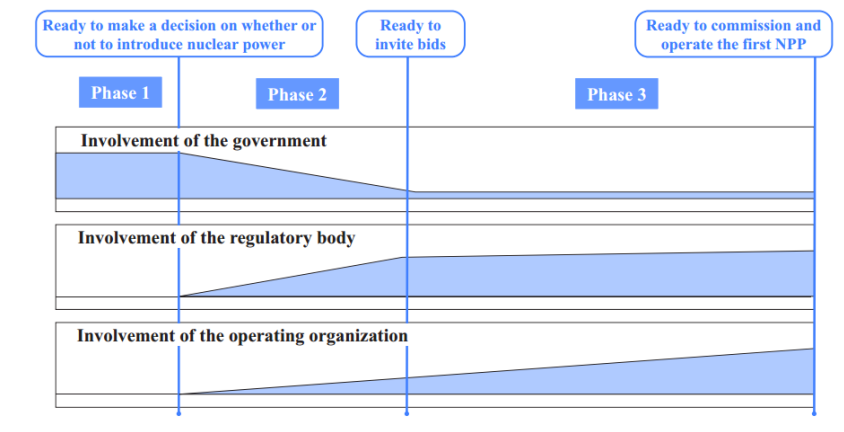


FIG. 64. Progressive involvement of the main organizations in the nuclear power programme (indicative only, to be used with flexibility).

2.144.

2.156 Efficient and effective management systems constitute a cross-cutting element of the safety infrastructure, applicable for all the organizations involved in the nuclear power programme. However, as indicated in Fig. 64, the extent of involvement of the different organizations will vary considerably during the different phases of implementation of the nuclear power programme. While the government is the major player in Phase 1, the regulatory body may not be created before Phase 2, and Phase 3 is the main phase for the implementation of the operating organization's programmes.

2.157 2.145. All the actions taken by the relevant organizations should be included in the framework of an effective management systems. In this regard, the requirements stated in GS-R-3-16 GS-R Part 2 [17] should provide the basis for the management systems, which should be established before the actions are conducted by the applicable organizations in the applicable phase.

2.158 All organizations should avoid complacency and maintain the overall attention on safety.

Phase 1

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirements 1 and 19 of GSR Part 1 (Rev. 1) [5];~~
- ~~— Requirements of GS-R-3 [16]~~The requirements of GSR Part 2 [17] as a whole;
- ~~— Requirement 5 of GSR Part 3 [8];~~Requirements
- ~~— Paragraphs 6.1–6.9 of IAEA Safety Standards Series No. NS-R-3 [34]~~(Rev. 1), Site Evaluation for Nuclear Installations [27].

Action 72. The government should take into account the essential role of leadership and management for safety to achieve a high level of safety and to foster a strong safety culture within organizations.

Action 73. The government should ensure that all the activities conducted are included within the framework of an effective integrated management system.

Action 74. The government, when identifying senior managers for the prospective organizations to be established, should look for persons with leadership capabilities and an attitude emphasizing that emphasizes safety culture.

2.159 2.146. Selection~~The selection~~ of ~~the~~ senior managers should be accorded great importance in establishing an effective management focused on keeping safety paramount as an overriding priority. The senior managers will define the mission, strategies, objectives and policies of the

organizations and will make decisions accordingly. In identifying persons for top positions in the prospective operating organization and regulatory body, priority should be given to persons with leadership capabilities and attitudes emphasizing safety culture.-

2.160 2.147. In particular, if the senior managers of the regulatory body are recognized as having the highest level of competence (in nuclear technology, law, public administration or some other relevant discipline), appropriate experience and a sound character, their judgements and the decisions ~~to be implemented~~ made by the regulatory body are likely to be respected. Organizations headed by persons who are perceived as lacking competence or as holding their positions for political reasons will have difficulty in maintaining confidence internally and externally, and might be perceived as compromising the independence of the regulatory body.

2.161 2.148. Leadership in safety should be demonstrated at all levels in organizations. Safety should be achieved and maintained by means of an effective integrated management system. ~~An effective~~ Leadership and management system for safety will ensure, in a coherent manner, that safety will not be compromised by other requirements or demands. Management systems (including quality management systems) should ensure, among other things, the promotion of a safety culture at all levels of the organization, the regular assessment of safety performance, and the application/identification of lessons ~~learned~~ from experience, including the recognition ~~and treatment~~ of potential precursors to accidents and taking actions to eliminate these. Human factors should also be taken into account, with due consideration of all possible interactions of individuals at all levels with technology and with organizations.-

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirements 1, 19 and 35 of GSR Part 1 (Rev. 1) [5];~~
- ~~— Requirements of GS-R-3 [16]~~The requirements of GSR Part 2 [17] as a whole;
- ~~— Requirement 5 of GSR Part 3 [8];~~
- ~~— Requirement 7 of GSR Part 5 [9];~~
- ~~— Requirements Paragraphs 6.1 to 6.9 of NS-R-3 [31]; (Rev. 1) [27];~~
- ~~— Requirement 2 of SSR-2/2 [17]; Requirement (Rev. 1) [18];~~
- ~~— Paragraph 306 of TS-R-1 [32]~~IAEA Safety Standards Series No. SSR-6 (Rev. 1), Regulations for the Safe Transport of Radioactive Material, 2018 Edition [28].

Action 75. The regulatory body and the operating organization should start developing and implementing effective integrated management systems in their respective organizations and should promote a strong safety culture.

Action 76. The regulatory body and the operating organization should develop competences in managing the growth of and change in the organization.

Action 77. The regulatory body and the operating organization should make appropriate arrangements for measurement, assessment (both ~~'self-assessment'~~self-assessment and independent assessment) and continuous improvement of their integrated management systems.

~~2.162 2.149.~~ Early in Phase 2, all the top positions in the operating

organization and in the regulatory body should be filled on the basis of criteria defined in Phase 1. A safety culture takes time to develop, and the leadership of both the operating organization and the regulatory body should initiate, from the very beginning, programmes and practices to build a safety culture in their respective organizations. As an effective way of establishing a safety culture and promoting the development of leadership for safety, management systems should be implemented that provide structure and direction to the relevant organizations that will have responsibilities for safety, in accordance with ~~GS-R-3 [16]~~ GSR Part 2 [17].

2.163 The regulatory body should develop a safety culture policy, incorporate safety culture into regulatory processes, and train its management and staff in their respective roles and responsibilities in the implementation of the safety policy.

2.164 The regulatory body should also implement a process of regulatory oversight of the culture for safety in the operating organization.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, 19 and 35 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements of ~~GS-R-3 [16]~~ GSR Part 2 [17] as a whole;
- ~~—~~ Requirement 5 of GSR Part 3 [8];
- ~~—~~ Requirement 7 of GSR Part 5 [9];
- ~~—~~ Requirements 5.37–5.39 of GS-R-2 [26];
- ~~—~~ Requirements Requirement 26 of GSR Part 7 [10];

— Paragraphs 6.1–6.9 of NS-R-3 ~~{34~~(Rev. 1) [27];

— ~~—~~ Requirement 2 of IAEA Safety Standards Series No. SSR-2/1
{33(Rev. 1), Safety of Nuclear Power Plants: Design [29];

— ~~—~~ Requirements 2, 8, 9 and 15 of SSR-2/2 [17]; ~~— Requirement~~(Rev. 1) [18];

— Paragraph 306 of ~~TS-R-1~~ ~~{32~~SSR-6 (Rev. 1) [28].

Action 78. The senior management of all the relevant organizations should provide effective leadership and effective management for safety to ensure a sustainable high level of safety and a strong safety culture.

Action 79. All the relevant organizations should continue the implementation of a management system that promotes the concept that requirements for safety shall be paramount within the organization, overriding all other demands.

Action 80. The operating organization and the regulatory body should ensure that the effectiveness of their integrated management systems is monitored and measured, and that self-assessments as well as independent assessments are conducted regularly for continuous improvement.

Action 81. All the relevant organizations should ensure that appropriate arrangements for management of safety related knowledge (including record management and report management) and knowledge transfer are in place.

Action 82. All the relevant organizations should ensure that leadership and succession development programmes are in place to develop future leaders with a strong emphasis on safety.

Action 83. The operating organization should ~~prepare~~ describe the

provisions for managing for safety ~~management programme as well as in~~
the corresponding chapter of the safety analysis report.

Action 84. The regulatory body should review and assess the operating organization's programme on safety management.

~~2.150.~~ Individuals should be made accountable for and encouraged to take 'ownership' of their work and to strive for improvements in their performance.

~~2.165 2.151.~~ Managers and leaders should encourage and welcome the reporting of possible safety related concerns by individuals throughout the organization and should respond to valid concerns promptly and in a positive manner.

~~2.166 2.152.~~ A common understanding of the key aspects of safety culture within the organizations should be ensured and a questioning attitude should be promoted at all levels of the organization.

~~2.167 2.153.~~ The operating organization and the regulatory body should establish and maintain a system for the control of records and reports that are important to safety. Documentation should be controlled in a consistent and compatible manner throughout its preparation, revision, review, approval, release, distribution and archiving.

~~2.168 2.154.~~ To sustain the effectiveness of the management system, it should be measured and monitored *on* a periodic basis. Self-assessment has been identified as an important mechanism that organizations should use to improve their performance.

~~2.169 2.155.~~ Self-assessment can be reinforced by independent assessment, which can be carried out by independent audit teams within the organization or by bodies that are external to the organization. In this phase, processes for self-assessment should be established for continuous

monitoring of the effectiveness of the operating organization and the regulatory body.-

2.170 ~~2.156~~. Senior management should treat information as an essential resource. Proper transmission and continuity of knowledge is vital for the sustainable long term management of safety.

2.171 ~~2.157~~. Programmes and processes should be in place for the development of future leaders and for the preservation and management of corporate knowledge (both explicit and tacit) of the organization.

ACTIONS 85–98: HUMAN RESOURCES DEVELOPMENT

General

2.172 ~~2.158~~. Requirement 11 of GSR Part 1 (Rev. 1) [5] states that:

“The government shall make provision for building and maintaining the competence of all parties having responsibilities in relation to the safety of facilities and activities”-.”

The ~~organizations~~parties covered by this requirement include the regulatory body, the operating organization, research organizations and external support organizations, industrial organizations and organizations providing technical services.

2.173 ~~2.159~~. Requirement ~~4.39~~ of ~~GS R-3 [16]~~GSR Part 2 [17] states that:-

“Senior management shall determine the ~~competence requirements for individuals at all levels~~competences and resources necessary to carry out the activities of the organization safely and shall provide ~~training or take other actions to achieve the required level of competence~~”-them”.

This requirement applies to all organizations involved in safety related activities.

~~2.174 2.160.~~ Recommendations on human resources development for the regulatory body ~~and the~~ are provided in GSG-12 [22]; recommendations for the operating organization are provided in ~~GS-G-1.1 [21] and IAEA Safety Standards Series No. NS-G-2.8—[34,~~ Recruitment, Qualification and Training of Personnel for Nuclear Power Plants [30].

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 1, 11 and 18 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements 4.1, 4.3 and 4.5 of GS-R-3 [16]; ~~—~~ Requirement 9 of GSR Part 2 [17];
- ~~—~~ Requirement 2 of GSR Part 3 [8]; ~~—~~
- ~~—~~ Requirement 21 and 25 of GSR Part 7 [10]. [moved up for numerical order]
- ~~—~~ Requirement 4 of SSR-2/2 [47]; ~~(Rev. 1) [18];~~

Action 85. The government should consider a strategy for attracting, recruiting, training and retaining an adequate number of experts to meet the needs of all organizations involved in ensuring safety in a prospective nuclear power programme.

Action 86. The government should identify competences required in areas relating to nuclear safety and the approximate number of experts needed.

Action 87. The government should identify national institutions and

institutions in other States that could provide education and training and could start training in key areas relating to nuclear safety.

Action 88. The government should identify gaps in safety related training at existing training institutions and should plan to strengthen existing training institutions or to establish new training institutions to fill these gaps.

Action 89. The government should ensure that prospective senior regulators identified by the government and prospective safety experts to be involved in the nuclear power programme gain an understanding of the principles and criteria of nuclear safety.

2.175 ~~2.161.~~ Human resource development is a demanding and complex task in terms of resources (both time and money) and it should be properly addressed. An assessment of education and training needs should be conducted as one of the first tasks in Phase 1. Cooperation with other States and international organizations should be pursued to provide insights into the competences and human resources necessary for implementing a nuclear power programme.

2.176 ~~2.162.~~ The assessment ~~process for of~~ education and training needs should include the ~~development~~preparation of a list of the areas of expertise necessary to support the development of the legal and regulatory framework, site evaluation, design assessment, construction ~~and~~, regulatory oversight and emergency preparedness and response, together with estimates of the number of individuals necessary in ~~those functional~~these areas ~~of expertise~~. In later phases, expertise should be available for commissioning, operation, maintenance and radioactive waste management. The education and training needs identified by this assessment process should be managed by the relevant organization

through a systematic approach to training.

2.177 2.163. The assessment process should also include an examination of the ~~current~~ capabilities of existing academic facilities ~~and~~, research and development centres ~~as well as~~ and technical training institutions to provide training in certain areas of technical expertise that will be required for the licensing, operation and oversight of nuclear power plants. The assessment should ~~lead to conclusions on~~ determine the adequacy of the current capabilities to meet the training needs ~~identified~~ in areas such as reactor physics, thermal hydraulics, chemistry, radiation protection, materials science, strength analysis, reliability technology, mechanical engineering, civil engineering, earth sciences, assessment of radiological environmental impact, electrical engineering, instrumentation and control engineering, human behavioural science, testing of materials, project management ~~and~~, organizational management and emergency management.

2.178 2.164. On the basis of the assessment of education and training needs, a comprehensive plan for either upgrading existing training institutions or building new training institutions should be developed. Possibilities for collaboration in human resources development with potential vendor States and other States in which nuclear power plants are being operated should be explored at an early stage.

2.179 2.165.—Experience shows that, before education and training curricula are put in place, it could be useful to utilize opportunities for education in institutions in other States, to send nuclear trainees abroad and to hire specialists from other States to provide academic and practical education and training, so as to start developing human resources from the earliest phase.-

2.166. Consideration should also be given to hiring staff from other

industries.

~~2.180 2.167.~~ Due consideration should be given to securing and maintaining human resources, since the loss of trained human capital maymight jeopardize the implementation and sustainability of the safety infrastructure. In ~~the~~ light of the experience of developing States, a strategy to attract and retain ~~within the State~~ high quality staff within the State should be developed. This strategy could include measures such as adequate return arrangements for trainees sent to other States, sufficient salaries, good working conditions and career positions. Furthermore, all national organizations with safety related functions, especially the regulatory body, should be provided with the means necessary to attract and retain high quality staff, in potential competition with recruitment by the operating organization and industrial organizations.

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~—~~ Requirements 1, 11 and 18 of GSR Part 1 (Rev. 1) [5];

~~—~~ Requirement 9 of GSR Part 2 [17];

Requirements ~~4.1, 4.3, 4.4 and 4.5 of GS-R-3~~ [16];

~~—~~ Requirements 2, 3, 2.4 and 26 of GSR Part 3 [8];

~~—~~ Requirement 21 and 25 of GSR Part 7 [10]. [moved for numerical order]

~~—~~ Requirements 4 and 7 of SSR-2/2 [17]; ~~Requirements (Rev. 1) [18];~~

~~—~~ Paragraphs 311 to 315 of TS-R-1 [32]. ~~SSR-6 (Rev. 1) [28];~~

Action 90. All relevant organizations should implement a strategy to attract and retain high quality trained personnel.

Action 91. All relevant organizations should support the safety related training of their prospective staff in nuclear organizations in other States.

Action 92. The regulatory body and the operating organization should actively recruit staff so as to ensure capability in areas relevant to safety in a timely manner.

Action 93. The government and relevant organizations should establish new institutes or new curricula relevant to safety, as identified in Phase 1.

Action 94. All relevant organizations should commence the education and training in academic and vocational institutions of the necessary number of persons for ensuring safety.

[2.181](#) ~~2.168~~. A strategy to attract and retain trained high quality personnel should be implemented. As identified in Phase 1, this [may/might](#) include measures such as adequate return arrangements for trainees sent to educational institutions in other States, sufficient salaries, good working conditions and career positions. The government should also verify that all organizations with crucial safety related [tasks/responsibilities](#), especially the regulatory body, have been able to attract high quality staff.-

[2.182](#) ~~2.169~~. Early in Phase 2, a policy decision should be made regarding the implementation of the plans that were developed in Phase 1 for ensuring the availability of experts. Implementation of the selected plan should begin early enough in Phase 2 so that sufficient numbers of individuals can complete the necessary training and occupy positions in the regulatory body, the operating organization, external support organizations and industrial organizations before the commissioning of the first nuclear

power plant.

~~2.183 2.170.~~ Where the assessment in Phase 1 has shown the need for new institutions or extended curricula, such ~~new~~ institutions ~~should be established~~ and curricula should be ~~revised~~~~established~~. The operating organization should manage their training programme through a systematic approach to training.

~~2.184 2.171.~~ At the beginning of Phase 2, the senior management positions of the regulatory body should be filled. The management of the regulatory body should develop the staffing strategy in parallel with the development of the national regulatory process. Throughout Phase 2, the regulatory body should gradually recruit and develop the necessary expertise. ~~The~~It should be an objective ~~is to have~~ early in Phase 2 to already have staff of the regulatory body who are able to specify and understand safety requirements. ~~The safety requirements are~~ for use by the operating organization in the bidding process or contract negotiations and for ~~its own~~ use by the regulatory body in the review of the site and the application for the construction ~~license~~license. The staff also have to be able to make other safety related decisions at the time when such decisions are ~~needed~~necessary. The specific needs for competence and training for Phase 3, notably for the staff who will have to perform inspections during construction, as well as assessing compliance and the achievement of safety objectives, ~~are~~should be identified in Phase 2.

~~2.185 2.172.~~ At the end of Phase 2, the operating organization should have sufficient technical expertise to specify competently the safety requirements in a call for bids or contract negotiations for a nuclear power plant, and to evaluate the safety relevant parts of the bids or contracts to be received early in Phase 3. Even if the support of consultants ~~may be~~is

available internationally for this purpose, the operating organization should start early ~~enough~~ to recruit experts with a good overall understanding of the safety issues, the site specific safety features and the nuclear power plant designs. ~~Recruitment should be conducted, with the goal of the~~ The implementation of the future stages of the programme— should be taken into account during the recruitment process.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~—~~ Requirements 1, 11 and 18 of GSR Part 1 (Rev. 1) [5];

~~—~~ Requirement 9 of GSR Part 2 [17];

Requirements ~~4.1, 4.3, 4.4 and 4.5~~ of ~~GS R-3~~ [16];

~~—~~ Requirements 2, 3, 2-4 and 26 of GSR Part 3 [8];

~~—~~ Requirement 21 and 25 of GSR Part 7 [10];

~~—~~ Requirements 4 and 7 of SSR-2/2 [17]; ~~Requirements~~ (Rev. 1) [18];

~~—~~ Paragraphs 311–315 of TS-R-1 [32] ~~SSR-6~~ (Rev. 1) [28].

Action 95. The operating organization, the regulatory body ~~and~~, external support organizations and relevant response organizations should ensure the availability of sufficient competent human resources for the efficient and effective conduct of all activities at the appropriate time.

Action 96. The operating organization should prepare a human resources management programme (including staffing, qualification and training) as well as the corresponding parts of the safety analysis report.

Action 97. The regulatory body should review and assess the operating

organization's programme with regard to human resources management.

Action 98. The government should continue promoting the development of education in the nuclear field so as to continue providing a flow of qualified people in areas relevant to safety.

~~2.186 2.173.~~ A sustainable level of expertise in nuclear power technology and safety should be maintained by means of the continuous recruitment of competent staff and long term generic research programmes on safety that provide and preserve the strength of the nuclear power programme (see paras ~~2.178~~191–~~2.189~~201 on research for safety and regulatory purposes).

~~2.187 2.174.~~ The operating organization should recruit and train its staff to support construction, preparation for operation and licensing. The operating organization should manage their training programme through a systematic approach to training. At the beginning of this phase, staff should be recruited with experience of project management, civil construction, equipment manufacturing, welding, non-destructive testing, instrumentation and control engineering, fire prevention and protection, and quality management. The operating organization should begin to use integrated competences ~~from~~ early in the construction stage to verify that the plant is built to high standards of quality and in accordance with design requirements. Competences are also needed in the operating organization to promote a strong safety culture in the other organizations involved throughout the construction project. The need for ~~customer's~~ verification of quality by the customer is not diminished, even in ~~the~~ turnkey type project. This is because the operating organization will have the prime responsibility for safety during plant operation, and this requires assurance of the quality during construction. Experience in various areas of plant

design should be available in order to assess the detailed plans for construction and ~~component—manufacturing—the~~ manufacture of components. The control room operating personnel and the supervisory staff for plant operation, maintenance and specific technical areas should be recruited, and their plant specific training should commence before plant construction is half completed. A full-~~scope~~ plant specific simulator should be acquired for training the control room operators, and training should be arranged ~~in due time before commissioning of~~ early during the plant construction stage and in consideration of the relevant regulatory requirements.

~~2.188 2.175.~~ The regulatory body should continue recruiting and training staff to be able to provide adequate oversight of construction, equipment manufacturing and, towards the latter part of Phase 3, commissioning of the plant. The staff should have a strong technical background as well as a thorough knowledge and understanding of the regulations and guides. Actions should be taken to address the specific competence and training needs identified in Phase 2.

~~2.189 2.176.~~ For the purpose of providing highly skilled experts for the operating organization, the regulatory body and for other organizations with crucial safety related tasks, educational institutions should continue to offer ~~curriculums~~ curricula that are appropriate to meeting the needs of the nuclear power programme, including safety culture.

~~2.190 2.177.~~ All organizations involved in the nuclear power programme should have a systematic way of categorizing, disseminating and retaining ~~all the~~ knowledge (including training material) obtained through international cooperation and assistance and contracted commercial services. This approach should be sustainable ~~for~~ in terms of the continuous

development of human resources and institutional knowledge.

ACTIONS 99–104: RESEARCH FOR SAFETY AND REGULATORY PURPOSES-

~~General~~

General

~~2.191 2.178.~~ Vendors and other organizations can provide technical advice and support to the operating organization in the licensing stages and in the early years of operation, but these ~~in-depth~~ competences should be integrated in due time within the State. Long term safety research objectives should be established so as to reduce reliance upon vendors which ~~it~~ cannot be assumed ~~will~~to continue to exist throughout the lifetime of the nuclear power plant.

~~2.192 2.179.~~ Research in States commencing a nuclear power programme should be focused on the safety features and ~~core areas~~operation of the prospective nuclear power plants as well as on site related safety issues. Analytical methods should be learned through national research by developing tools (~~i.e.g.~~ computer programs) and models as well as experimental methods (e.g. taking samples to be analysed in laboratories) that can be used for plant specific safety analyses in later stages. The accumulated knowledge ~~could~~can then be used for deterministic safety analysis and probabilistic safety analysis as well as for the assessment of the behaviour of the reactor in transient conditions. Experience has shown that such analyses should be repeated throughout the plant operating lifetime;~~;~~ for independent analysis for licensing and relicensing~~and;~~ for planning potential power upgrades or other modifications,~~or;~~ and for analysing operational events and considering measures to prevent their

recurrence. The experimental research should focus on, among other things, understanding the properties and ageing of materials in the reactor, as well as other phenomena relating to the ageing of structures and components. An ~~in-depth~~in-depth understanding of the behaviour of materials should be acquired for addressing safety related concerns that can arise when indications of cracking are found in pressure retaining components and piping.

~~2.193 2.180.~~ In addition to providing an increased understanding of the ~~key characteristics~~safety features and operation of the prospective nuclear power plant and the safety issues relating to ~~them~~these characteristics, the research should ~~serve~~support the general development of knowledge ~~of~~ and ~~competence~~competences in nuclear science and technology as well as in the scientific bases of radiation protection and waste management in the State. Research and development in the State should also be directed at building specific competence in certain areas, ~~and research~~. Research also constitutes good training ~~in or preparation~~ for all interested parties ~~of in preparation for~~ what ~~is to come with a~~ will be needed during the nuclear power plant project.

~~2.194 2.181. Beyond the~~ In addition to research focused on technical ~~core~~ areas, attention should be given to ~~aspects relating to~~safety related research into management systems and human factors.

~~2.195 2.182.~~ If a decision is made to utilize a research reactor for supporting safety related research, ~~then the State is expected to make adequate arrangements to comply with~~ or for developing human resource capacity for nuclear safety, the research facility should meet the requirements established in IAEA Safety Standards Series No. ~~NS-R-4, on SSR-3,~~ Safety of Research Reactors [3531], and ~~should give due~~

~~consideration to the recommendations provided in~~ the associated Safety Guides.

~~However, these issues are not explicitly covered in this Safety Guide.~~

Phase 1

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirements 1 and 11 of GSR Part 1 (Rev. 1) [5].

Action 99. The government should consider in which areas in-depth knowledge is necessary for assessing and analysing safety related aspects of a nuclear power plant project, and should identify research centres that can start research programmes in safety related areas of knowledge.

Action 100. The government should identify ~~gaps in~~ the capabilities of domestic research centres to meet needs in core areas of knowledge, and should plan to establish new research centres for ~~coresuch~~ areas as necessary.

~~2.196 2.183.~~ National research activities should be considered and initiated as early as possible when considering ~~launching~~the introduction of a nuclear power programme. The areas of science and technology in which research and development are of vital importance for every State with ~~aan~~ operating nuclear power plant ~~in operation~~ include reactor physics, thermal hydraulics, material sciences, strength analysis and probabilistic safety assessment. Examples of other areas in which research could~~may~~ be considered are fire safety, human performance, seismic analyses, consequence analysis for ~~severe accidents, assessment for beyond~~ design

basis accidents and design extension conditions and management of organizations.-

2.197 2.184.—In establishing new research programmes, consideration should be given to whether the research can best be conducted within the existing institutions in which the necessary structures and scientific and academic networks are already in place, or whether a new institution should be set up/established. Both approaches have been used by States in the past.

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirements 1 and 11 of GSR Part 1 (Rev. 1) [5];—

— Requirement 3 of GSR Part 5 [9].

Action 101. The operating organization and the regulatory body should be involved in identifying areas for safety research.

Action 102. The government should implement plans to establish new institutions for research relating to safety, as ~~identified in Phase 1~~necessary.

Action 103. Research centres should begin conducting research relating to safety in areas in which in-depth knowledge is essential to support safe long term operation of nuclear power plants.

2.198 2.185.—In the development of a nuclear power programme, the operating organization and the regulatory body should contribute to identifying areas in which research relating to safety should be conducted to fill ~~in~~ gaps in knowledge. An integrated research plan should be developed ~~that,~~ consistent with the national strategy for safety, which

consolidates all the current and planned activities for identifying long-term gaps in knowledge and the associated needs for research.

2.199 2.186.—The national knowledge base should be strengthened by means of research groups that are established in vital areas of safety. These groups should participate in international networks in their respective areas and some group members should be temporarily assigned to on the job training in research organizations in other States. The research in vital areas of safety is aimed at creating an independent knowledge base within the State, which will be necessary to support the contracting and licensing processprocesses, and later to support construction, commissioning, safe plant operation, management of radioactive waste, as well as final disposal, decommissioning or closure of facilities and regulatory oversight of safety.

2.200 2.187.—If vital research on nuclear safety cannot be conducted within existing research organizations, a dedicated nuclear research organization should be established.

Phase 3

The following actions are recommended to should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirements 1 and 11 of GSR Part 1 (Rev. 1) [5]; —
- Requirement 3 of GSR Part 5 [9].

Action 104. Research centres and other relevant organizations should focus their research on the features and safety aspects of the nuclear power plant that will be constructed, including features and aspects specific to the actual plant site.

2.201 2.188.—As soon as the contract for a new nuclear power plant has

been signed and the type of plant is known, the national research community should develop a comprehensive set of tools tailored to ~~the~~ safety analyses: that will be undertaken for the facility. Plant specific models should be incorporated into the generic tools. Comprehensive ~~analysis~~ analyses should be conducted to gain an understanding of the safety margins, the impact of changes in the model on the results of the safety analysis, and potential cliff edge effects¹⁰. The aim of such research is to provide a capability for fast and reliable support to the operating organization and the regulatory body in their safety assessments, and to gain an understanding of the safety consequences of any abnormal event.

2.202 2.189.—Arrangements to maintain close ~~contacts~~ contact with academic research and educational establishments should be ~~ensured~~ implemented. Such arrangements could include participation in conducting specialized training and confirmatory research projects. A nuclear power programme requires a pool of highly skilled and innovative personnel with appropriate expertise, which can only be maintained through an active national commitment to education and research on safety.

ACTIONS 105–116: RADIATION PROTECTION

General

General

2.203 2.190.—Humans have always been exposed to ionizing radiation (termed ‘natural background radiation’), because of the radioactivity ~~of~~

¹⁰ A cliff edge effect, in a nuclear power plant, is an instance of severely abnormal plant behaviour caused by an abrupt transition from one plant status to another following a small deviation in a plant parameter, and thus a sudden large variation in plant conditions, in response to a small variation in an input. [26].

~~material~~ contained in rocks that form the Earth's crust and due to the exposure of the Earth's surface to cosmic rays. The As noted in para. 1.1, the fundamental safety objective stated in the IAEA's Fundamental Safety Principles established in SF-1 [1] is to protect people and the environment from harmful effects of ionizing radiation.

2.204 2.191. The principles of radiation protection are not specific to nuclear power plants but apply to all facilities and activities in which ionizing radiation is produced.

2.205 2.192. Facilities and activities that give rise to radiation risks must yield an overall benefit (Principle 4 of the IAEA's Fundamental Safety Principles [1], 'Justification of facilities and activities'). Protection must be optimized to provide the highest level of safety that can reasonably be achieved (Principle 5 [1], 'Optimization of protection'). Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm (Principle 6 [1], 'Limitation of risks to individuals').

2.193. This Safety Guide addresses the protection of people and the environment from harmful effects of ionizing radiation, as the fundamental safety objective of the IAEA's Fundamental Safety Principles [1]. 'People' in the context of this Safety Guide includes workers and the public.

Phase 1

The following actions are recommended to should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirement 7 of GSR Part 1 (Rev. 1) [5]; —

— Requirements 2 and 43 of GSR Part 3 [8]; — Requirements

— Paragraphs 4.1–4.15 of NS-R-3 [3] (Rev. 1) [27].

Action 105. The government should consider the additional radiation risks and special needs associated with the operation of nuclear power plants.

Action 106. The government should ensure that an initial radiological environmental impact ~~analysis~~¹¹ assessment is conducted as appropriate on the basis of a defined set of criteria, at a regional scale and with the use of available data.

Action 107. The government should recognize the need for integrating radiation protection regulations and new safety regulations for nuclear power plants.

~~2.206 2.194.~~ The State is likely already to be engaged in activities involving sources of radiation (e.g. research reactors, or industrial or medical applications of radiation) for which ~~require the establishment of~~ legislation and other provisions for radiation protection. have been established. However, the implementation of a nuclear power programme would give rise to additional hazards ~~resulting from the expansion of activities.~~ This~~that~~ would necessitate amending or complementing the existing national framework.

~~2.207 2.195.~~ Preparation of a radiological environmental impact ~~analysis~~assessment is a key component in the process of demonstrating the protection of the environment from radiation risks. The process, which is part of a more general environmental impact assessment, as addressed in ~~the section on a national policy and strategy for safety~~para. 2.14 of this

¹¹ ~~The radiological environmental impact analysis is part of both the environmental impact assessment mentioned in the section on national policy and strategy for safety of this Safety Guide (paras 2.1–2.16) and the site evaluation report addressed in the section on site survey and site evaluation of this Safety Guide (paras 3.24–3.48).~~

Safety Guide, is should be based on a graded approach to ensure that the resources devoted to safety are commensurate with the magnitude of the radiation risks and in accordance with Principle 5 of the IAEA's Fundamental Safety Principles [1]. A Safety Guide on radiological environmental impact analysis for the verification of radiological protection is being prepared to provide guidance on how to produce such a radiological environmental impact analysis. SF-1 [1].

2.208 Recommendations on radiological environmental impact assessment are provided in:

- IAEA Safety Standards Series No. GSG-8, Radiation Protection of the Public and the Environment [32];
- IAEA Safety Standards Series No. GSG-9, Regulatory Control of Radioactive Discharges to the Environment [33];
- IAEA Safety Standards Series No. GSG-10, Prospective Radiological Environmental Impact Assessment for Facilities and Activities [34].

Phase 2

The following actions are recommended to should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirement 7 of GSR Part 1 (Rev. 1) [5];
- Requirements 1–4, 6–16, 18–32 and Schedule III and Schedule IV of GSR Part 3 [8];
- Requirements Paragraphs 4.1–4.15 of NS-R-3 (Rev. 1) [27];
- Requirements 78 and 79 of SSR-2/1 (Rev. 1) [29];
- Paragraphs 301–303 of TS-R-1 (Rev. 1) [28].

Action 108. The regulatory body and/or the government should amend the legislation and/or regulations, as appropriate, for the purposes of regulating radiation protection to include specific aspects of the nuclear power programme.

Action 109. The regulatory body should establish or approve, as appropriate, the limits and constraints regarding workers and the public both for normal operation and for potential exposure situationsexposures in a nuclear power plant.

Action 110. The operating organization should update the radiological environmental impact analysisassessment for the site selected, as appropriate.

Action 111. The regulatory body should review and assess the radiological environmental impact analysisassessment for the site selected, as appropriate.

Action 112. The operating organization should commence a radiological environmental monitoring programme.

Action 113. The operating organization should use all appropriate safety principles and requirements and regulatory requirements with regard to radiation protection in preparing the bid specifications or contract negotiations for the nuclear power plant.

2.209 2.196.—The State should adapt its arrangements for radiation protection to include specific needs for radiation protection in the commissioning, operation, associated fuel transport, management and storage of radioactive waste and spent fuel, and decommissioning of a nuclear power plant. This should cover radiation monitoring and radiation protection for workers and the public and protection of the environment, as

appropriate, against radiation risks. To ~~determine~~establish dose limits (~~established~~ in nuclear laws or more commonly in the accompanying regulations), the requirements to be fulfilled by the regulatory body and/or the government as appropriate are established in Ref.paras. 3.26–3.28 of GSR Part 3 [8].

2.210 2.197. The regulatory body and the operating organization ~~also~~ should also give consideration to ~~Refs [36, 37]~~the recommendations provided in GSG-9 [33] and IAEA Safety Standards Series No. NS-G-1.13, Radiation Protection Aspects of Design for Nuclear Power Plants [35], within the context of the issuing of regulations and ~~for~~ the preparation of bid specifications or contract negotiations.

2.211 2.198. The radiological environmental monitoring programme should be ~~developed~~planned with the intent to verify that solid, liquid and gaseous radioactive releases from the operation of the nuclear power plant are kept as low as reasonably achievable, and are satisfactorily controlled and monitored so that authorized limits on discharges are complied with. Training in radiation protection should be incorporated in the operating organizations' systematic approach to training. Responsible persons should be certified and periodically requalified. Non-radiological impacts may be addressed in separate documentation and may be submitted to a separate authority, as appropriate. The environmental monitoring should be commenced early in order to obtain accurate reference information on natural conditions with regard to baseline radiation and other conditions in the ~~neighbourhood~~vicinity of the site selected for the nuclear power plant.-

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety

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Requirements:

- ~~—~~ Requirement 7 of GSR Part 1 [\(Rev. 1\)](#) [5];
- ~~—~~ Requirements 1–4, 6 ~~33, 43–46, Schedule III 16, 19–32~~ and Schedule ~~IV~~[III](#) of GSR Part 3 [8];
- ~~—~~ ~~Requirements~~[Paragraphs](#) 4.1–4.15 of NS-R-3 ~~34~~[\(Rev. 1\)](#) [27];
- ~~—~~ Requirements 78 and 79 of SSR-2/1 ~~33~~[\(Rev. 1\)](#) [29];
- ~~—~~ Requirement 21 of SSR-2/2 ~~17~~; ~~Requirements~~[\(Rev. 1\)](#) [18];
- ~~—~~ ~~Paragraphs~~ 301–303 of ~~TS-R-1~~[32](#)SSR-6 [\(Rev. 1\)](#) [28].

Action 114. The operating organization should establish a radiation protection programme, should continue implementing an environmental radiological monitoring programme, and should prepare the corresponding chapters of the safety analysis report.

Action 115. The regulatory body should review and assess the operating organization's programmes with regard to radiation protection and relevant environmental protection, and should verify compliance with the regulatory requirements.

Action 116. The regulatory body should ensure that arrangements are in place for the monitoring of all ~~releases~~[discharges](#) from the nuclear power plant to the environment.

~~2.212 2.199.~~ The radiation protection programme established by the operating organization should include arrangements for the control of contamination and for the monitoring of radiation levels inside the facility, releases of radioactive effluents, and ~~doses from~~ occupational ~~radiation~~[doses](#)[exposure](#). The objective of the radiation protection programme is to protect people individually and collectively, by ensuring that doses to individuals remain within the relevant dose limits and as low as reasonably

achievable. Due consideration should also be given to the appropriate design and location of structures, systems and components as prerequisites for proper radiation protection; [\(see Requirement 5 of SSR-2/1 \(Rev. 1\) \[29\]](#), and to the accuracy and reliability of the measuring equipment used for radiation monitoring.

[2.213 2.200.](#) ~~The earlier~~ [Previous](#) estimates ~~for of~~ the ~~releases of~~ radioactive ~~material discharges~~ in ~~normal~~ operational states, as well as [the radioactive releases](#) in [design basis](#) accident [and design extension](#) conditions, should be confirmed when the final configuration of the plant is known.

[2.214 2.201.](#)—IAEA Safety Guides [[33, 36–38–40](#)] provide recommendations on [these radiation protection](#) programmes [and radiation monitoring](#).

ACTIONS 117–121: SAFETY ASSESSMENT

General

[2.215 2.202.](#) Safety assessment should be carried out for a nuclear power plant to determine whether an adequate level of safety has been achieved for the plant and whether the safety objectives and safety criteria ~~as~~ specified by the plant designer, the operating organization and the regulatory body have been met.

[2.216 2.203.](#) Safety assessment plays an important part throughout the lifetime of a nuclear power plant whenever decisions are made on safety issues.

[2.217 2.204.](#) Safety assessment should be a systematic process throughout the lifetime of the plant to identify radiation risks that arise for workers, the public and the environment during normal operation, in anticipated

operational occurrences, and in accident conditions—(, including ~~severe accidents~~)—design extension conditions with core melting. The aim of safety assessment is to determine whether adequate measures have been taken to control radiation risks to an acceptable level, with account taken of both the prevention of abnormal events and the mitigation of their consequences. The scope and level of detail of the safety assessment should increase as the design develops and as the way in which the plant will be operated is defined. Requirements for carrying out a safety assessment are established in ~~Ref. [4]~~IAEA Safety Standards Series No. GSR Part 4 (Rev. 1), Safety Assessment for Facilities and Activities [39].

~~2.218 2.205.~~ The operating organization ~~should have~~has the responsibility for carrying out the safety assessment. It should be responsible for the method by which the assessment is performed and for the quality of the results.-

~~2.219 2.206.~~ A general understanding of the safety features of a nuclear power ~~plants~~plant is required in order to make a knowledgeable decision on whether to embark on a nuclear power programme. A comprehensive safety assessment is required to support the decisions made by the ~~plant operators~~operating organization on the design and operation of the plant. ~~A~~An independent safety assessment is also required by the regulatory body before issuing authorizations for the construction—~~and~~, commissioning and operation of the plant: (see para. 3.15 of SF-1 [1]).

~~2.220 2.207.~~ The safety assessment should cover all the scientific and technical issues that relate to the safety of the plant and the associated radiation risks. This includes the safety analysis, which consists of a set of different analyses for evaluating and assessing challenges to safety in various plant states, including anticipated operational occurrences and

accident conditions (including ~~severe accidents~~ design extension conditions with core melting). The safety assessment uses both deterministic and probabilistic methods. As stated in paras 4.54 and 4.55 of GSR Part 4 (Rev. 1):

—“4.54. The aim of the deterministic approach is to specify and apply, for anticipated operational occurrences and postulated accident conditions, a set of conservative deterministic rules and requirements for the design and operation of facilities or for the planning and conduct of activities. These rules and requirements, when they are met, are expected to provide a high degree of confidence that the level of radiation risks to workers and the public arising from the facility or activity will be acceptably low. This conservative approach provides a way of compensating for uncertainties in the performance of equipment and the performance of personnel.”

—“4.55. The objectives of a probabilistic safety analysis are to determine all significant contributing factors to the radiation risks arising from a facility or activity, and to evaluate the extent to which the overall design is well balanced and meets probabilistic safety criteria, where these have been defined. In the area of the safety of a nuclear power plant, probabilistic safety analysis uses a comprehensive, structured approach to identifying failure scenarios. It constitutes a conceptual and mathematical tool for deriving numerical estimates of risk. The probabilistic approach uses realistic assumptions wherever possible and provides a framework for addressing explicitly many of the uncertainties explicitly. Probabilistic approaches may provide insights into the reliability of system performance, interactions and weaknesses in the design, the application of defence in depth, and risks that it may not be possible to derive from a deterministic

analysis.”

~~2.221 2.208.~~ The safety assessment should be carried out by suitably qualified and experienced people who are knowledgeable in the relevant areas of science and technology and in all aspects of safety assessment and analysis that are required for the particular type of nuclear power plant to be built.

~~2.222 2.209.~~ The safety assessment may be supported by a programme of research and development. ~~Paragraphs 2.178 2.189 cover research for safety and regulatory purposes.~~

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~—~~ Requirements 5, 6 and 8 of GSR Part 4 ~~[41(Rev. 1) [39].~~

Action 117. The government should familiarize itself with the IAEA safety standards and with other States’ practices, as appropriate, to gain an understanding of the resources and competences ~~needed for capabilities~~ for safety assessment.

~~2.223 2.210.~~ The ~~State~~ government should recognize the need to develop expertise in the relevant organizations in nuclear safety and safety assessment.-

~~2.224 2.211.~~ The government should engage in a dialogue with governmental organizations in other States and international organizations (e.g. IAEA, OECD/NEA) so as to take account of developments in nuclear safety and safety assessment.

~~2.225 2.212.~~ The government should consider the optimum ways of utilizing safety assessments that have already been carried out by designers, operating organizations and regulatory bodies in other States, and by international organizations.

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 24, ~~25 and~~ 26 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement 13 of GSR Part 3 [8];
- ~~—~~ Requirements 1–6, 8, 14–16 of GSR Part 4 ~~[41]~~ (Rev. 1) [39].

Action 118. The operating organization, the regulatory body and external support organizations, as appropriate, should start to develop the expertise to ~~prepare for the~~ conduct or review ~~of the~~ safety assessments.

~~2.226 2.213.~~ The operating organization and the regulatory body, together with the external support organizations, advisory bodies, research organizations, academic institutions, and specific experts or consultants should start to develop their skills for safety assessment in all technical fields that are relevant for safety.-

~~2.227 2.214.~~ The development and use of the safety assessment should provide the framework for the production of the necessary information to demonstrate compliance with the relevant safety requirements and for the radiological environmental impact ~~analysis~~ assessment that is carried out to support site evaluation and plant selection.

~~2.228 2.215.~~ The operating organization, which has the prime

responsibility for safety, should recruit and train personnel with the necessary skills and expertise ~~necessary~~ to develop the safety analysis to be included in the safety analysis report, or to assess the safety analysis report that will be provided by the vendor in the following phase. The result of the safety assessment should serve as an input to the operating organization's systematic approach to safety.

~~2.229 2.216.~~ The operating organization and the regulatory body may need support from external support organizations ~~which have,~~ or individuals ~~who have, the~~ with specialist skills in particular areas. External expert support is addressed in paras ~~2.407 115–2.441 150.~~

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 24, ~~25 and~~ 26 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement 13 of GSR Part 3 [8];
- ~~—~~ Requirements 1–24 of GSR Part 4 ~~[41];~~ (Rev. 1) [39];
- ~~—~~ Requirements 5 and 39 of SSR-2/1 ~~[33];~~ (Rev. 1) [29];
- ~~—~~ Requirement 12 of SSR-2/2 ~~[17]~~ (Rev. 1) [18].

Action 119. The operating organization should perform comprehensive safety assessments of the nuclear power plant and should produce safety analysis reports to demonstrate that all relevant safety requirements have been met.

Action 120. The regulatory body should carry out a comprehensive review and an independent verification of the safety analysis reports submitted by the operating organization to verify compliance with the

regulatory requirements.

Action 121. The operating organization and/or the regulatory body should obtain support from external support organizations or individual experts in performing or reviewing safety assessments, as necessary.

~~2.230 2.217.~~ The operating organization should carry out a comprehensive safety assessment of the proposed design and operation of the plant, as part of the preparation of the safety analysis report. This safety assessment should address nuclear safety and all radiation risks to workers, the public and the environment, from the operation of the nuclear power plant, ~~and~~ The safety assessment should demonstrate that these risks have been controlled and reduced to a level that is as low as reasonably achievable. The assessment should also demonstrate that the structures, systems and components, including the barriers incorporated into the design, fulfil the safety functions required of them, and that adequate defence in depth and that adequate safety margins have been ~~incorporated~~ provided in the design. Where weaknesses are identified in the design or in operation, improvements should be made to remedy them. The safety assessment should incorporate both deterministic and probabilistic approaches. The results of the safety assessment should also be used for preparing emergency plans.

~~2.231 2.218.~~ The operating organization should conduct an assessment of the safety information and analyses provided by the vendor ~~for its~~ (. The results of this assessment should be used by the operating ~~organization's)~~ organization in the preparation of the safety analysis report before submitting it to the regulatory body. This requires the use of ~~proper~~ appropriate assessment tools and the application of a management system. The assessment should include independent verification of the

analyses provided by the vendor. This verification could be conducted either by the staff of the operating organization or by external support organizations.

2.232 2.219. The regulatory body should carry out a comprehensive review and independent verification of the safety analysis report to ~~determine~~verify whether the regulatory requirements have been met or whether safety related improvements are required. This should be completed as a condition for the authorizations required for the construction and commissioning of the plant to proceed beyond the hold points defined in the licensing process.

2.233 2.220. In the design and construction phase, the contacts established between the vendor, the operating organization ~~and~~, the regulatory body ~~with~~and other organizations in the nuclear field should be used to identify improvements and to determine which of ~~them~~these improvements are applicable to the plant being built. Such improvements include any safety related improvements to meet national safety requirements, improvements that are being made at other plants (in particular at plants of the same design) and improvements in the tools that are available to carry out the safety assessment. Such contacts should also be used to identify relevant research activities and emerging nuclear safety issues.

2.234 2.221. An example of the format and content of the safety analysis report can be found in Ref. [42]IAEA Safety Standards Series No. GS-G-4.1, Format and Content of the Safety Analysis Report for Nuclear Power Plants [40].

ACTIONS 122–132: SAFETY OF RADIOACTIVE WASTE MANAGEMENT,

SPENT FUEL MANAGEMENT AND DECOMMISSIONING

General

General

2.235 2.222. Principle 7, para.Paragraph 3.29, of the IAEA's Fundamental Safety Principles [1], 'Protection of present and future generations', SF-1 [1], states that:

“Radioactive waste must be managed in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long term management.”

2.236 2.223. A State considering a nuclear power programme is likely already to be engaged in activities involving sources of radiation (e.g. research reactors, or industrial or medical applications of radiation) whichthat require arrangements for the predisposal management and disposal of low level and intermediate level radioactive waste.-

2.237 2.224. Implementation of a nuclear power programme will cause a significant increase in the volume and activity of the waste that shouldwill need to be safely managed and disposed of. High level radioactive waste with a very long lifetimehalf-life poses a new challenge for radioactive waste management. In addition to high level radioactive waste, there may also be spent fuel for which no future use is foreseen.-

2.238 2.225. Spent fuel management includes all activities relating to the handling and storage of spent fuel, whether or not it has been designated as radioactive waste. The designation will depend on whether the chosen nuclear fuel cycle is closed or open (i.e. whether the fuel cycle requiresinvolves the reprocessing or the direct disposal of the spent fuel). In

either case, storage of the spent fuel will be ~~required~~necessary. The time period for storage will be a significant factor in determining the provisions required for safety.

2.239 2.226. In some States, a dedicated organization is established for radioactive waste management. In other States, the operating organization takes care of the predisposal management and ~~final~~ disposal of radioactive waste generated by its nuclear power plants, or at least of the low level waste and intermediate level waste. If a decision is made to establish a dedicated organization for radioactive waste management, some of the tasks assigned to the operating organization in this Safety Guide could be under the responsibility of the organization for waste management. Irrespective of the State's decision as to the establishment of a dedicated waste management organization, the responsibility of the licensee(s) has to be clearly defined. This implies that it must be made clear in which steps the responsibility corresponds to the waste generator and when this responsibility is transferred to the waste management organization.

2.240 2.227. The scope of this Safety Guide does not include nuclear fuel cycle facilities. However, if nuclear fuel cycle facilities form part of the nuclear power programme, the safety requirements ~~of NS-R-5 [43] and the supporting established in IAEA Safety Guides would apply~~ Standards Series No. SSR-4, Safety of Nuclear Fuel Cycle Facilities [41] should be met.

2.241 2.228. Financial aspects relating to the safety of radioactive waste management and of spent fuel management are addressed in paras 2.97–~~2.106 on funding and financing in this Safety Guide~~ 105–2.114.

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase

as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirements 7 and 10 of GSR Part 1 (Rev. 1) [5];
- Requirement 2 of GSR Part 3 [8];
- Requirements 1 and 2 of GSR Part 5 [9];
- Requirements 2.1, 3.1–3.4, 6.1–6.5 and 9 of WS-R-5 [18] GSR Part 6 [19].

Action 122. The government should recognize the long term nature of the safety requirements for, and the cost implications of, radioactive waste management (including disposal of waste), spent fuel management and decommissioning.

Action 123. The government should consider the feasible options for radioactive waste management (including disposal of waste), spent fuel management and decommissioning, on the basis of a comprehensive long term policy and strategy.

2.242 2.229. The availability of alternative options for managing high level radioactive waste, including its ~~final~~ disposal or returning the spent fuel to the fuel supplier, should be considered before making a decision on launching/introducing a nuclear power programme. The possibility of ensuring For each option, the need to ensure long term safety by means of alternative options and the uncertainty of cost estimates in each option should be taken into account. It should be recognized that dependence on services in other States for spent fuel management, as included in some options, would increase the uncertainty of the cost estimate.

2.243 2.230. An important issue that should be considered in making a decision on the approach to radioactive waste management is the choice of

option for the nuclear fuel cycle. The ~~question is whether to have options~~ are an open fuel cycle with direct disposal of spent fuel ~~or whether instead to have, or~~ a closed fuel cycle in which the spent fuel is reprocessed and the high level waste arising from ~~its~~ reprocessing has to be disposed of. ~~Which alternative~~ The option that is chosen will have implications for the approach to waste disposal, for the costs of spent fuel management and, in the longer term, for the sustainability of nuclear power as a global energy source. There is no easy answer to the question of which alternative is the best. The decision to select a particular ~~alternative option~~ depends on many factors, ~~some being including cost-based and others of a,~~ technical ~~nature~~ issues, or matters of policy, including security. Regardless of the ~~alternative option~~ selected, cost estimates for ~~final~~ waste disposal should be made to assess the economics of nuclear power production and to be able to provide sufficient funds for radioactive waste management (see also paras 2.98–2.107 ~~on funding and financing~~ 105–2.114).

~~2.244 2.231. Radiological~~ The radiological impacts and ~~the~~ costs of decommissioning a nuclear power plant should ~~also be factored into part of~~ the consideration of whether or not to implement a nuclear power programme. In addition to the ~~type of waste being~~ generated during operation, large amounts of solid waste of low and very low ~~specific~~ activity concentration are produced in decommissioning activities. Specific requirements for decommissioning are ~~addressed~~ established in ~~WS R-5 [18]. GSR Part 6 [19].~~

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirements 7 and 10 of GSR Part 1 (Rev. 1) [5];
- Requirements 2 and 31 of GSR Part 3 [8];
- Requirements 1–12 and 17 of GSR Part 5 [9];
- Requirements 2.1–2.3, 2.5, 3.1–3.8, 4.1–4.8, 6.1–6.5, 8 and 9 of WS-R-5 [18] GSR Part 6 [19];
- Requirement 2215 of SSR-2/2 [17] GSR Part 7 [10];
- Requirements 35, 36 and 38 of SSR-2/1 [33] (Rev. 1) [29];
- Requirement 22 of SSR-2/2 (Rev. 1) [18].

Action 124. The government and other interested parties, as appropriate, should establish the national policy and strategy for radioactive waste management, spent fuel management and decommissioning, and should set the goals for its implementation to an appropriate schedule, including site investigations for the purposes of radioactive waste disposal.

Action 125. The government, together with the operating organization, should consider the need for establishing a national organization responsible for radioactive waste management, or for extending the organization for radioactive waste management if this already exists in the State.-

Action 126. The regulatory body should establish the necessary regulatory requirements on radioactive waste management, spent fuel management and decommissioning, as necessary for bid specifications or contract negotiations.

Action 127. The operating organization should consider the arrangements that are necessary for ensuring the safety of radioactive waste management, the safety of spent fuel management and safety in decommissioning, and for minimizing the generation of radioactive

waste.

2.245 2.232. Alternative ~~interim~~ storage and disposal strategies for low level, intermediate level and high level radioactive waste and for spent fuel should be studied in Phase 2. The studies should focus on the safety, feasibility and costs of alternative strategies. ~~As concerns~~ With regard to the disposal of low level and intermediate level radioactive waste, it should be decided whether the operating organization will do this on the site, or whether there will be a national approach with a ~~central final repository~~ disposal facility, and possibly a dedicated organization to operate such a facility. This should be decided early enough that the ~~treatment processing~~ facilities and ~~interim~~ storage facilities for low level and intermediate level radioactive waste can be taken into account in the design of the nuclear power plant. It should be ensured that optimum arrangements are made for the reduction of waste volumes to be performed on the plant site.

2.246 2.233. For managing long lived radioactive waste ~~and~~, high level radioactive waste and spent fuel, the government and the waste management organization should assess whether the ~~final~~ disposal of radioactive waste can be provided for by means of national arrangements or whether assistance from other States is necessary. In general, national arrangements are feasible in an open nuclear fuel cycle with direct disposal of spent fuel. However, the use of a closed nuclear fuel cycle in a small nuclear power programme would require services to be rendered by a reprocessing organization in another State.-

2.247 2.234. Although the disposal solutions with respect to low level, intermediate level and high level radioactive waste will probably not have been selected, the government should ensure that the funding mechanisms

are determined and that the costs are estimated as accurately as possible. This ~~would be essential for~~ is so that an informed decision ~~to~~ can be made on the funds to be allocated for the purposes of radioactive waste management.

~~2.248 2.235.~~ Detailed regulations governing the back end of the nuclear fuel cycle are not necessary by the end of Phase 2, but work should be started to establish the policy and regulations governing activities such ~~areas~~ as the transport and interim storage of radioactive waste. ~~and spent fuel.~~

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 7 and 10 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements 2 and 31 of GSR Part 3 [8];
- ~~—~~ Requirements 1–20 of GSR Part 5 [9];
- ~~—~~ Requirements ~~2.1 2.5, 3.1 3.8, 4.1 4.8, 5.1 5.14, 6.1 6.5 and 8–10 of WS-R-5 [18]~~ GSR Part 6 [19];
- ~~—~~ Requirements ~~22 and 33 of SSR-2/2 [17];~~ Requirement 15 of GSR Part 7 [10];
- ~~—~~ Requirements 35, 36 and 38 of SSR-2/1 ~~[33]~~ (Rev. 1) [29];
- ~~—~~ Requirements 22 and 33 of SSR-2/2 (Rev. 1) [18].

Action 128. The operating organization should prepare a programme for radioactive waste management and spent fuel management, as well as a programme for decommissioning management ~~programme~~, in accordance with the national policy and strategy, and should prepare the corresponding chapters of the safety analysis report.

Action 129. The regulatory body should review and assess the operating organization's programmes for waste management and spent fuel management and for decommissioning, and should verify their compliance with the regulatory requirements.-

Action 130. The operating organization, and the radioactive waste management organization, if applicable, should make their respective ~~interim~~ storage facilities fully operational and ready to receive radioactive waste and spent fuel from the nuclear power plant.

Action 131. The regulatory body should implement its regulatory oversight programme for facilities and activities for radioactive waste management and spent fuel management.

Action 132. All the relevant organizations should be aware of international efforts and progress with regard to the disposal of radioactive waste.

~~2.249 2.236.~~ Work should be started by the operating organization, and by the radioactive waste management organization, if applicable, to determine and to evaluate the sites and the arrangements ~~and sites~~ that would be viable for the ~~final~~ disposal of low level and very low level radioactive waste.

~~2.250 2.237.~~ The ~~treatment~~processing facilities for low level and intermediate level radioactive waste should be incorporated, as necessary, into the nuclear power plant. It should be ensured that the arrangements for ~~reduction of~~reducing the volume of waste and the arrangements for the packaging of waste are in accordance with the strategy for radioactive waste management ~~strategy~~. The facilities should be fully operational at the time of startup of the first reactor.

~~2.251 2.238.~~ The mechanism for funding the decommissioning costs and the costs for radioactive waste management ~~and the~~ (including disposal of radioactive waste) should be established by legislation before the startup of the first reactor (see also paras 2.105–2.114).

~~2.98 2.107 on funding and financing).~~

ACTIONS 133–145: EMERGENCY PREPAREDNESS AND RESPONSE

General

General

~~2.252 2.239. Good design Safety~~ features ~~and~~ incorporated in the design of nuclear power plants and an effective leadership and management for safety that foster a strong safety culture ~~as well as safe operation of a nuclear power plant should make the~~ are necessary to establish a very low probability of plant event sequences that could result in high radiation doses or in an early radioactive release or a large radioactive release ~~extremely low.~~ However, ~~the probability is not zero. despite the high level of confidence that the occurrence of such sequences is extremely unlikely. the application of the concept of defence in depth requires additional barriers or other measures to mitigate the consequences of radioactive releases that could potentially result from accident conditions.~~

~~2.253~~ Emergency ~~planning~~ preparedness and response for the protection of ~~plant personnel, emergency workers, the public~~ human life, health, property and the environment ~~is an essential element of plant safety, as stated in, in accordance with~~ Principle 9 of the IAEA's Fundamental Safety Principles [1], ~~on emergency preparedness and response, and are an essential element~~

of nuclear safety as has been demonstrated in past incidents-emergencies.

2.254 Emergency arrangements need to be developed and implemented for an adequate preparedness to effectively respond to a full range of postulated nuclear or radiological emergencies in relation to the nuclear power programme, including those of very low probability. These arrangements need to be based on a comprehensive hazard assessment to be performed in accordance with the requirements established in GSR Part 7 [10]. Further recommendations are provided in IAEA Safety Standards Series No. GS-G-2.1, Arrangements for Preparedness for a Nuclear or Radiological Emergency, [42], IAEA Safety Standards Series No. GSG-2, Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency [43] and IAEA Safety Standards Series No. GSG-11, Arrangements for the Termination of a Nuclear or Radiological Emergency [44]. In addition, Ref. [45] specifically considers the development of an adequate level of emergency preparedness and response for a State embarking on a nuclear power programme.

2.255 In addition to the specific roles and responsibilities of the regulatory body and the operating organization in relation to plant safety in general and to on-site emergency arrangements specifically, considerations of overall emergency preparedness and response will include response organizations at local, regional and national levels. These response organizations should be engaged as early as possible in the consideration of a nuclear power programme. In Phase 1 these organizations will be involved in: the evaluation of their existing capabilities in emergency preparedness and response; the identification of needs for the strengthening of their capabilities with regard to the nuclear power programme; and the development of an associated action plan. In Phase 2 and Phase 3, these

response organizations will be increasingly involved in the development of adequate arrangements in accordance with the action plan and their respective roles and responsibilities.

2.256 The full emergency arrangements in relation to the nuclear power programme should be established and tested in an exercise conducted before the fuel is brought to the site.

2.257 The IAEA Safety Standards on emergency preparedness and response [10, 42–44] provide detailed requirements, recommendations and guidance for ensuring an adequate preparedness and response for a nuclear or radiological emergency irrespective of the cause.

Phase 1 ~~Phase 1~~

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 7 and 8 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement 43 of GSR Part 3 [8];
- ~~—~~ Requirements ~~1 and 2.1–2.6~~ of ~~GS-R-2~~ [26] GSR Part 7 [10].

Action 133. The government should develop awareness of the need for the early establishment of emergency plans.

Action 134. The government should identify institutions response organizations and new arrangements for supporting emergency preparedness and response.

2.258 ~~2.240.~~ An appreciation of the need for emergency planning should be developed with the involvement of the entire community, including the

public, local authorities and national organizations. Appropriate local and national organizations in the State, and the public should be aware that emergency arrangements require the involvement of many organizations and require complex interactions between ~~these (mostly non-nuclear)~~ organizations—~~largely non-nuclear organizations~~. During Phase 1, the need ~~should be recognized for agreement onto~~ agree the allocation of responsibilities ~~infor~~ for developing arrangements for emergency preparedness and response should be recognized, as well as the need to agree how these arrangements should be coordinated. A close examination of emergency planning options and costs should also be considered at this stage.

2.259 2.241 International cooperation plays a key role in emergency preparedness and response. Due consideration should be given at the national level to the steps by which a State becomes a party ~~Party~~ to ~~and ratifies~~ the Convention on Early Notification of a Nuclear Accident [12] and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency ~~13~~ [13].

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 7 and 8 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements 43–46 and Schedule IV 44 of GSR Part 3 [8];
- ~~—~~ Requirements 2.1–2.6, 3.1–3.20, 2, 4, 5.2–5.30 and 20–23 of GS-R-2 [26] GSR Part 7 [10];
- ~~—~~ Requirement Requirements 18 and 19 of SSR-2/2 [47] (Rev. 1) [18];
- ~~—~~ Requirements Paragraphs 304 and 305 of TS-R-1 [32] SSR-6 (Rev. 1) [28].

Action 135. The government should ~~specify~~determine the national ~~institutions~~response organizations with responsibilities for emergency preparedness and response.

Action 136. The government should specify the general approach for emergency preparedness and response on the basis of the probability and severity of the emergency.

Action 137. The government should start implementing new arrangements as identified in Phase 1 for strengthening the infrastructure for emergency preparedness and response.

Action 138. The regulatory body should develop ~~basic~~the regulations on emergency preparedness and response, as necessary for the development of infrastructure.

Action 139. The operating organization should start developing a general emergency preparedness programme for nuclear power plants.

~~2.260 2.242.~~ During Phase 2, details of the implementation ~~details of the~~ arrangements for emergency preparedness and response do not need to be in place, but implementation of the general approach for emergency planning should be started. ~~This covers, inter alia:~~ and development of a protection strategy should be initiated. These arrangements should cover, among other things:

- ~~—~~ Basic legislation and regulations for emergency ~~planning~~preparedness and response;
- ~~—~~ Threat~~Hazard~~ assessment;
- ~~—~~ Emergency response plans, procedures and including concepts of operations and procedures;
- ~~—~~ Procedures for emergency classification;

— Procedures for protecting emergency workers and helpers in an emergency;

— Demographic characteristics of the site or sites selected;

— Procedures for provisions for public notification warnings, information and instruction;

— Procedures for the implementation of urgent and early protective actions; and other response actions;

— Procedures for requesting and effectively using assistance resources from other identified organizations capable of augmenting the planned response;

— Procedures for medical response;

— Procedures for the implementation of longer term protective actions;

— Procedures for dealing with non-radiological consequences;

— 2.243. The Procedures for managing radioactive waste following the emergency; Guidelines for terminating the emergency and for analysis of the emergency and emergency response.

2.261 Any gaps identified in existing national institution emergency arrangements and in the capabilities of response organizations and communication networks should be filled, or else the at all levels should be filled. Alternatively, an action plan should be developed to fill any such gaps, with the implementation of this plan initiated in Phase 2 and completed in Phase 3. The operating organization should track the progress of training towards filling of these gaps should be realized through an action plan to be implemented later in Phase 3a systematic approach to training.

2.262 2.244. The establishment of an effective emergency response organization and of the associated interactions and provisions should be

commenced in Phase 2 as it can take a long time.

~~2.263 2.245.~~ The operating organization, response organizations and the regulatory body should give due consideration to the requirements for emergency preparedness for and response to a nuclear or radiological emergency, as established in ~~GS-R-2 [26]~~, GSR Part 7 [10], and the respective guidance and recommendations provided in GS-G-2.1 [42], GSG-2 [43] and GSG-11 [44]. These considerations need to account for a sufficient number of emergency workers to respond to simultaneous emergencies on all units.

~~2.264 2.246.~~ National activities ~~with~~ to support the intention of ~~ratifying or becoming a Party to~~ the Convention on Early Notification of a Nuclear Accident [12] and the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency [13] should be continued and should be completed as early as possible.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 7 and 8 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirements 43–46 and Schedule IV of GSR Part 3 [8];
- ~~—~~ Requirements ~~2.1–2.6, 3.1–3.20, 4.1–4.100, 5.2–5.39 of GS-R-2 [26]~~ and Appendices I and II of GSR Part 7 [10];
- ~~—~~ Requirement 18 of SSR-2/2 ~~[17]~~ (Rev. 1) [18];
- ~~—~~ ~~Requirements~~ Paragraphs 304 and 305 of ~~TS-R-SSR-6 (Rev. 1) [32]~~ [28].

Action 140. The regulatory body should establish detailed regulations on

emergency preparedness and response.

Action 141. The operating organization should develop and implement an emergency ~~preparedness programme~~plan and emergency ~~plans and~~ procedures for the nuclear power ~~plants,~~plant and should ~~prepare the corresponding chapter of the safety analysis report. put in place adequate arrangements to support preparedness for an effective response.~~

Action 142. The government and the regulatory body should develop and implement emergency plans and emergency procedures and should put in place adequate arrangements to support preparedness ~~programmes~~for an effective response at the local, national and, as appropriate, international levels.

Action 143. The government and the regulatory body should establish arrangements for coordination between the emergency ~~response~~-plan of the nuclear power plant and the plans of the relevant ~~national institutions~~response organizations that would be involved in emergency response.

Action 144. The regulatory body should review and assess the emergency ~~programme~~plan and ~~the~~ emergency ~~plans and~~ procedures for nuclear power plants, ~~and should~~to the extent necessary to verify compliance with the regulatory requirements.

Action 145. The government, the regulatory body and the operating organization should demonstrate their emergency response ~~capabilities~~capability by conducting appropriate exercises that include ~~local authorities~~all the organizations concerned, people who are potentially affected, and ~~local communities~~representatives of news

media.


2.265 2.247. In Phase 3, by the time the nuclear fuel first arrives on the site, the development of emergency arrangements should be completed ~~and the testing and/or exercising of the emergency.~~ These arrangements should be tested and/or exercised with local and national organizations, ~~and their demonstration~~ demonstrated to the regulatory body ~~should be performed.~~ Scenarios including possible disruption of local and regional infrastructure should also be considered.

2.266 2.248. Programmes, plans and procedures for preparedness for a nuclear or radiological emergency should be implemented at the international, national, regional, local and ~~plant~~ operating organization levels. Emergency notification systems should be in place and should be thoroughly tested. The State should be responsible for establishing arrangements for coordination between the emergency ~~response~~ plan of the nuclear power plant, the plans of the relevant national ~~institutions~~ response organization involved in emergency response at all levels, and other States, consistent with the relevant IAEA safety standards, particularly GSR Part 7 [10], and international conventions ~~7 [11–14].~~

2.267 2.249. The ~~procedures for~~ communication channels ~~procedures~~ and protocols for the chains of command and control between the various emergency centres of the operating organization, the local, regional and national authorities and the regulatory body should be developed, ~~put in place~~ established and tested.

2.268 2.250. At this stage, the regulatory body should have reviewed and, ~~if required~~ as appropriate, approved the on-site emergency ~~response~~ plans. ~~†The~~ The government, through the national coordination mechanism, should have reviewed and approved, as necessary, the respective emergency plans

at the local, regional and national level. The government, through the national coordination mechanism, and the regulatory body should also have verified the adequacy and consistency of these plans in emergency drills and exercises conducted with the participation of local and national organizations, and, if appropriate, organizations in other States and international organizations involved in response in all phases of an emergency.-



3.- IMPLEMENTING THE IAEA SPECIFIC SAFETY REQUIREMENTS FOR THE ESTABLISHMENT

OF THE SAFETY INFRASTRUCTURE

ACTIONS 146–159: OPERATING ORGANIZATION

General

3.1. 3.1.—In a nuclear power programme, the safety related responsibilities of the operating organization include:-

- Specifying the safety requirements for the plant design in accordance with national laws and regulations and appropriate international standards, and verifying that these requirements are met;
- Ensuring the quality of structures, systems and components of the plant;
- Ensuring that a knowledgeable workforce is acquired and maintained ~~at all times~~, including the plant operators and other plant staff;
- Ensuring the safe operation of the plant by implementing an adequate organizational structure, and allocating responsibilities and delegating authority within the organization to achieve proper management and to ~~minimize and~~ address interface issues, including interfaces between safety, ~~and~~ security, ~~and between~~ maintenance and operations, ~~etc.~~;
- Establishing safety policies and implementing management programmes for safe operation and verifying their effectiveness;
- Establishing and implementing a policy for personnel qualification, as well as programmes for ~~staff~~ the continued training

and retraining of staff.

- Establishing and implementing an appropriate policy on an individual's suitability for duty, and addressing the adequacy of the physical and mental fitness of all employees, contractors and visitors, as applicable.
- Establishing liaison with public authorities and the regulatory body and other public authorities for the purposes of considering, understanding and ensuring compliance with regulatory requirements.
- Establishing liaison with organizations for design, construction, commissioning and manufacturing, and other organizations involved in the nuclear power programme, to ensure the proper understanding and transfer of information and experience.
- Providing resources, services and facilities to plant management and adequately supervising safety related work performed by contractors.
- Providing adequate information for the purposes of liaison and public relations.
- Ensuring the collection, evaluation, implementation and dissemination of operating experience.
- Ensuring that the decision making process gives adequate consideration to the selection of priorities and the organization of activities.

3.2. Principle 1 of the IAEA's Fundamental Safety Principles [SF-1] on 3.2. 'responsibility for safety' [1] states that "the:

"The prime responsibility for safety must rest with the person or organization responsible for facilities and activities that give rise to radiation risks". It is therefore the operating organization that has to

~~meet the fundamental safety objective “To protect people and the environment from harmful effects of ionizing radiation”, by taking the following measures:~~

~~“(a) It is therefore the operating organization that has to meet the fundamental safety objective “to protect people and the environment from harmful effects of ionizing radiation”, by taking the measures stated in para 2.1 of SF-1 [1], as follows:~~

- ~~(a) “To control the radiation exposure of people and the release of~~ radioactive material to the environment;
- ~~(b) To restrict the likelihood of events that might lead to a loss of control over a nuclear reactor core, nuclear chain reaction, radioactive source or any other source of radiation;~~
- ~~(c) To mitigate the consequences of such events if they were to occur.”~~

3.3. ~~It is incumbent on the~~The operating organization ~~has a responsibility~~ to ~~specify safety criteria and to assure itself~~demonstrate that the design, construction and operation of ~~the~~ nuclear power ~~plants~~plant meet the applicable safety criteria ~~defined in national regulations and/or approved by the regulatory body~~. In addition, the operating organization is responsible for the establishment of procedures and arrangements for ensuring the safe control of the nuclear power plant under all conditions, for the establishment and maintenance of a competent staff with a strong safety culture, and for the control of the fissile material and radioactive material that is utilized or generated. These responsibilities should be discharged in accordance with applicable safety ~~objectives~~goals and the requirements established by or approved by the regulatory body.

3.4. ~~The IAEA Safety Requirements publication SSR-2/2, Safety of Nuclear Power Plants: Commissioning and Operation [17 (Rev. 1) [18]~~

establishes requirements, and ~~IAEA Safety Guide NS-G-2.4, The Operating Organization for Nuclear Power Plants~~ [29], [25] provides further recommendations and guidance on how to set up an operating organization with a strong safety culture for high performance in terms of safety.

3.5. Staffing of the operating organization and the development of its management system are addressed in paras 2.459172–2.477190 on human resources development and paras 2.442151–2.457171 on leadership and management ~~for safety of this Safety Guide~~.

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirements 5, 6 and 11 of GSR Part 1 (Rev. 1) [5];
- Requirement 4 of GSR Part 3 [8];
- Requirements 1 and 4 of SSR-2/2 (Rev. 1) [18].

Action 146. If the operating organization has already been established or identified in Phase 1 (which is not the scenario developed in this Safety Guide, ~~in which the operating organization is established at the beginning of Phase 2~~), it should be involved together with the government in activities for development of the safety infrastructure from the beginning.

Action 147. The government should consider the financial resources and the necessary competences and staffing that are expected from an organization operating a nuclear power plant so as to ensure long term safety.

Action 148. The government should consider the different ways of

establishing an operating organization to ensure long term safety.

3.6. ~~3.6.~~ In Phase 1, the prospective operating organization may not yet have been identified or established, and even if it exists, it is not expected to start activities on a broad basis. Nevertheless, a vision of the operating organization that is going to implement a future project should be defined, and potential forms of ownership should be envisaged. In order to ensure that the future operating organization can ~~beardischarge~~ its responsibility for safety, a core group of the prospective organization should be established and should start early to plan and implement progressively all the necessary provisions, structures and procedures ~~that are necessary.~~ The first goal is preparation for the bidding process or contract negotiations to take place at the end of Phase 2. An appropriate programme for human resource development for achieving this goal, and for continuing further with preparations for construction, should be planned in Phase 1.

3.7. ~~3.7.~~ Considerations in Phase 1 include topics such as:

- ~~—~~ — The capabilities and resources of existing electrical power producing companies to enter into the nuclear field;
- ~~—~~ — The safety implications of various contract options for nuclear power plants, such as ~~turnkey~~¹⁰ turnkey¹², super ~~turnkey~~¹⁴ turnkey¹³, split ~~package~~¹² package¹⁴ or ~~multicontract~~¹³ multicontract¹⁵ approaches;

¹² In a turnkey project, a single contractor or a consortium of contractors takes the overall responsibility for the entire technical works.

¹³ In a super turnkey project, a single contract is placed for the entire nuclear power plant. This implies that the prime responsibility for the technical success of the project, and therefore for the design of the plant, is placed upon the contractor.

¹⁴ In a split package project, the technical responsibility is divided between a relatively small number of contractors, each building a large fraction of the works.

¹⁵ In a multicontract project, the owner or the architect-engineer assumes responsibility for the engineering of the plant, and issues a large number of contracts.

—The possibilities of joint ventures with operating organizations in other States to strengthen safety capabilities, and the legal implications of such ventures;

—The possibilities of ownership by other States;

—The, and the, legal implications of the former two issues concerning other States such ownership;

—The design authority function (see Action 177 and paras 3.49-54-3.69 on design safety);

—The preliminary environmental impact analysis/assessment (both radiological and nonradiological/non-radiological).

3.8. These topics should be assessed together with the financial arrangements and the staff numbers and competences expected from the operating organization

10.

~~In a turnkey project, a single contractor or a consortium of contractors takes the overall responsibility for the entire technical works.~~¹¹

~~In a super turnkey project, a single contract is placed for the entire nuclear power plant. This implies that the prime responsibility for the technical success of the project, and therefore for the design of the plant, is placed upon the contractor.~~¹²

~~In a split package project, the technical responsibility is divided between a relatively small number of contractors, each building a large fraction of the works.~~¹³

~~In a multicontract project, the owner or the architect-engineer assumes responsibility for the engineering of the plant, and issues a large number of contracts.~~

3.8. at all stages of the preparation and implementation of construction projects, as well as during operation, to provide for long term safety.

3.9. ~~3.9.~~ In planning to establish the general structure of the operating organization, consideration should be given to four kinds of management function:

—Policy making functions, such as making investment decisions, setting management objectives, establishing a policy for nuclear

safety and for quality, human resources development, allocating resources, approving the contents of management programmes, and setting policies on fitness for duty;

— *Operating functions*, which include executive decision making and actions for the operation of the plant, both in operational states and in accident conditions;

— *Support functions*, which include obtaining from both on-site and off-site organizations the technical and administrative services and facilities necessary to perform the operating functions;

— *Safety functions and quality management functions*, which include review of the design and oversight of the construction, manufacturing and supporting functions, as well as the internal quality management processes of the operating organization.

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirements 5, 6 and 11 of GSR Part 1 (Rev. 1) [5];

— Requirement 4 of GSR Part 3 [8];

— Requirements 1–5 of SSR-2/2 ~~17~~ (Rev. 1) [18].

Action 149. The operating organization should be formed, if it has not already been formed, and it should be expressly assigned its prime responsibility for safety.

Action 150. The operating organization should appoint managers and key experts, should specify its organizational structure, and should establish its policy for human resources development for discharging

its responsibility for safety.

Action 151. The operating organization should establish an integrated management system in which safety has the overriding priority.

Action 152. The operating organization should establish a suitable constructive working relationship with the regulatory body and with relevant national and international organizations, consistent with governmental policy.

Action 153. The operating organization should establish a bidding process for bidding or contract negotiations and should specify the safety requirements to be included ~~in the call for bids~~, consistent with national regulations.

Action 154. The operating organization should make provision to include matters relating to the transfer of safety knowledge in the bid specifications or contract negotiations, consistent with governmental policy.

3.10. ~~3.10.~~ The operating organization should recognize its prime responsibility for safety. Key management positions of the operating organization, or of a separate project organization for the nuclear power ~~plants~~plant within an existing electrical power company, should be filled. The organizational structure and the staffing strategy of the operating organization should be the outcome of the assessment performed in Phase 1.

3.11. ~~3.11.~~ The operating organization ensures, in Phase 2, that it has a clear understanding of all relevant safety requirements (IAEA Safety Requirements ~~or~~and national safety requirements, if already established) and will have the necessary capabilities:

- ==—▲ To implement the project management on its own;
- ==—▲ To train and maintain its staff to ensure safe plant operation;
- ==—▲ To specify the site characteristics, including the external events and the features of the local infrastructure that should be taken into account in plant design;
- ==—▲ To gain an understanding of how to meet all safety requirements and to incorporate the safety requirements properly into the call for bids or contract negotiations;
- ==—▲ To specify the evaluation process for bids or contract negotiations, giving due importance to safety criteria;
- ==—▲ To assess, with the help of external support organizations, as necessary, the safety features of the plants being offered by vendors, and to explain the conclusions of the safety assessment to the regulatory body;
- ==—▲ To verify the capabilities of the potential vendor organizations, including the vendor's management system, in-house competences, practices and contractual arrangements in using subcontractors for major tasks and equipment supplies, and their experience in managing large construction projects;
- ==—▲ To verify the preparedness of potential vendors to implement the project, including maturity of the detailed design;
- ==—▲ To develop the operating organization's own effective and efficient integrated management system, including quality control, for construction and manufacturing, on the basis of good knowledge of national and international standards and requirements;
- ==—▲ To consider approaches to spent fuel management and radioactive waste management.

funding, should be made and it should be ensured that ~~they~~ these provisions are properly incorporated into the agreements and commercial contracts associated with the nuclear power programme.-

3.13. ~~3.13.~~ Cooperation between the main entities involved in the programme, as well as international organizations, is of paramount importance to the success of the nuclear power programme. Their efforts should be coordinated, and the operating organization is likely to play the lead role in coordinating the main partners.-

3.14. ~~3.14.~~ It is recognized that in some States the operating organization may not be the eventual legal owner of the nuclear power plant. Where this is the case, the ~~clarity of the~~ roles and responsibilities of each organization should be ~~ensured~~ clearly defined. However, the prime responsibility for safety rests with the authorized party that becomes the operating organization of the nuclear power plant.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— ~~Requirements 5, 6 and 11 of GSR Part 1~~ (Rev. 1) [5];

— ~~Requirement 3.7 of GS-R-3 [16]~~ GSR Part 2 [17];

— ~~Requirement 4 of GSR Part 3~~ [8];

— ~~Requirement 2 of GSR Part 7~~ [10].

— ~~Requirement 1 of SSR-2/1~~ [33 (Rev. 1) [29];

— ~~Requirements 1–32 of SSR-2/2~~ [17 (Rev. 1) [18];

— ~~Requirements 9.58, 63 and 68 of SSR-4, 9.49–9.53 of NS-R-5 [43]~~ [41].

Action 155. The operating organization should implement a safety policy that includes goals and objectives that give safety matters the highest priority, as part of its integrated management system¹⁶.

Action 156. The operating organization should give primary consideration to safety aspects during the evaluation of bids or contract negotiations.

Action 157. The operating organization should, in coordination with the vendor as necessary, prepare all the safety documentation as required in the licensing process for submission to the regulatory body.

Action 158. The operating organization should develop all necessary programmes for operational management (including programmes for operations, maintenance and training) and should submit them to the regulatory body, as appropriate.

Action 159. The operating organization should ensure completion of the construction of the nuclear power plant in accordance with the design basis licence conditions, and with primary consideration given to safety aspects.

3.15. ~~3.15.~~ A clear safety policy emphasizing the priority to be given to safety over the demands of production and project schedules should be developed by the operating organization and should be communicated to its own personnel and to all contractors. The safety policy should demonstrate the commitment of the management to high performance in terms of safety. It should be supported by the provision of the resources necessary to achieve the safety targets and quality targets.

¹⁶ ~~See paras 2.142–2.157 on leadership and management for safety for further information.~~

3.16. ~~3.16.~~ The operating organization should actively promote a strong safety culture among its own personnel and among contractor organizations.

3.17. ~~3.17.~~ Progressively in Phase 3, the operating organization should grow larger in size and complexity. The organization should plan for the rapid change in its size, its functions, its responsibilities, its organization and its management techniques. Training of all staff should be systematically designed, delivered and evaluated. The growth and the change should be achieved while the safety culture continues to be developed throughout the organization. The organization will undergo a transition in focus from construction oriented to operation oriented during Phase 3.-

3.18. ~~3.18.~~ The description of the structure and of the functions to be performed by the individual departments in the operating organization, on the site and off the site, and by individuals in each department, as well as the lines of responsibility, authority and communication, should be unambiguous.

3.19. ~~3.19.~~ In the evaluation of bids or negotiation of contracts, the operating organization should ensure that the proposed designs comply with the national safety requirements.

3.20. ~~3.20.~~ Irrespective of the type of contract, the operating organization should verify the quality of structures, systems and components, in accordance with its responsibility for safety.

3.21. ~~3.21.~~ The operating organization should prepare all the documentation required for obtaining the necessary licences in accordance with the regulatory requirements. ~~This may include, depending~~ Depending

on the national licensing process, this may include:

- Safety analysis reports (see paras 2.202–2.221 on safety assessment ~~for further information~~).
- Probabilistic safety analyses (which might be included in the safety analysis report; ~~see paras 2.202–2.221 on safety assessment for further information on probabilistic safety analysis~~).
- Operational limits and conditions (which might be included in the safety analysis report). The operation of the nuclear power plant should be controlled in accordance with a set of operational limits and conditions, derived from the safety analysis, which identify the boundaries of safe operation. The application of these operational limits and conditions is intended to prevent conditions arising that could lead to accidents, and to ~~limit~~mitigate the consequences of any such accidents, if they do occur. Operational limits and conditions are developed as a part of ensuring that the plant is operated in accordance with the design assumptions and design intent as well as with its licence conditions.-

3.22. 3.22. The operating organization should also be prepared to manage the licensing process, including providing any additional information ~~that will be required~~requested by the regulatory body during the course of the licensing process (often the review of the safety analysis report generates a large number of requests for additional information).

3.23. 3.23. As required by SSR-2/2 ~~[17~~(Rev. 1) [18], it is the responsibility of the operating organization to develop operating procedures and a range of management programmes important to safety. ~~As stated~~Procedures should be developed for normal operation, as well as to control anticipated operational occurrences and accident conditions

(including design basis accidents and design extension conditions without significant fuel degradation). For design extension conditions with core melting (severe accident conditions), specific guidelines should be developed. As described in NS-G-2.4 [29], the areas to be covered by various management programmes for the safe operation of the plant should include, but are not limited to, the following:

- Staffing (see paras 2.458172–2.477190 on human resources development);
- Qualification and training (see paras 2.458172–2.477190 on human resources development);
- Commissioning (see paras 3.70–3.77 on preparation for commissioning 78–3.88);
- Plant operations (in conjunction with the operational limits and conditions);
- Maintenance;
- In-service inspection;
- Surveillance;
- Fuel management;
- Chemistry;
- Safety analysis and review;
- Physical protection (see paras 3.94–3.108 on interfaces with nuclear security);
- Radiation protection (see paras 2.490203–2.204214 on radiation protection);
- Industrial safety;
- Waste management (see paras 2.222236–2.238252 on safety of radioactive waste management, spent fuel management and decommissioning);

- Environmental monitoring (see paras 2.~~490~~203–2.~~201~~214 on radiation protection and paras 3.~~24~~25–3.~~48~~53 on site survey and site evaluation);
- Emergency preparedness (see paras 2.~~239~~253–2.~~250~~269 on emergency preparedness and response);
- Fire safety;
- Quality assurance (see paras 2.~~442~~151–2.~~457~~171 on leadership and management for safety and paras 2.~~407~~115–2.~~441~~150 on external support organizations and contractors);
- Human factors;
- Feedback of operating experience;
- Plant modifications (see paras 3.~~49~~54–3.~~69~~77 on design safety);
- Document control and records (see paras 2.~~442~~151–2.~~457~~171 on leadership and management for safety);
- Management of ageing;
- Decommissioning (see paras 2.~~222~~236–2.~~238~~252 on safety of radioactive waste management, spent fuel management and decommissioning).

3.24. Operating experience should be considered during construction and commissioning to incorporate any required design changes before operation. The operating organization should perform periodic evaluations of the operating experience and submit or make available the results to the regulatory body, as appropriate. The operating organization should ensure that any reasonably practicable safety improvements identified in the review are implemented in a timely manner, consistent with regulatory requirements.

General

General

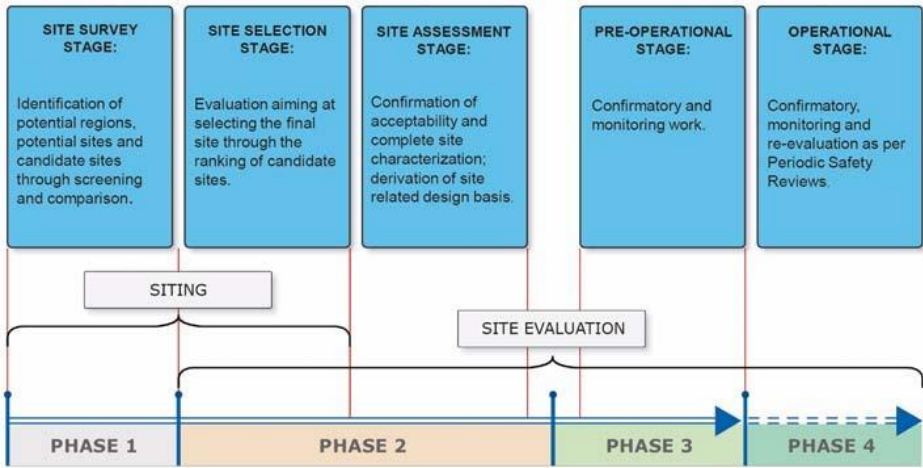
3.25. 3.24. Principle 8 of the IAEA's Fundamental Safety Principles [1], 'Prevention of accidents', SF-1 [1], states that "all practical efforts must be made to prevent and mitigate nuclear or radiation accidents". Paragraph 3.32 of Ref. [1] mentions, and para. 3.31 of SF-1 [1] states that: "The primary means of preventing and mitigating the consequences of accidents is 'defence in depth'." The implementation of defence in depth includes adequate site selection, as described in the context para. 3.32 of providing defence in depth, SF-1 [1].

3.26. 3.25. The site selection process, also called The siting process for a new nuclear installation, is divided into two stages, as shown in Figure 5. In the first stage, ' (site survey', usually large regions are investigated to find potential sites are considered on the basis of existing available data and suitable candidate sites are chosen on the basis of available data (Phase 1). The In the second stage, ' (site selection', is aimed to select), the site candidate sites are compared and is ranked to reach the completion preferred site on the basis of the site selection process safety and other criteria. In stage 3, the acceptability of the selected site¹⁷ is confirmed, its complete ('site characterization') detailed site characterization is performed and the site related parameters needed necessary for the design of the nuclear power plant are derived (Phase 2). The In stage 4, (pre-operational stage) based on site monitoring and detailed information obtained during site preparation for construction the site is confirmed. Site monitoring and

¹⁷ For the purposes of this Safety Guide, it is assumed that only one single site is required for a nuclear power plant (to locate the number of reactor units under consideration). However, the methodology is fully applicable to a number of sites.

periodic re-evaluation of site hazards and site parameters continue during the operational stage.

3.27. The site evaluation process follows starts after the site survey and should be continued throughout the entire lifetime of the nuclear power plant (Phases 3 and 4) to take into account changes in the site characteristics and associated environmental impacts, in evaluation methodologies and in safety standards (see Fig. 7). This process5). Site evaluation is usually divided into four stages: site selection, site assessmentcharacterization, the pre-operational stage and the operational stage.



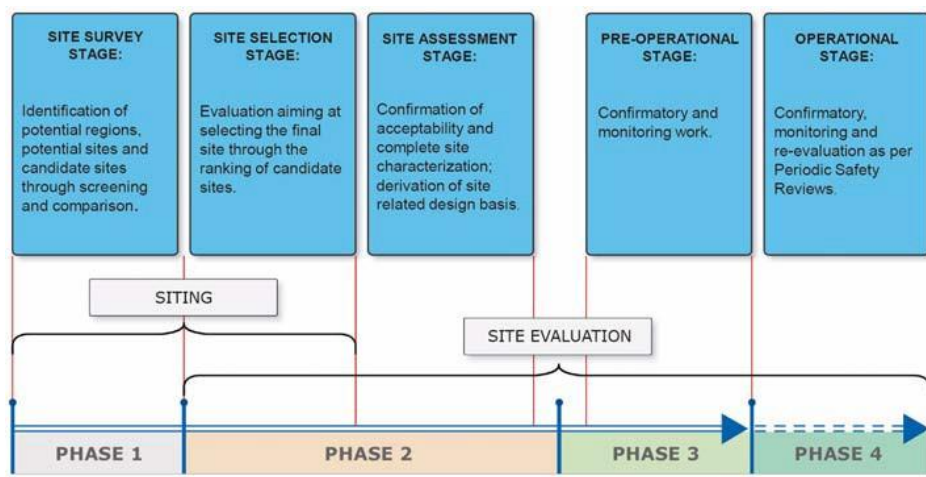


FIG. 75. The consecutive stages of site survey and site evaluation.

3.26-

3.28. The emphasis ~~necessary~~ on safety aspects during the site survey stage (Phase 1) evolves with time. As the process progresses to screen out more and more potential sites (and therefore to retain only a few potential sites), the safety aspects ~~becomes~~become more important. The data collected and the methods used for these few sites should all be treated and scrutinized with similar care, because ~~for the site finally selected (i.e. the preferred candidate site), these~~this data will be used in the subsequent stages of the licensing process- for the site that is finally selected (i.e. the preferred candidate site).

3.29. ~~3.27.~~ In Phase 2, after the site selection stage, the confirmation of acceptability of the site and a complete site characterization are performed in the site ~~assessment~~characterization stage. This process precedes the preparation of the site evaluation report, ~~which.~~ The site evaluation report should be approved by the regulatory body.

3.30. ~~3.28.~~ After approval of the site evaluation report by the regulatory body, confirmatory work and site monitoring ~~work~~ should be continued

throughout the pre-operational stage (Phase 3).

3.31. A periodic review of site specific hazards should be performed and the findings of the review should be used to re-evaluate the safe operation of the nuclear installation.

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirement 31 of GSR Part 3 [8];
- ~~Requirements Paragraphs~~ 2.1–2.29, 3.1–3.55, 4.1–4.15, and 6.1–6.9 of NS-R-3 ~~[34]~~ (Rev. 1) [27].

Action 160. The government should ensure that potential sites are identified and candidate sites are selected on the basis of a set of defined criteria, at a regional scale and with the use of available data¹⁸.

3.32. 3.29. In accordance with Principle 8 of ~~the IAEA's Fundamental Safety Principles~~ SF-1 [1], and in order to be able to make an informed policy decision at the end of Phase 1 on whether or not to introduce nuclear power, it should be ~~evaluated~~ determined whether suitable sites are available for locating a nuclear power plant. A general survey should be conducted at the national and regional scale, on the basis of data, information and documentation that are already available, to determine the availability and acceptability of such sites. The public should be involved at these early stages. The objectives of this phase cannot be fulfilled if no

¹⁸ If the operating organization is already established or identified in Phase 1 (which is not the scenario developed in this Safety Guide, in which it is established at the beginning of Phase 2), it should be involved in the site survey.

suitable sites are available on the basis of established safety criteria.

3.33. 3.30. A set of criteria relating to the acceptability and comparison of sites should be identified from the beginning of Phase 1. Both Safety related aspects and non-safety related aspects should be properly taken into account, because of the interface between them. This will provide for the development of the site selection and site evaluation processes during the subsequent phases, without the need and avoid having to revert to earlier steps because of a lack of suitable available sites.

3.34. 3.31. While 'acceptability' (or exclusion) criteria in relation to safety are well defined in accordance with IAEA safety standards [2 Safety Standards Series No. SSG-35, Site Survey and Site Selection for Nuclear Installations [46], the criteria for comparison of the candidate sites may/might differ from State to State — and from one phase to another — on the basis of the results obtained and the iterative nature of the process.-

3.35. 3.32. These/The criteria should provide for a consistent set of boundary conditions from different fields (e.g. safety, for a variety of considerations versus development and social needs, (e.g. safety considerations versus, development and societal needs, security considerations, safety considerations versus and historical or/and archaeological conditions) that will exclude unacceptable sites in the early stages of the programme-siting process. This will leave for further consideration only those sites that fulfil the acceptability conditions.

3.36. 3.33. As regards safety related conditions, the relevant The requirements for safety conditions for site evaluation for nuclear installations are established in NS-R-3 (Rev. 1) [27], and the associated recommendations are provided in the IAEA safety standards.SSG-35 [46].

As stated in para. 2.1 of NS-R-3 [31], three main(Rev. 1) [27]:

“In the evaluation of the suitability of a site for a nuclear installation, the following aspects ~~are~~shall be considered:

(a) — The effects ~~on the nuclear power plant~~ of external events occurring in the region of the particular site, ~~i.e. (the external hazard events could be~~ of natural ~~and~~origin or human induced origins);

(b) — The characteristics of the site and its environment that could influence the transfer to people and the environment of ~~released~~ radioactive material; ~~that has been released~~;

(c) — The population density and population distribution, ~~as well as and~~ other characteristics of the external zone ~~that may~~^[19] in so far as they could affect the possibility of ~~taking~~implementing emergency ~~measures, including response actions and~~ the need to evaluate the risks to individuals and to the population.”

3.37. 3.34. Each site has specific characteristics that should be taken into account in adapting the design of the nuclear power plant. These characteristics, which ~~may~~could represent risks for the plant, include natural hazards such as earthquakes and surface faulting, meteorological events, flooding, geotechnical hazards, and the potential combination of such events. They also include human induced hazards due to nearby industrial activities or transport routes. Also, the risk of malicious acts ~~may~~might be (to some extent) site dependent, i.e.g. some site features might provide protection against malicious acts.

¹⁹ Taking into account the need for establishing emergency planning zones and distances in accordance with GSR Part 7 [10].

~~3.38. 3.35.~~ The expected ~~impacts~~impact of the plant on the public and the environment ~~are considered, to estimate, in terms of~~ the consequences of radioactive discharges in ~~normal operation~~operational states and potential radioactive releases ~~resulting from accidents.~~in accident conditions, should be considered. This requires a preliminary analysis of the dispersion of radioactive material ~~due to atmospheric phenomenon~~through the atmosphere, through surface water and through groundwater. The prospective population distribution should also be analysed, ~~to characterize~~and dietary habits, as well as the uses of land and water in the region, ~~should be characterized.~~ This preliminary analysis is to raise the awareness of the possible radiological impacts to the environment that need to be addressed in Phase 2 through the environmental impact assessment process. This should be done as part of the radiological environmental impact ~~analysis~~assessment addressed in paras 2.490203–2.201214 on radiation protection.

~~3.39. 3.36. As regards~~With regard to the conditions that are not directly safety related, the criteria to be established include national needs and specific local needs in all the relevant aspects (e.g. legal aspects, archaeological and historical aspects, economics and social development, land use, energy distribution networks, accessibility and availability of local infrastructure, public acceptability, and proximity to industrial and military centres).

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

— Requirement 31 of GSR Part 3 [8];

~~— Requirements~~ Paragraphs 2.1–2.29, 3.1–3.55, 4.1–4.15, and 6.1–6.9 of NS-R-3 ~~{34(Rev. 1) [27]}~~.

Action 161. The regulatory body should establish specific safety requirements for site evaluation, including requirements for the process for authorizing the site selected, in compliance with the relevant IAEA safety standards.

Action 162. The operating organization should complete the investigations relating to the acceptability of the candidate sites and should select the preferred candidate site for the first nuclear power plant, making use of specific data, information and studies, and assessments conducted on the fullest possible temporal and spatial scales of investigation.

Action 163. The operating organization should prepare the site evaluation report and should submit it to the regulatory body, on the basis of a full assessment of the site selected and including the confirmation of site acceptability and the characterization of the site for the definition of the site related design basis parameters.-

Action 164. The regulatory body should review and assess the site evaluation report, and should make a decision regarding the acceptability of the site selected and the site related design ~~bases~~ basis.

Action 165. The operating organization should use all the appropriate information relevant to safety and to regulatory control that is related to or derived from the site ~~assessment~~ characterization to prepare the bid specifications or negotiate contracts for the nuclear power plant.

Action 166. The operating organization should start to evaluate and modify the site and the radiological environmental monitoring

programme, as necessary, after the site evaluation report has been approved.

~~3.40. 3.37.~~ The licensing process by the regulatory body should be well defined to provide the operating organization with a clear indication of the stages and the requirements of the regulatory ~~body's intervention processes~~ (for example, the review and approval process of the site evaluation report, issuance of a site permit).

~~3.41. 3.38.~~ Two main stages are implemented during Phase 2 ~~which are driven by a different 'focus' and the depth of the substantiation process, as follows:~~

~~—~~ ~~Comparison and ranking studies of the candidate sites, focusing~~ on a number of sites as identified, selected and preliminarily ranked in Phase 1;

~~—~~ ~~Detailed~~ A detailed evaluation and assessment ~~of the site selected,~~ focusing on the ~~site~~ selected site and making use of specific data, information and studies, and assessments conducted on ~~the fullest possible scales~~ a large scale of investigation, both temporal (for example, the prehistorical, historical and instrumental time periods) and spatial (for example, the regional, near-regional, site vicinity and site areas).-

~~3.42. 3.39.~~ To be ready for inviting bids or to negotiate contracts for the first nuclear power plant during Phase 2, the assessment of the candidate sites — which were identified, screened and compared in Phase 1 — should be completed by means of a specific evaluation process for ranking ~~the~~ each site and selecting the preferred candidate site following the site selection stage. This site selection stage is followed by the site ~~assessment~~ characterization stage. At this stage a full, specific and detailed

evaluation of the site selected is carried out to confirm its acceptability, to derive the site related design basis and to prepare the radiological environmental impact ~~analysis~~²⁰ assessment, as well as the non-radiological impact assessment (for example, of impacts of thermal discharges, chemical discharges) in accordance with the national regulatory framework. This is done by means of detailed evaluation studies and investigations that are specific to the site and commensurate with the objectives of Phase 2 of being ready for inviting bids or to negotiate contracts.

~~3.43. 3.40.~~ The operating organization should define in the early stages of the site selection process the maximum nuclear capacity to be installed at the site. The assessment of emergency plans should consider collocated nuclear installations with special emphasis on those that could experience concurrent accidents.

~~3.44. 3.41.~~ In accordance with the requirements of NS-R-3 ~~[34~~(Rev. 1) ~~[27]~~ and with regard to the potential radiological impacts on the region for operational states and for accident conditions leading to emergency response measures, an estimate should be made of expected releases of radioactive material²¹. Since in Phase 2 the design of the plant and its safety features ~~may~~might not be known, the potential releases should first be estimated using generic and bounding values, and should be updated later in Phase 3 when the design and safety features are known.

~~3.45. 3.42.~~ During Phase 2, all site evaluation tasks should be conducted in accordance with the requirements ~~and established in NS-R-3 (Rev. 1)~~

²⁰ See paras 2.190–2.201 on radiation protection for further guidance.

²¹ This issue is detailed further in the radiological environmental impact assessment, as mentioned in paras 2.190–2.201 on radiation protection.

[27], and the recommendations of the IAEA safety standards provided in Refs [47–53] on site evaluation [31, 44–49].

3.46. ~~3.43.~~ Information on frequency and severity derived from the characterization of the hazards resulting from external events is required for establishing the design basis hazard level for the nuclear installation, taking into account uncertainties in the design basis hazard level.

3.47. The site ~~assessment~~ characterization process should lead to the preparation by the operating organization of the site evaluation report, which includes the confirmation of site acceptability and the complete site characterization. This should be used as the basis for the preparation of the chapter on site evaluation in the safety analysis report in Phase 3. In some States the site evaluation report is called a site safety report.

3.48. ~~3.44.~~ The operating organization should identify necessary improvements to the site, ~~(to be built in Phase 3)~~ that are important to safety, such as site protection measures against external hazards (for example, external floods, groundwater level and hydrogeological conditions), provision of an ultimate heat sink, road access, communications and water supplies, which ~~may~~ might also have an impact on the implementation of emergency plans.

3.49. ~~3.45. This step~~ The regulatory body should ~~give rise to~~ engage in intensive interactions with the public ~~at large, and,~~ in particular with the local population, ~~and with~~ local organizations and local authorities. ~~Further information on this issue is provided in paras 2.84–2.96 on transparency and openness.~~

3.50. ~~3.46.~~ An environmental ~~survey~~ monitoring programme around the power plant site should be started well before commissioning of the plant,

to obtain reference data on the radioactive isotopes ~~to be~~ found in the environment before operation of the plant is commenced. These data can later be ~~consulted in~~ used when identifying radioactive isotopes that might have been released from the nuclear power plant.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirement 31 of GSR Part 3 [8];~~
- ~~— Requirements Paragraphs 2.1–2.29, 3.1–3.55, 4.1–4.15, 5.4, 1A and 6.1–6.9 of NS-R-3 [34 (Rev. 1) [27].~~

Action 167. The operating organization should prepare the chapter on site evaluation ~~of~~ in the safety analysis report, and then update it, taking into account the specificities of the ~~reactor~~ nuclear power plant selected and the data and information gathered during the pre-operational stage.-

Action 168. The operating organization should implement necessary safety improvements to the site, ~~if required,~~ as site protection measures determined as a result of the ~~tasks of~~ external hazard assessment.

Action 169. The operating organization should continue to implement the environmental programme and the site monitoring programme.-

3.51. 3.47. Paragraph 5.1 of NS-R-3 (Rev. 1) [27] states that:

“The characteristics of natural and human induced hazards as well as the demographic, meteorological, seismological and hydrological conditions of relevance to the nuclear power plant ~~should~~ shall be

monitored over the lifetime of the plant.

3.52. Paragraph 5.1A of NS-R-3.48- (Rev. 1) [27] states that:

“Site specific hazards shall be periodically reviewed using updated knowledge, typically every ten years, and shall be re-evaluated when necessary. A review after a shorter interval shall be considered in the event of evidence of potentially significant changes in hazards (for example, in the light of the feedback of operating experience, a major accident or the occurrence of extreme events). The implications of such a review of site specific hazards for the safe operation of the nuclear installation shall be evaluated.”

3.53. Activities for radiological environmental impact ~~analysis~~assessment or environmental monitoring are addressed in paras 2.490203–2.204214 on radiation protection.

ACTIONS 170–184: DESIGN SAFETY

General

3.54. 3.49- Principle 8 of the IAEA’s Fundamental Safety Principles [1], ‘Prevention of accidents’, SF-1 [1], states that “All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.” Also, and para 3.31 of SF-1 [1] states that: “The primary means of preventing and mitigating the consequences of accidents is ‘defence in depth’”.

3.50. The IAEA Safety Requirements publication SSR 2/1 [33], Safety for the design of Nuclear Power Plants: Design, establishes the requirements to be fulfilled by the nuclear power plant.

3.55. 3.51-plants are established in SSR-2/1 (Rev. 1) [29]. The key design safety principles and issues that should be taken into account in the design include:

- The concept of multiple barriers and defence in depth for the prevention and mitigation of accidents and the independence of safety provisions of different levels of defence in depth;
- The concept of deterministic analysis for design safety; failure criteria, redundancy, diversity and physical separation;
- The concept of postulated initiating events and minimization of the plant's sensitivity to such events;
- The ~~concept~~ concepts of ~~postulated accident~~ design basis accidents and design extension conditions ~~and severe plant conditions~~;
- ~~Internal hazards and external hazards~~;
- The practical elimination of event sequences that could lead to an early or large release
- Design with sufficient margins or protection of items important to safety against internal and external hazards, with consideration of the potential for specific hazards to impact several units at the site simultaneously”.
- High reliability of heat transfer to an ultimate heat sink including conditions generated by natural hazards more severe than those derived from the site evaluation
- Design features to enable the safe use of non-permanent equipment for cooling and power supply
- The systematic consideration of human factors, including the human-machine interface;
- Verification of ~~the~~ a balanced design by means of probabilistic analyses;
- Safety classification of structures, systems and components and the correlation of safety classes with requirements on quality and reliability;

- The utilization of proven codes and standards for the design of structures, systems and components;
- Active versus passive safety functions;
- Safety aspects of structures, systems and components important to safety such as the reactor core, reactor cooling system, containment, emergency power system and instrumentation and control systems.

— 3.52.

3.56. Other factors that should be considered in the design include:-

- Optimization of radiation protection (for occupational and public exposure);
- Minimization of the generation of radioactive waste;
- The feasibility of decommissioning.

3.57. ~~3.53.~~ The codes and standards that are used by different vendors in the design of structures, systems and components depend on the State of origin. A high level of safety can be achieved by the consistent application of codes and standards together with the use of national practices for quality assurance. ~~The IAEA Safety Requirements publication~~ Paragraph 4.15 of SSR-2/1 [33(Rev. 1) [29] states in para. 3.6 that “Where:

“National and international codes and standards that are used as design rules, they for items important to safety shall be identified and evaluated to determine their applicability, adequacy and sufficiency, and shall be supplemented or modified as necessary to ensure that the final quality of the design is commensurate with the necessary associated safety function.” ~~Experience shows that the~~

The vendor usually proposes a set of codes and standards. The operating organization and the regulatory body should assess the applicability of

these codes and standards and their consistency with national safety requirements.

~~3.58. 3.54.~~ The maturity of the national technical infrastructure is an important ~~boundary condition~~factor that should be considered for ensuring the safety of the operation of a nuclear power plant. A nuclear power plant does not exist in isolation; ~~it~~the safe and reliable operation of the plant should be supported by a number of external factors. These include the reliability of external electrical power grids and water supplies. These external factors should be taken into account in the design. One vital factor for the safety of a nuclear power plant is the reliability of the external electrical power grid.-

Phase 1

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~—~~ Requirements of SSR-2/1 (Rev. 1) as a whole [~~3329~~];

Action 170. The government should ~~learn~~understand the objectives for nuclear safety, and how they are taken into account in nuclear power plants of various designs.

Action 171. The government should consider the availability of the technical infrastructure as well as the reliability of the national power grid, and should consider the potential impacts of these on the design requirements for the safety of the nuclear power plant.

~~3.59. 3.55.~~ Individuals that are to be involved in the nuclear power programme should ~~start acquiring~~acquire knowledge of the ~~major aspects of IAEA Safety Requirements publication No.~~ principal technical

requirements given in SSR-2/1, ~~Safety of Nuclear Power Plants: Design~~ [33 (Rev. 1), [29], as well as the features of the various nuclear reactor technologies. It is not ~~required~~necessary to ~~go into too much~~include a lot of technical detail in this phase, but the main features and principles of safety in design ~~safety~~ should be understood.

3.60. ~~3.56.~~ The supply of electrical power is a vital service for a nuclear power plant, and the reliability of the power supply depends mostly on the reliability of the external grid. ~~Consideration— The stability of the grid~~ should be givensufficient to ~~the risk associated with events in which a nuclear power plant goes to a fast shutdown and the~~minimize electrical grid collapses as a consequence, resulting in at least temporary loss of external power. Also, thedisturbances that could result in a reactor trip.

3.61. The reliability of on-site poweremergency and alternate power sources also depends on external elements such as the provision of high quality industrial products (for example, diesel fuel, fluids including oils, gases). Among other factors contributing to safety are the supply chain for spare parts and consumables, and ~~the~~ access to a skilled workforce. The reliability of the technical infrastructure should be assessed, and compensatory measures should be planned as necessary.-

Phase 2

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 5, 15, 16 and 29 of GSR Part 3 [8];
- ~~—~~ Requirements of SSR-2/1 (Rev. 1) as a whole [33]; ~~—29];~~
- ~~—~~ Requirements 6.43–6.54 ~~15 and 16 of NS-R-5 [43]~~ SSR-4 [41].

Action 172. All the relevant organizations should obtain an in-depth understanding of the safety principles and safety requirements applicable in the design of a nuclear power plant.

Action 173. The operating organization should conduct a thorough market survey of the available nuclear power technologies and should investigate their safety features.

Action 174. The regulatory body should prepare and enact national safety regulations on design that are necessary for bid specification or contract negotiation.

Action 175. The government and the operating organization, as applicable, should start to implement plans for improving the national technical infrastructure, as necessary, to fill in previously identified gaps in the capabilities necessary for ensuring safety.

Action 176. The operating organization should include in the bid specification or contract negotiation all the safety and regulatory aspects that should be considered in the design, with account taken of the status of the national technical infrastructure.

3.62. 3.57. In the preparation of bid specifications or contract negotiation, the operating organization should take into account the information identified in the evaluation of the site, to make sure that they are it is adequately reflected in the design basis for ~~the~~ structures, systems and components.

3.63. 3.58. The call for bids or contract negotiation should ~~require the stipulate that~~ potential vendors ~~to~~ specify the codes and standards that they are planning to use and ~~should require them to~~ confirm that these codes and standards meet the safety requirements included in the bid specifications:

or contract negotiation.

3.64. ~~3.59.~~ At this stage of the process, the decisions that should be made typically include the type of nuclear power plant to be built, including its main safety characteristics, the specification of any additional safety features that should be incorporated into the design, and the choice of the site on which the plant will be built.

3.65. ~~3.60.~~ During Phase 2, the government and the operating organization should develop plans for improving the national technical infrastructure, as feasible, and should start implementing ~~those~~these plans. In so doing, it is ensuring that, among other things, the national electricity system will be capable of withstanding the sudden loss of the largest generating unit (and also its prolonged scheduled maintenance) without compromising the safety of the nuclear power plant. The necessary funding should be allocated for this purpose, with the objective of completing the necessary improvements before the commissioning of the nuclear power plant.

3.66. ~~3.61.~~ Where the supply of external services cannot be ensured with adequate reliability, compensatory measures should be planned and taken into account in the bid specifications or contract negotiation, since ~~they may~~these measures might have impacts on the safety of the plant design. These compensatory measures could involve the strengthening of certain plant systems with respect to reference plants or generic plant designs.

3.67. ~~3.62.~~ The interfaces between ~~nuclear~~ safety and nuclear security should be considered as part of the design process. These interfaces should be considered in such a way that the impacts of safety on security and the impacts of security on safety are taken into account from the design stage onwards and an appropriate balance is achieved. Safety measures and security measures should be designed and applied in an integrated manner.

and as far as possible in a complementary manner, so that security measures do not compromise safety and safety measures do not compromise security.

Phase 3

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirements 5, 15, 16 and 29 of GSR Part 3 [8];
- ~~—~~ Requirements of SSR-2/1 (Rev. 1) as a whole [33]; ~~—~~ 29];
- ~~—~~ Requirements 10 and 11 of SSR-2/2 [47]; ~~—~~ (Rev. 1) [18];
- ~~—~~ Requirements ~~6.43–6.54~~15 and 16 of ~~NS-R-5 [43]~~SSR-4 [41]

Action 177. The operating organization should establish a ‘design ~~entity~~authority’ that will maintain the knowledge of the safety design and its configuration management over the lifetime of the plant.

Action 178. The operating organization should conduct an adequate safety review of the designs proposed by the vendors in the submitted bids or contract negotiation, including an assessment of the associated sets of codes and standards.

Action 179. The operating organization should establish proper interaction with the selected vendor for the preparation of the safety documents.

Action 180. The government and the operating organization should ensure the completion of all the required improvements of the national technical infrastructure consistent with the plant design.

Action 181. The operating organization should prepare and provide to the regulatory body the safety documents required in the licensing process.

Action 182. The regulatory body should review and assess the safety documentation such as the safety analysis ~~reports~~report, and should verify the compliance of the design with regulatory requirements.

Action 183. The operating organization should ensure the adequate validation and verification of the design of the nuclear power plant and its structures, systems and components, and the regulatory body should review this validation and verification.

Action 184. The operating organization and the regulatory body should implement their respective processes to address modifications made to the design during construction and afterwards.

3.68. ~~3.63.~~ When evaluating bids or in contract negotiations, the operating organization should verify that the proposed designs satisfy the national safety requirements.

3.69. ~~3.64.~~ Although a comprehensive design review before the acceptance of a bid or contract is not a ~~general~~widespread practice, the operating organization should conduct an adequate design verification of the submitted bid or contract proposal so as to provide confidence that the main design features are in compliance with the respective safety requirements, including those relating to qualified personnel.

3.70. ~~3.65.~~ Once the bid or contract proposal has been accepted, finalization of the design and preparation of a safety analysis report should start early in Phase 3. The safety analysis report should be prepared in accordance with the format and content ~~as~~ specified in the national

regulations or as agreed ~~upon~~ with the regulatory body.-

3.71. ~~3.66.~~ All improvements of the national technical infrastructure consistent with the plant design, such as the reliability of the electrical power supply, the availability of diesel fuel and the availability of spare parts for the safe operation of the nuclear power plant, should be completed. The operating organization should establish proper coordination with the ~~grid~~-management organization of the electrical power grid and should test the reliability of the external grid.-

3.72. ~~3.67.~~ Early in Phase 3, the operating organization should submit the safety analysis report to the regulatory body together with the application for construction. A radiological environmental impact ~~analysis~~assessment should be submitted at the ~~latest at the~~ same time. The safety related construction activities on the site cannot commence until a construction licence has been granted.-

3.73. ~~3.68.~~ The regulatory body should review the safety analysis report, and supporting documentation as necessary, to verify that the design requirements ~~as~~-established in the national regulations ~~are met~~ for the safe operation of the nuclear power plant and for preventing safety related incidents and accidents or for mitigating their consequences are met. The review of the safety analysis report ~~might~~will take ~~some~~ time, and ~~it~~the review schedule should be discussed and agreed ~~upon~~(to the extent possible) between the regulatory body and the operating organization ~~to the extent possible. The process of review and assessment is dealt with in other sections of this Safety Guide.~~

3.74. ~~3.69.~~ At this stage, a process should be specified by means of which the changes in design made during construction of the plant can be considered, with the involvement of the regulatory body, where

appropriate. The operating organization should establish a procedure to ensure the proper design, review, control and implementation of ~~all~~any permanent and temporary modifications, ~~if any~~. This procedure should be followed to ensure that the ~~plant's~~ design basis for the plant is maintained, that limits and conditions are observed, and that applicable codes and standards are met. These modifications should be taken into account in the safety analysis report.

ACTIONS 185—188: PREPARATION FOR COMMISSIONING

General

~~3.75. 3.70. Commissioning activities are beyond the scope of this Safety Guide, since~~ Phase 3 ends just before the beginning of commissioning tests; consequently, commissioning activities are beyond the scope of this Safety Guide. However, some activities in preparation for commissioning are conducted in Phase 3.

~~3.76. 3.71. At the end of Phase 3, the entire safety infrastructure necessary to operate the nuclear power plant should be in place in compliance with the relevant IAEA safety standards and national regulations.~~

~~3.77. IAEA Safety Guide~~Standards Series No. ~~NS-G-2.9, on SSG-28,~~ Commissioning for Nuclear Power Plants [~~5054~~], provides recommendations on all steps of the commissioning stage.

Phase 3

Phase 3

The following actions ~~are recommended to~~should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

—Requirement 25 of SSR-2/2 (Rev. 1) [18].

Action 185. The regulatory body should issue requirements on commissioning including the establishment of a severe accident management programme.

Action 186. The operating organization should establish a comprehensive commissioning programme, should prepare the corresponding chapter of the safety analysis report, as appropriate, and should ensure that there are a sufficient number of competent operating staff to be involved in commissioning activities.

Action 187. The operating organization should establish mechanisms for the transfer of responsibilities for safety with the constructor at the end of Phase 3.

Action 188. The regulatory body should review and assess the commissioning programme, should verify compliance with requirements and should prepare a programme to oversee the commissioning of systems important to safety in the next phase.

3.78. 3.72. The regulatory body should establish requirements concerning commissioning, which may/might include the establishment of hold points beyond which the operating organization may not/cannot proceed without the approval of the regulatory body, such as:

- Overall cold and hot hydraulic system performance tests;
- Fuel loading;
- First criticality and zero power tests;
- Power tests on different levels;
- Trial operation;—
- Commercial operation.

3.79. 3.73. The operating organization should develop a commissioning programme so as to provide evidence that the plant as ~~constructed~~built meets the design intent and complies with ~~the~~ safety requirements. Operating procedures should be validated to the extent practicable as part of the commissioning programme, with the participation of the ~~future~~ operating personnel. Active tests of the nuclear power plant. The operating personnel should be trained through participation in the operating organization's systematic training programme and by being present on site during the construction phase.

3.80. Commissioning includes both non-nuclear and nuclear tests. Nuclear tests are performed with nuclear fuel in the core, and ~~the test should~~ consist of fuel loading tests, first criticality tests, zero power level tests, power escalation tests at different power levels and trial operation.

3.81. 3.74. ~~The operating organization, because~~Because of its responsibilities in the subsequent operating phase of the plant, the operating organization should verify that the commissioning programme checks as exhaustively as possible the characteristics of the plant. as exhaustively as possible. In particular, the commissioning programme should ~~do the following:~~

- Confirm that the plant as built is consistent with the provisions of the safety analysis report, and record baseline data — to be used later as reference data — on the performance of structures, systems and components ~~to be used later as reference data;~~
- Ensure that the plant meets the requirements of the regulatory body;
- Demonstrate the validity of the operating instructions and procedures, and provide an opportunity for the operating personnel to

learn operating skills and to acquire experience in the plant's response to control commands;

— Supply the information and data necessary to verify the adequate implementation of the integrated management programmessystem.

3.82. 3.75. Even if commissioning activities are performed by the supplier or other groups, the operating organization should make the necessary arrangements to participate in review and approve these activities at all stages, since the responsibility for safety rests with the operating organization.

3.83. 3.76. The operating organization should establish mechanisms to transfer the ownership of the plant systems from the vendor.

3.84. The operational phase of the plant is generally considered to commence when fuel is initially loaded into the reactor. This phase will overlap with activities for the commissioning of the plant. All essential elements for the safe operation of the nuclear power plant should be in place prior to initial fuel loading. These essential elements will consist of many factors, both organizational and technical, as considered in the IAEA Safety Requirements publication SSR-2/2 [17(Rev. 1) [18].

3.85. 3.77. Specific approvalauthorization by the regulatory body should be requirednecessary before the start of normal operation. Such approvalauthorization should be granted on the basis of an appropriate safety analysis report and the results of the commissioning programme.

ACTIONS 189–192: TRANSPORT SAFETY

General

3.86. 3.78. The implementation of a nuclear power programme

~~necessitates transporting~~ involves the transport of radioactive material with specific characteristics, which ~~may require~~ might necessitate amending or complementing the existing national framework for safety in transport. This radioactive material will include fresh and used nuclear fuel and, depending on the national strategy for radioactive waste management, the transport of other radioactive waste may increase significantly.

~~3.87. 3.79.~~ The ~~safety-safe transport~~ of radioactive material ~~transport~~ is principally assured through a graded approach, including elements of design, testing and review of the transport package, ~~as established in SSR-6 (Rev. 1) [28].~~ The graded approach to the transport ~~requirements of~~ radioactive material is ~~established~~ based on the type and quantity of radioactive material to be shipped. Fresh nuclear fuel has a ~~very~~ low level of radioactivity, and the main technical means for ensuring its safe transport should be the design of a transport package that controls the risk of ~~nuclear~~ criticality through its structural and containment features. Depending on the type of transport package to be used and the national requirements for fresh fuel shipment, additional testing and regulatory reviews ~~may~~ could be required.

~~3.80.~~ Spent fuel, in contrast, is highly radioactive, and the main technical means for protection against hazards during its transport ~~should be~~ are the design, testing and review of a transport ~~package that contains the fuel in a certified~~ package that has been type tested in all credible accident conditions and has been shown to maintain its integrity and leak-tightness. Another important safety measure is the control of external radiation levels of the transport package. The ~~possibility~~ risk of nuclear criticality and damage caused by heat ~~and other hazardous conditions~~ should also be taken into consideration.

~~3.88. 3.81.~~ As for all nuclear-related activities, the ~~The~~ transport of certain radioactive material requires a prior approval of the package design and, depending on the material to be shipped, approval of the shipment by a

competent authority.

3.89. ~~3.82.~~ Unlike the situation in a stationary facility, the environment of radioactive material being transported is subject to change, and this should be taken into account in planning the shipment, and in the respective emergency plans.

3.83. ~~ASSR-6 (Rev. 1) [28] establishes a comprehensive corpusset of regulations is established in the IAEA Safety Requirements publication TS-R-1 on Regulations for the Safe Transport of Radioactive Material (the Transport Regulations) [32]. A well structured legal system should incorporate these rules.~~

3.90. ~~3.84.~~ An adequate legal framework should be established to implement international regulations for the safe transport of dangerous goods, radioactive material, and these should be incorporated into the national regulatory framework.

3.91. Different modes of transport (by road, rail, sea, air) have their own international or regional regulations for the transport of dangerous goods (including radioactive material), as issued by the respective transport organizations. ~~The Transport Regulations [32]~~ An adequate legal framework should be established to implement international regulations for the transport of dangerous goods. The provisions of SSR-6 (Rev. 1) [28] are implemented through incorporation into these instruments regulations.

Phase 1

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~—~~ Requirement 7 of GSR Part 1 (Rev. 1) [5];

~~—~~ Requirement 2 of GSR Part 3 [8];

~~—~~ Requirements The provisions of TS-R-1 [32] SSR-6 (Rev. 1) [28] as a

whole.

Action 189. The government should consider the implications for the legal and regulatory framework of the transport of nuclear fuel and radioactive waste, ~~over and above~~ in addition to the existing transport of other radioactive material.

3.92. 3.85. Activities involving radioactive sources (for example, at research reactors, or in industrial or medical applications of radiation) that require the establishment of regulations in respect of the transport of radioactive material will already be being carried out in most States. In most States there will be regulations in place that cover not only the materials currently being transported, but also all materials relevant to a nuclear power programme, (and for which international conventions apply (in respect of transport by air and by sea, and for some States also by land). There)). In such States, there may also be a regulatory body in charge of the oversight of safety in the transport of nuclear material. ~~However, the regulatory system may not be in active use in some areas in States without a nuclear power programme.~~

3.93. 3.86. ~~The~~ IAEA Safety ~~Guide on~~ Standards Series No. SSG-33, Schedules of Provisions of the IAEA Regulations for the Safe Transport of Radioactive Material (20052012 Edition) [~~51]~~ sets out55], presents the different schedules by provisions for the safe transport of radioactive material according to the assigned UN number. There are essentially two sets of UN numbers; one set (for fissile material) ~~relates closely~~ is especially relevant to the conduct of a nuclear power programme. The different UN numbers for fissile and non-fissile material indicate that additional controls are required in the transport of fissile material. The regulatory body should be competent in ensuring that the appropriate

controls are in place. The transport of spent nuclear fuel is an especially demanding task that is likely to require new types of arrangements to be made.-

3.94. 3.87. While a nuclear power programme will typically result in a small percentage increase in the number of shipments of radioactive material, it will increase by several orders of magnitude the total quantity of radioactive material transported. The degree of protection afforded by that is necessary for this small number of additional packages should be significantly higher than that afforded by for the majority of packages being transported.

3.95. 3.88. A crucial aspect to To prepare for the transport of radioactive material is to ensure from the nuclear power programme, it should be ensured that new regulators regulatory bodies /are cognizant of familiar with the existing regulatory regimes framework.

3.96. 3.89. The key functions of a regulatory body in relation to the transport of radioactive material are set out in the IAEA Safety Guide on Standards Series No. TS-G-1.5. Compliance Assurance for the Safe Transport of Radioactive Material [52]. An important part of information gathering is to examine each 56]. Each of these functions should be examined and to assess the available resources and skills available. It may be that some to fulfil these functions are should be assessed. Some functions might be initially carried out in other States, but: however, the regulatory body for transport of radioactive material in a State with a nuclear power programme should develop domestic competence in all areas. The following paragraphs provide a summary of the issues in each area:

— Design assessment. In many cases, this function will be limited in terms of scope and resources (or may might not exist at all) until a

nuclear power programme is established.

— *Witnessing of testing.* The level of testing in relation to the transport of radioactive material in a nuclear power programme is significantly different from that for the majority of shipments of radioactive material. The testing ~~may~~^{might} involve skills that are not available in the regulatory body if there is no nuclear power programme.

— *Witnessing of manufacture.* It is possible that ~~many~~^{the} regulatory ~~bodies~~^{body} for the transport of radioactive material ~~do~~^{does} not need to witness any manufacturing until a nuclear power programme is established. Although it is the responsibility of the packaging owner to witness manufacturing, the regulatory body should ~~also~~^{periodically} witness the manufacture of packaging ~~from time to time~~ as a part of compliance assurance.

— *Examination of maintenance and servicing arrangements.* The complexity of packages, types of material, hostile environments and length of operating lifetime of components all introduce issues ~~peculiar~~^{that are specific} to the transport of radioactive material in a nuclear power programme. In some cases, packages used in a State will be serviced and maintained in another State until a nuclear power programme decision is made.

— *Monitoring of transport operations.* Since the number of shipments remains reasonably constant, the monitoring of transport operations is unlikely to be of concern, either in terms of competence or in terms of resources.

— *Enforcement actions and investigation of incidents.* Most States will have adequate capabilities in this area.

— *Interdepartmental liaison and/or cooperation.* The key issue with

regard to interdepartmental liaison and/or cooperation is that any new regulatory body that is proposed should fit into the existing regulatory framework without any overlaps or gaps.

— *Issuing of approvals.* The issuing of approvals ~~may~~might be a new process for the regulatory body. The approval system may be modelled on other industries within the country (for example, aircraft certification) or other systems ~~in Member States~~identified through networking and interactions with other ~~Member~~Member States.

— *Regulatory review and maintenance of an effective legal framework.* ~~While some new legislation may be required, the~~The area of regulatory review and maintenance of an effective legal framework ~~may~~might increase resource requirements, but the necessary skills should be available in one of the existing regulatory bodies. Some new legislation might be necessary.

— *~~Training~~Staff training and distribution of information.* ~~Training~~Staff training and the distribution of information on how the regulatory body works are likely to be among the first requirements in Phase 3. An advantage of globally harmonized regulations for the transport of radioactive material is that information and training can be imported from other States and adapted as necessary.

— *Emergency planning and exercises.* Since the quantity of radioactive material being transported will increase considerably, there should be effective planning for an emergency response. ~~Up~~Prior to ~~this point~~a nuclear power programme, in most cases the radioactive material being transported is most likely to pose a secondary risk in ~~any~~a serious transport accident. However, with the development of a nuclear power programme, there ~~may~~could be cases in which the radioactive material could give rise to the primary risk

in an accident. This could have wide ranging implications, depending on the national infrastructure and arrangements for ~~an~~ emergency preparedness and response.

- Audits of management systems. Most States will have adequate capability in the area of audits of management systems.

Phase 2

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirement 7 of GSR Part 1 (Rev. 1) [5];
- Requirement 2 of GSR Part 3 [8];
- ~~Requirements~~ Requirement 2 of TS-R-1 [32] GSR Part 7 [10];
- The provisions of SSR-6 (Rev. 1) [28] as a whole.

Action 190. All relevant organizations should makeprepare a plan on how to meet the relevant international safety requirements and should start to fill the gaps identified in Phase 1.

Action 191. The regulatory body and the organizations in charge of the transport of radioactive material should participate in international activities and networks to provide mutual support.

3.97. 3.90. Arrangements The arrangements for the transport of fresh fuel and spent fuel should be assessed. The possible routes and modes of fuel transport should be tentatively identified on the basis of this assessment (including the assessment of security). The feasibility of the plans should be evaluated, with account taken of the access routes to the nuclear power plant site, and the points of entry to and exit from the State.

~~3.98. 3.91.~~ An evaluation should also be made of the expected needs for the transport of low level and intermediate level radioactive waste generated during plant operation. This applies if a national ~~interim~~ storage or disposal site is under consideration, as opposed to the ~~disposal~~ storage of radioactive waste in a location on the nuclear power plant site.-

~~3.99. 3.92. As a consequence of~~ Due to the internationally harmonized requirements for the transport of radioactive material, it should be possible to obtain assistance from another State. There are several international groupings or associations of regulatory bodies for the transport of radioactive material ~~which~~ that can offer mutual support. The regulatory body should consider joining such a grouping or association ~~at this stage~~.

Phase 3

The following actions ~~are recommended to~~ should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~—~~ Requirement 7 of GSR Part 1 (Rev. 1) [5];
- ~~—~~ Requirement 2 of GSR Part 3 [8];
- ~~— Requirements~~ Requirement 2 of ~~TS-R-1~~ [32] GSR Part 7 [10];
- ~~— The provisions of SSR-6 (Rev. 1) [28]~~ as a whole.
- ~~—~~

Action 192. The regulatory body and the organizations in charge of the transport of radioactive material should fully implement the changes to the national requirements and arrangements for the transport of radioactive material in accordance with the plan developed in Phase 2.

~~3.100. 3.93.~~ The first transport of radioactive material to be conducted as part of the new nuclear power programme will be the transport of fresh

nuclear fuel to the nuclear power plant site. Requirements for such transport should be ~~in place and implemented~~established before planning the transport. While other types of transport are not expected to take place during Phase 3, it is ~~often a requirement~~expected that operating organizations of nuclear power plants should have contingency plans in place for the transport of radioactive material from nuclear power plants prior to their operation. As a result, the transport of all radioactive material should be considered by the regulatory body during Phase 3, even though such transport may not start until some years later.

ACTIONS 193–~~200~~197: INTERFACES WITH NUCLEAR SECURITY

General

~~3.101.3.94. The IAEA Fundamental Safety Principles [Paragraph 1} state.~~10 of SF-1 [1] states that ~~“safety:~~

“Safety measures and security measures have in common the aim of protecting human life and health and the environment” ~~and that~~
~~“safety....~~ Safety measures and security measures must be designed and implemented in an integrated manner so that security measures do not compromise safety and safety measures do not compromise security”~~“.~~”

~~3.95.~~ This section ~~concerns~~refers to the interfaces between safety aspects and nuclear security aspects, that are to be taken into account in the development ~~process~~ of a nuclear power programme. ~~The relevant~~

3.102. Relevant guidance with regard to the establishment of a nuclear security regime is provided in the IAEA Nuclear Security Series.

~~Implementing Guides are available~~ Specific guidance is provided in the IAEA Nuclear Security Series ~~[53, 54]~~ No. 19, Establishing the Nuclear Security Infrastructure for a Nuclear Power Programme [57].

~~3.103. 3.96. The fields covered by safety~~ Safety and by security, respectively, ~~are partially distinct, but safety and nuclear~~ security have a common purpose — to protect people and the environment from harmful effects of ionizing radiation, including those effects arising from a nuclear security event — and are therefore complementary. Incidents give rise to risks, whether the initiating event for a given radioactive release follows a natural event, an equipment failure or a ~~malicious act. Security covers prevention with regard to theft of nuclear material, as well as prevention of any risk of sabotage of nuclear facilities or radioactive material. With regard to the risk of theft of nuclear materials, control measures and accountability of nuclear material developed either at the national level or within the framework of international controls (safeguards) are also a specific part of security.~~ nuclear security event. Nuclear security is concerned with the prevention of, detection of, and response to, criminal or intentional unauthorized acts involving or directed at nuclear and other radioactive material, associated facilities and associated activities (see IAEA Nuclear Security Series No. 20, Objective and Essential Elements of a State's Nuclear Security Regime [58]).

~~3.104. 3.97. Nuclear security and safety infrastructures should be built during~~ During each phase of the development process of a nuclear power programme. ~~They, nuclear security and safety infrastructures~~ should be developed, as far as possible, in a ~~well~~ coordinated manner.-

~~3.105. 3.98.~~ All organizations involved in a nuclear power programme should be made aware of the commonalities and differences between safety

and nuclear security to be able to factor both into development plans. The ~~synergies~~interfaces between safety and nuclear security have to be ~~developed~~recognized and ~~encouraged~~; safety and nuclear security ~~have to complement~~infrastructures should be developed in a manner that complements and ~~enhance one another~~enhances both disciplines.

Phase 1

The following actions should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirement 12 of GSR Part 1 (Rev. 1) [5];
- Requirement 6 of GSR Part 2 [17].

Action 193. The government should foster both safety culture and nuclear security culture, taking into account their commonalities and differences.

3.106. A safety culture and a nuclear security culture that govern the attitudes and behaviour of individuals should be developed and fostered within the management system.

3.107. Safety culture and nuclear security culture are recommended based on similar concepts. However, there are also some concepts that are unique to nuclear security culture, such as trustworthiness and confidentiality (see IAEA Nuclear Security Series No. 7, Nuclear Security Culture [59]).

Phase 2

The following actions should be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

- Requirement 12 of GSR Part 1 (Rev. 1) [5];—

Requirement ~~2.1 of GSR 3~~ [16].

Action 193. ~~The government should foster both safety culture and security culture, taking into account their commonalities and differences.~~

~~3.99. A safety culture and a security culture that govern the attitudes and behaviour of individuals should be developed within the management system.~~

~~3.100. Safety culture and security culture are based on similar notions. However, there are also some notions that are unique to security culture, such as deterrence and confidentiality. Furthermore, with regard to the sharing of responsibility and the confidentiality of information, the development of a security culture will involve major participation of the government. The involvement of several competent authorities in security matters imposes a certain number of structures and communication and information exchange systems so that the organizations involved understand and complement each other.~~

Phase 2

The following actions are recommended to be completed in this phase as a step towards the full implementation of all relevant IAEA Safety Requirements:

~~— Requirement 126 of GSR Part 4 [52 [17];~~

~~— Requirement 2.1 of GS-R-3 [16]; Requirement 5 of GSR Part 5 [9];~~

~~— Requirement 2 and 23 of GSR Part 7 [10];~~

~~— Requirement 8 of SSR-2/1 (Rev. 1) [29];~~

~~— Requirement 5.1617 of GS-RSSR-2 [26]/2 (Rev. 1) [18]~~

Action 194. All the relevant organizations should coordinate safety and nuclear security aspects from the early stages of development, establishing maximum synergy and, where necessary, integration.

Action 195. ~~The government should define the responsibilities of the operating organization and other competent authorities in relation to security.~~

Action 196. ~~The government should develop mechanisms to communicate to the public appropriate information regarding safety~~

and nuclear security.

~~3.101. The State should take appropriate steps within the governmental, legal and regulatory framework to establish and ensure the proper implementation of the State's nuclear security regime, including the assignment of regulatory tasks to one or more competent authorities. The government should ensure effective overall cooperation and relevant information sharing between the competent authorities and other parts of the government responsible for security matters. This should include sharing of the relevant information in accordance with national arrangements.~~

~~3.108. 3.102.~~ Relevant structures, systems and components and procedures should be examined with regard to both nuclear security and safety aspects so as to ensure that an optimal balance is achieved.-

~~3.109. 3.103.~~ A single regulatory body may be responsible for both safety and nuclear security, or the regulatory body may consist of separate competent authorities ~~owing to covering~~ the ~~different~~ areas ~~covered for of~~ safety and nuclear security. ~~For nuclear security, there could be specific structures and means of control of a different type.~~ A consultation and coordination mechanism is required between ~~the two~~these authorities to ensure ~~effective protection with regard to possible malicious acts and to manage that any potential conflicts in implementing different~~ regulatory requirements ~~that may be conflicting~~are avoided.

~~3.110. 3.104.~~ With respect to the degree to which nuclear safety and nuclear security are to be integrated, special attention should be paid to ~~differences in the government's degree of government involvement since.~~ Typically, a larger number of authorities are concerned with nuclear security than with safety. ~~Consequently; consequently,~~ there are more interfaces to deal with and a greater need for cooperation and coordination.

Phase 3

The following actions ~~are recommended to~~should be completed in this phase

as a step towards the full implementation of all relevant IAEA Safety Requirements:

- ~~— Requirement 12 of GSR Part 1 (Rev. 1) [5];~~
- ~~— Requirement 6 of GSR Part 2.1 of GS-R-3 [16]; — [17];~~
- ~~— Requirement 5 of GSR Part 5 [9]; —~~
- ~~— Requirement 5.162 and 23 of GS-R-2 [26]; GSR Part 7 [10]~~
- ~~— Requirement 8 of SSR-2/1 (Rev. 1) [29]~~
- ~~— Requirement 17 of SSR-2/2 (Rev. 1) [18].~~

Action ~~197~~195. The regulatory body (possibly consisting of several authorities) should ensure that nuclear security regulations do not compromise safety and that safety regulations do not compromise nuclear security.-

Action ~~196~~198. ~~The operating organization should prepare a physical protection programme and should submit it to the regulatory body as appropriate.~~

Action ~~199~~. All the relevant organizations should ensure that emergency preparedness and response plans in the fieldsfield of safety and contingency and response plans in the field of nuclear security are complementary, coherent and well-coordinated among all of the entities involved.

Action ~~200~~197. The operating organization and the regulatory body should continue to promote safety culture and nuclear security culture in their respective organizations.

~~3.105. The operating organization should provide a physical protection programme that prevents or deters unauthorized access, intrusion, theft, direct attack and internal or external sabotage of systems important to safety and nuclear materials. This programme should include clear plans and procedures to provide physical protection of the site by means of vehicle-~~

~~entrance and exit control, vehicle parking and traffic control and personnel access control.~~

~~3.111. 3.106.~~ Major decisions regarding safety enhancements and nuclear security enhancements require the consultation of each discipline ~~on a continuous basis~~. For example, enhancements such as barriers, locks and fences that are designed to improve physical ~~security may~~ protection could have the unintended consequence of delaying or preventing plant operators from taking actions to safely shut down and cool down the reactor. The arrangements for clear delineation of responsibilities with regard to safety aspects and nuclear security aspects should include coordination and communication processes as well as mechanisms for resolving potential conflicts between safety aspects and nuclear security aspects.

~~3.112. 3.107.~~ If safety and nuclear security regulatory bodies are separate, there should be consultation and coordination mechanisms between them.-

~~3.108. Both the operating organization and the competent authorities should develop plans as appropriate to limit the consequences of an accident.~~

■

Appendix

OVERVIEW OF ACTIONS TO BE TAKEN IN EACH PHASE FOR THE ESTABLISHMENT OF SAFETY INFRASTRUCTURE

PHASE 1-

	Responsible entities (main)				Actions to be taken to implement the IAEA Safety Requirements in Phase 1, and bases for these actions
Action No.	Government	Legislators	Regulatory body	Operating organization	
Implementing the IAEA General Safety Requirements for Safety Infrastructure					
1 — National policy and strategy for safety					
Basis	Requirement 1 of GSR Part 1; (Rev. 1) [5] Requirements 10 and 29 of GSR Part 3 [8] (revision Requirement 2 of BSS); GSR Part 5 [9] Requirement 2 of GSR Part 5-7 [10]				
-1					The government should consider the necessary elements of a national policy and strategy for safety to meet the fundamental safety objective and the safety principles established in the Fundamental Safety Principles (IAEA Safety Fundamentals) . SF-
-2					The government should provide for the coordination of all activities to establish the safety infrastructure.
-3					The government should ensure that the status of the safety infrastructure in relevant areas is assessed and that radiological radiation protection considerations are adequately taken into account.
-4					The government should take due account of the assessment of the elements of the safety infrastructure and of the fundamental principle of justification when making a decision on whether or not to introduce a nuclear power programme.
2 — Global nuclear safety regime					
Basis	Requirements 1, 14 , and 1436 of GSR Part 1; (Rev. 1) [5] Requirement 7 and 17 of GSR Part 7 [10]				
11					The government should prepare for participation in the global nuclear safety regime.
12					The government should begin a dialogue with neighbouring States regarding its projects for establishing a nuclear power

13				The government and relevant organizations, (if they already <u>such organizations</u> exist,) should establish contact with organizations in other States and international organizations to seek advice on safety related matters.
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3 — Legal framework

Basis	Requirements 1–4 of GSR Part 1; □ (Rev. 1) [5] Requirement 2 of GSR Part 3 [8] (revision of BSS); □ Requirement 1 of GSR Part 5; □ [9] <u>Requirement 4 of GSR Part 6 [19]</u> Requirements 3.32 and 3.420 of WS-R-5 <u>GSR Part 7 [10]</u>			
20				The government should identify all necessary elements of a legal framework for the safety infrastructure, and should plan how to structure it and develop it <u>this framework</u> .
21				The government should consider the process that should be employed to license nuclear facilities in the later stages of the programme.

4 — Regulatory framework

Basis	Requirements 1, 3, 4, 7 and 11 of GSR Part 1; □ (Rev. 1) [5] Requirements 2 and 3 of GSR Part 3 [8] (revision of BSS); □ Requirement 1 of GSR Part 5; □ [9]			
24				The government should recognize the need for an effectively independent and competent regulatory body, and should consider the appropriate position of the regulatory body in the State's governmental and legal framework for safety.
25				The government should seek advice from the regulatory body on radiation safety issues relating to a nuclear power programme.
26				The government should identify the prospective senior managers of the regulatory body.

5 — Transparency and openness

Basis	Requirements 1 and 36 of GSR Part 1; □ (Rev. 1) [5] Requirements 3.65 and 5.2612 of GS-R-3 <u>GSR Part 2 [17]</u> Requirement 1 of GSR Part 5; □ [9]			
39				The government should establish a policy and guidance to inform the public and <u>other</u> interested parties of the benefits and risks of nuclear power, to facilitate their involvement in the decision making <u>process</u> on a prospective nuclear power programme.
40				The government should establish a process to ensure that the comments arising from consultation with <u>relevant the public and other</u> interested parties are considered, and it should communicate about the results of these considerations to the interested parties.

6 — Funding and financing

Basis	Requirements 1, 3, 10 and 11 of GSR Part 1; □ (Rev. 1) [5] Requirement 4.19 of GS R 3 ; □ GSR Part 2 [17] Requirement 1 of GSR Part 5; □ Requirements 6.1–6.5 [9] Requirement 9 of WS R 5 ; □ GSR Part 6 [19] Requirement 2 of GSR Part 7 [10]			
48				<u>The government should plan funding for education and training, and for research centres and other national infrastructure, to support the safe operation of nuclear power plants including on-site and off-site emergency arrangements.</u>
49				<u>The government should require that the operating organization allocates the necessary financial resources to ensure the safety of its nuclear power plants until the end of their planned operating lifetime.</u>

48				<u>The government should plan funding for education and training, and for research centres and other national infrastructure, to support the safe operation of nuclear power plants.</u>
49				<u>The government should consider the long term economic conditions of nuclear power plant operation to ensure that the operating organization is able to ensure the safety of its nuclear power plants until the end of their planned operating lifetime.</u>

50				The government should consider the various possible sources for the funding of the regulatory body.
51				The government should consider the various possible sources and mechanisms of funding for radioactive waste management and spent fuel management, the decommissioning of nuclear power plants and the disposal of radioactive waste.

7 — External support organizations and contractors

Basis	Requirements 4, 11, 13 and 20 of GSR Part 1; □ (Rev. 1) [5] Requirements 3.14 and 5.23 of GS R 3 ; □ GSR Part 2 [17] Requirement 2 of GSR Part 3 [8]- (revision of BSS); □			
61				The government should consider the availability of expertise, industrial capability and technical services that could support the safety infrastructure in the long term.
62				The government should assess the need to create or to enhance national organizations to provide technical support to the regulatory body and the operating organization for the safe operation of nuclear power plants.

8 — Leadership and management for safety

Basis	Requirements 1 and 19 of GSR Part 1 [5] (Rev. 1) [5] GSR Part 2 as a whole [17] Requirement 5 of GSR Part 3 [8] (revision of BSS) Requirements		
72			The government should take into account the essential role of leadership and management for safety to achieve a high level of safety and to foster <u>a strong</u> safety culture within organizations.
73			The government should ensure that all the activities conducted are included within the framework of an effective <u>integrated</u> management system.
74			The government, when identifying senior managers for the prospective organizations to be established, should look for persons with leadership capabilities and an attitude <u>emphasizing that emphasizes</u> safety culture.
9 — Human resources development			
Basis	Requirements 1, 11 and 18 of GSR Part 1 (Rev. 1) [5] Requirement 9 of GSR Part 2 [17] <u>Requirement 2 of GSR Part 3 [8]</u> Requirement 21 and 25 of GSR Part 7 [10] Requirement 4 of SSR-2/2 (Rev. 1) [18]		
85			<u>The government should consider a strategy for attracting, recruiting, training and retaining an adequate number of experts to meet the needs of all organizations involved in ensuring safety in a prospective nuclear power programme.</u>
86			<u>The government should identify competences required in areas relating to nuclear safety and the approximate number of experts needed.</u>
87			<u>The government should identify national institutions and institutions in other States that could provide education and training and could start training in key areas relating to nuclear safety.</u>
88			<u>The government should identify gaps in safety related training at existing training institutions and should plan to strengthen existing training institutions or to establish new training institutions to fill these gaps.</u>
89			<u>The government should ensure that prospective senior regulators identified by the government and prospective safety experts to be involved in the nuclear power programme gain an understanding of the principles and criteria of nuclear safety.</u>

Basis	Requirements 1, 11 and 18 of GSR Part 1;□ Requirements 4.1, 4.3 and 4.5 of GS-R-3;□ Requirement 2 of GSR Part 3 [8] (revision of BSS);□ Requirement 4 of SSR 2/2.-			
-85				The government should consider a strategy for attracting, training and retaining an adequate number of experts to meet the needs of all organizations involved in ensuring safety in a prospective nuclear power programme.
-86				The government should identify competences required in areas relating to nuclear safety and the approximate number of experts needed.
-87				The government should identify national institutions and institutions in other States that could provide education and training and could start training in key areas relating to nuclear safety.
-88				The government should identify gaps in safety related training at existing training institutions and should plan to strengthen existing training institutions or to establish new training institutions to fill these gaps.
-89				The government should ensure that prospective senior regulators identified by the government and prospective safety experts to be involved in the nuclear power programme gain an understanding of the principles and criteria of nuclear safety.

10 — Research for safety and regulatory purposes

Basis	Requirements 1 and 11 of GSR Part 1- (Rev. 1) [5],			
-99				The government should consider in which areas <u>in-depth</u> knowledge in depth is necessary for assessing and analysing safety related aspects of a nuclear power plant project, and should identify research centres that can start research programmes in safety related areas of knowledge.
100				The government should identify <u>gaps in</u> the capabilities of domestic research centres to meet needs in core <u>key</u> areas, and should plan to establish new research centres for core <u>such</u> areas as necessary.

11 — Radiation protection

Basis	Requirement 7 of GSR Part 1;□ (Rev. 1) [5], Requirements 2 and 43 of GSR Part 3 [8] (revision of BSS);□ <u>Requirements</u>			
105				The government should consider the additional radiation risks and <u>special</u> needs associated with the operation of nuclear power plants.

106			The government should ensure that an initial radiological environmental impact analysis assessment is conducted, as appropriate, on the basis of a defined set of criteria, at a regional scale and with the use of available data.
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107			The government should recognize the need for integrating radiation protection regulations and new safety regulations for nuclear power plants.
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12 — Safety assessment

Basis Requirements 5, 6 and 8 of GSR Part 4; (Rev. 1) [39]

117			The government should familiarize itself with the IAEA safety standards and with other States' practices in other States, as appropriate, to gain an understanding of the resources needed for capabilities for safety assessment.
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13 — Safety of radioactive waste management; ~~spent fuel management and decommissioning~~

Basis Requirements 7 and 10 of GSR Part 1; ~~;~~
(Rev. 1) [5] Requirement 2 of GSR Part 3 [8];
(~~revision of BSS~~); ~~;~~
Requirements 1 and 2 of GSR Part 5; ~~;~~ [9]
~~Requirements 2.1, 2.1.2, 4.5 and 9 of GSR Part 6.1, 6.5 of~~

122			The government should recognize the long term nature of the safety requirements for, and the cost implications of, radioactive waste management (including disposal of waste), spent fuel management and decommissioning.
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123			The government should consider the feasible options for radioactive waste management (including disposal of waste); ; spent fuel management and decommissioning, on the basis ; of a comprehensive long term strategy.
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14 — Emergency preparedness and response

Basis Requirements 7 and 8 of GSR Part 1; ~~;~~ (Rev. 1) [5]
Requirement 43 of GSR Part 3 [8] (~~revision~~
Requirements 1 and 2 of BSS); ~~;~~ Requirement 2.1–2.6 of GS-
R-2; GSR Part 7 [10]

133			The government should develop awareness of the need for the early establishment of emergency plans.
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134			The government should identify institutions response organizations and new arrangements for supporting emergency
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Implementing the IAEA Specific Safety Requirements for Safety Infrastructure

15 — Operating organization

Basis Principles Requirements 5, 6 and 11 of GSR Part 1; ~~;~~ (Rev. 1) [5]
Requirement 4 of GSR Part 3 [8] (~~revision of BSS~~); ~~;~~

146				If the operating organization has already been established or identified in Phase 1 (which is not the scenario developed in this Safety Guide, in which the operating organization is established at the beginning of Phase 2), it should be involved together with the government in activities for the development of the safety infrastructure from the beginning.
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147				The government should consider the financial resources and the necessary competences and staffing that are expected from an organization operating a nuclear power plant so as to ensure long term safety.
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148				The government should consider the different ways of establishing an operating organization so as to ensure long term safety.
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16 — Site survey, and site selection and evaluation

Basis	Requirement 31 of GSR Part 3 [8] (revision of BSS); Paragraphs 2.1–2.29, 3.1–3.55, 4.1–4.15; and 6.1–6.9 of NS-R-3- (Rev. 1) [27]			
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160				The government should ensure that potential sites are identified and candidate sites are selected on the basis of a set of defined criteria, at a regional scale and with the use of available data.
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17 — Design safety

Basis	SSR-2/1 (Rev. 1), as a whole [33]			
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170				The government should learn/understand the objectives for nuclear safety, and how they are taken into account in nuclear power plants of various designs.
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171				The government should consider the availability of the technical infrastructure as well as the reliability of the national power grid, and should consider the potential impacts of these on the design requirements for the safety of the nuclear power plant.
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18 — Preparation for commissioning

				No action in Phase 1.
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19 — Transport safety

Basis	Requirement 7 of GSR Part 1; (Rev. 1) [5] Requirement 2 of GSR Part 3 [8] (revision of BSS); TS-R-1			
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189				The government should consider the implications for the legal and regulatory framework of the transport of nuclear fuel and radioactive waste, over and above in addition to the existing transport of other radioactive material.
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20 — Interfaces with nuclear security

193				The government should foster both safety culture and security culture, taking into account their commonalities and differences.
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PHASE 2

		Responsible entities (main)		Actions to be taken to implement the IAEA safety standards in Phase 2, and bases for these actions
Action No.	Government-legislators	Regulatory body	Operating organization	
Implementing the IAEA General Safety Requirements for the Safety Infrastructure				
1 — National policy and strategy for safety				
Basis	Requirement 1 of GSR Part 1; □ (Rev. 1) [5] Requirements 10 and 29 of GSR Part 3 [8] (revision); <u>Requirement 2 of BSS;□GSR Part 5 [9]</u> Requirement 2 of GSR Part 5-7 [10]			
-5				The government should establish a clear national policy and strategy for meeting safety requirements in order to achieve the fundamental safety objective and to apply the fundamental safety principles established in the IAEA's Fundamental Safety Principles [1]. <u>SF-1 [1]</u> .
-6				The government should establish a policy for knowledge transfer □ for ensuring safety by means of contracts and agreements with organizations in other States that may be involved in the nuclear power programme.
-7				The government should ensure identification of responsibilities and their progressive allocation to the relevant organizations involved in the development of the safety infrastructure.
-8				The government should ensure that all the necessary organizations and other elements of the safety infrastructure are developed efficiently and that their development is adequately coordinated.
2 — Global nuclear safety regime				
Basis	Requirements 1 and 14 of GSR Part 1; □ (Rev. 1) [5] Requirement 6-3-6.6 <u>13</u> of GS R-3 <u>GSR Part 2</u> [17] <u>Requirement 7 and 17 of GSR Part 7 [10]</u> <u>Requirement 24 of SSR 2/2 (Rev. 1) [18]</u>			
14				All the relevant organizations should participate in the global nuclear safety <u>framework regime</u> .

16				All relevant organizations should strengthen their cooperation on safety related matters with States with advanced nuclear power programmes.
3 — Legal framework				
Basis	Requirements 1–4 of GSR Part 1 (Rev. 1) [5] Requirement 2 of GSR Part 3 [8] Requirement 1 of GSR Part 5 [9] Requirement 4 of GSR Part 6 [19] Requirements 2 and 20 of GSR Part 7 [10]			
22				The government should enact and implement the essential elements of the legal framework for the safety infrastructure.
4 — Regulatory framework				
Basis	Requirements 1, 3, 4, 7, 11, 15–19, 21– 26, 30 and 32 of GSR Part 1 (Rev. 1) [5] Requirement 3 of GSR Part 2 [17] Requirements 2 and 3 of GSR Part 3 [8] Requirements 1 and 3 of GSR Part 5 [9] Requirements 5 of GSR Part 6 [19] Requirement 2 of GSR Part 7 [10]			
27				The government should establish an effectively independent regulatory body that has adequate legal authority, technical and managerial competence, and human and financial resources to discharge its responsibilities in the nuclear power programme.
28				The government should appoint senior managers and key experts to the regulatory body and should assign to them the responsibility for developing the organization.
29				The regulatory body should consider the various regulatory approaches that are applied for nuclear power programmes of the same size, and should decide its approach, taking into account the State’s legal and industrial practices and the guidance provided in IAEA safety standards.
30				The regulatory body should establish a process to issue regulations and guides specifying the documentation and procedures necessary in the various steps of the licensing process and inspections to be conducted.
31				The regulatory body should develop and issue those safety regulations that are needed for the bidding process or contract negotiations.
32				The regulatory body should begin establishing a suitable working relationship with the operating organization and with other relevant national and international organizations.
5 — Transparency and openness				

<u>Basis</u>	Requirements 1, 21, 34 and 36 of GSR Part 1 (Rev. 1) [5] Requirements 5 and 14 of GSR Part 2 [17] Requirement 3 of GSR Part 3[8] Requirements 1 and 3 of GSR Part 5 [9] Requirements 10 and 13 of GSR Part 7 [10] Requirement 2 of SSRS-2/2 (Rev. 1)[18]		
<u>41</u>			The government should inform the public and interested parties regarding the safety implications of the decision on the implementation of a nuclear power programme.
<u>42</u>			All the relevant organizations should continue to inform the public and interested parties on safety issues, including the expected health and environmental impacts of a nuclear power programme.
<u>6 — Funding and financing</u>			
<u>Basis</u>	Requirements 1, 3, 10 and 11 of GSR Part 1 (Rev. 1) [5] Requirement 9 of GSR Part 2 [17] Requirement 1 of GSR Part 5[9] Requirement 9 of GSR Part 6 [19] Requirement 2 of GSR Part 7 [10] Requirements 1, 3 and 4 of SSR-2/2 (Rev. 1) [18]		
<u>52</u>			The government should make provision for long term funding for education and training, and for research centres and other national infrastructure to support the safe operation of nuclear power plants including on-site and off-site emergency arrangements.
<u>53</u>			The government should decide on the mechanism for sustainable funding of the regulatory body.
<u>54</u>			The operating organization should establish a policy for ensuring adequate funding so as not to compromise safety at any stage of the nuclear power programme.
<u>55</u>			The government should enact legislation that requires financial provision for the funding of long term radioactive waste management, spent fuel management and decommissioning.
<u>7 — External support organizations and contractors</u>			
<u>Basis</u>	Requirements 4, 11, 13, 17 and 20 of GSR Part 1 (Rev. 1) [5] Requirements 3 and 11 of GSR Part 2 [17] Requirements 2 and 3 of GSR Part 3 [8] Requirements 3 and 31 of SSR-2/2 (Rev. 1) [18]		
<u>63</u>			The operating organization and the government should encourage industrial organizations in the State to develop their capabilities

64				The government, and the operating organization, if applicable, should establish organizations to provide expertise and engineering support or other external support for regulatory oversight and for the safe operation of nuclear power plants, as identified in Phase 1.
65				External support organizations and potential contractors should begin to build competence and quality management systems for ensuring safety.
66				The regulatory body and the operating organization should plan arrangements for overseeing the activities performed by their respective external support organizations and contractors.
8 — Leadership and management for safety				
Basis	Requirements 1, 19 and 35 of GSR Part 1 (Rev. 1) [5] GSR Part 2 [17] as a whole Requirement 5 of GSR Part 3 [8] Requirement 7 of GSR Part 5 [9] Paragraphs 6.1–6.9 of NS-R-3 (Rev. 1) [27] Requirement 2 of SSR-2/2 (Rev. 1) [18] Paragraph 306 of SSR-6 (Rev. 1) [28]			
75				The regulatory body and the operating organization should start developing and implementing effective integrated management systems in their respective organizations and should promote a strong safety culture.
76				The regulatory body and the operating organization should develop competences in managing the growth of and change in the organization.
77				The regulatory body and the operating organization should make appropriate arrangements for measurement, assessment (both self-assessment and independent assessment) and continuous improvement of their integrated management systems.
9 — Human resources development				
Basis	Requirements 1, 11 and 18 of GSR Part 1 (Rev. 1) [5] Requirement 9 of GSR Part 2 [17] Requirements 2–4 and 26 of GSR Part 3 [8] Requirements 21 and 25 of GSR Part 7 [10] Requirements 4 and 7 of SSR-2/2 (Rev. 1) [18] Paragraphs 311–315 of SSR-6 (Rev. 1) [28]			
90				All relevant organizations should implement a strategy to attract and retain high quality trained personnel.
91				All relevant organizations should support the safety related training of prospective nuclear staff in nuclear organizations in other States

<u>92</u>				<u>The regulatory body and the operating organization should actively recruit staff so as to ensure capability in areas relevant to safety in a timely manner.</u>
<u>93</u>				<u>The government and relevant organizations should establish new institutes or new curricula relevant to safety, as identified in Phase 1.</u>
<u>94</u>				<u>All relevant organizations should commence the education and training in academic and vocational institutions of the necessary number of persons for ensuring safety.</u>

10 — Research for safety and regulatory purposes

Basis [Requirements 1 and 11 of GSR Part 1 \(Rev. 1\) \[5\]](#)
[Requirement 3 of GSR Part 5 \[9\]](#)

<u>101</u>				<u>The operating organization and the regulatory body should be involved in identifying areas for safety research.</u>
<u>102</u>				<u>The government should implement plans to establish new institutions for research relating to safety, as necessary.</u>
<u>103</u>				<u>Research centres should begin conducting research relating to safety in areas in which in-depth knowledge is essential to support safe long term operation of nuclear power plants.</u>

11 — Radiation protection

Basis [Requirement 7 of GSR Part 1 \(Rev. 1\) \[5\]](#)
[Requirements 1–4, 6–16, 18–32 and Schedule III of GSR Part 3 \[8\]](#)
[Paragraphs 4.1–4.15 of NS-R-3 \(Rev. 1\) \[27\]](#)
[Requirements 78 and 79 of SSR/2/1 \(Rev. 1\) \[29\]](#)
[Paragraphs 301–303 of SSR-6 \(Rev. 1\) \[28\]](#)

<u>108</u>				<u>The regulatory body and/or the government should amend the legislation and/or regulations, as appropriate, for the purposes of regulating radiation protection to include specific aspects of the nuclear power programme.</u>
<u>109</u>				<u>The regulatory body should establish or approve, as appropriate, the limits and constraints regarding workers and the public both for normal operation and for potential exposures in a nuclear power plant.</u>
<u>110</u>				<u>The operating organization should update the radiological environmental impact assessment for the site selected, as appropriate.</u>
<u>111</u>				<u>The regulatory body should review and assess the radiological environmental impact assessment for the site selected, as appropriate.</u>

113				The operating organization should use all appropriate safety principles and requirements and regulatory requirements with regard to radiation protection in preparing the bid specifications or contract negotiations for the nuclear power plant.
12 — Safety assessment				
Basis	Requirements 24–26 of GSR Part 1 (Rev. 1) [5] Requirement 13 of GSR Part 3 [8] Requirements 1–6, 8, 14–16 of GSR Part 4 (Rev. 1) [39]			
118				The operating organization, the regulatory body and external support organizations, as appropriate, should start to develop the expertise to conduct or review the safety assessments.
13 — Safety of radioactive waste management, spent fuel management and decommissioning				
Basis	Requirements 7 and 10 of GSR Part 1 (Rev. 1) [5] Requirements 2 and 31 of GSR Part 3 [8] Requirements 1–12 and 17 of GSR Part 5 [9] Requirements 1, 4–6, 8 and 9 of GSR Part 6 [19] Requirement 15 of GSR Part 7 [10] Requirements 35, 36 and 38 of SSR-2/1 (Rev. 1) [29] Requirement 22 of SSR-2/2 (Rev. 1) [18]			
124				The government and other interested parties, as appropriate, should establish the national policy and strategy for radioactive waste management, spent fuel management and decommissioning, and should set the goals for its implementation to an appropriate schedule, including site investigations for the purposes of radioactive waste disposal.
125				The government, together with the operating organization, should consider the need for establishing a national organization responsible for radioactive waste management, or for extending the organization for radioactive waste management, if this already exists in the State.
126				The regulatory body should establish the necessary regulatory requirements on radioactive waste management, spent fuel management and decommissioning, as necessary for bid specifications or contract negotiations.
127				The operating organization should consider the arrangements that are necessary for ensuring the safety of radioactive waste management, the safety of spent fuel management and safety in decommissioning, and for minimizing the generation of radioactive waste.

<u>Basis</u>	Requirements 7 and 8 of GSR Part 1 (Rev. 1) [5] Requirements 43 and 44 of GSR Part 3 [8] Requirements 1, 2, 4, 5 and 20–23 of GSR Part 7 [10] Requirements 18 and 19 of SSR-2/2 (Rev. 1) [18] Paragraphs 304 and 305 of SSR-6 (Rev. 1) [28]		
135			The government should determine the national response organizations with responsibilities for emergency preparedness and response.
136			The government should specify the general approach for emergency preparedness and response on the basis of the probability and severity of the emergency.
137			The government should start implementing new arrangements as identified in Phase 1 for strengthening the infrastructure for emergency preparedness and response.
138			The regulatory body should develop the regulations on emergency preparedness and response, as necessary for the development of infrastructure.
139			The operating organization should start developing a general emergency preparedness programme for nuclear power plants.
<u>Implementing the IAEA Specific Safety Requirements for Safety Infrastructure</u>			
<u>15 — Operating organization</u>			
<u>Basis</u>	Requirements 5, 6 and 11 of GSR Part 1 (Rev. 1) [5] Requirement 4 of GSR Part 3 [8] Requirements 1–5 of SSR-2/2 (Rev. 1) [18]		
149			The operating organization should be formed, if it has not already been formed, and it should be expressly assigned its prime responsibility for safety.
150			The operating organization should appoint managers and key experts, should specify its organizational structure, and should establish its policy for human resources development for discharging its responsibility for safety.
151			The operating organization should establish an integrated management system in which safety has the overriding priority.
152			The operating organization should establish a constructive working relationship with the regulatory body and with relevant national and international organizations, consistent with governmental policy.
153			The operating organization should establish a process for bidding or contract negotiations and should specify the safety requirements to be included, consistent with national regulations.

154				The operating organization should make provision to include matters relating to the transfer of safety knowledge in the bid specifications or contract negotiations, consistent with governmental policy.
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16 — Site survey and site evaluation

[Basis](#) [Requirement 31 of GSR Part 3 \[8\]](#)
[Paragraphs 2.1–2.29, 3.1–3.55, 4.1–4.15, 6.1–6.9 of NS-R-3 \(Rev. 1\) \[27\]](#)

161				The regulatory body should establish specific safety requirements for site evaluation, including requirements for the process for authorizing the site selected, in compliance with the relevant IAEA safety standards.
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162				The operating organization should complete the investigations relating to the acceptability of the candidate sites and should select the preferred candidate site for the first nuclear power plant, making use of specific data, information and studies, and assessments conducted on the fullest possible temporal and spatial scales of investigation.
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163				The operating organization should prepare the site evaluation report and should submit it to the regulatory body, on the basis of a full assessment of the site selected and including the confirmation of site acceptability and the characterization of the site for the definition of the site related design basis parameters.
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164				The regulatory body should review and assess the site evaluation report, and should make a decision regarding the acceptability of the site selected and the site related design bases.
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165				The operating organization should use all the appropriate information relevant to safety and to regulatory control that is related to or derived from the site characterization to prepare the bid specifications or negotiate contracts for the nuclear power plant.
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166				The operating organization should start to evaluate and modify the site and radiological environmental monitoring programme, as necessary, after the site evaluation report has been approved.
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17 — Design safety

[Basis](#) [Requirements 5, 15, 16 and 29 of GSR Part 3 \[8\]](#)
[SSR-2/1 \(Rev. 1\) \[29\] as a whole](#)
[Requirements 15 and 16 of SSR-4 \[41\]](#)

172				All the relevant organizations should obtain an in-depth understanding of the safety principles and safety requirements applicable in the design of a nuclear power plant.
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174				The regulatory body should prepare and enact national safety regulations on design that are necessary for bid specification or contract negotiations.
175				The government and the operating organization, as applicable, should start to implement plans for improving the national technical infrastructure, as necessary to fill in previously identified gaps in the capabilities necessary for ensuring safety.
176				The operating organization should include in the bid specification or contract negotiation all the safety and regulatory aspects that should be considered in the design, with account taken of the status of the national technical infrastructure.
18 — Preparation for commissioning				
				No action in Phase 2.
19 — Transport safety				
Basis	Requirement 7 of GSR Part 1 (Rev. 1) [5] Requirement 2 of GSR Part 3 [8] Requirement 2 of GSR Part 7 [10] SSR-6 (Rev. 1) as a whole [28]			
190				All relevant organizations should prepare a plan on how to meet the relevant international safety requirements and should start to fill the gaps identified in Phase 1.
191				The regulatory body and the organizations in charge of the transport of radioactive material should participate in international activities and networks to provide mutual support.
20 — Interfaces with nuclear security				
Basis	Requirement 12 of GSR Part 1 (Rev. 1) [5] Requirement 6 of GSR Part 2 [17] Requirement 5 of GSR Part 5 [9] Requirements 2 and 23 of GSR Part 7 [10] Requirement 8 of SSR-2/1 (Rev. 1) [29] Requirement 17 of SSR-2/2 (Rev. 1) [18]			
194				All the relevant organizations should coordinate safety and security aspects from the early stages of development, establishing maximum synergy and, where necessary, integration.

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Basis Requirements 4, 11, 13, 17 and

20 of GSR Part 1;

Requirements 3.14, 5.14, 5.23 and 5.24 of GS R 3;
Requirements 2 and 3 of GSR Part 3 [8] (revision of BSS);
Requirement 37 of SSR 2/1 [33];
Requirements 3 and 31 of SSR 2/2.

63 The operating organization and the government should encourage industrial organizations in the State to develop their capabilities with the objective of participating in the construction of nuclear power plants and supporting their safe long term operation.

64 The government, and the operating organization if applicable, should establish organizations to provide expertise and engineering support or other external support for regulatory oversight and for the safe operation of nuclear power plants, as identified in Phase 1.

65 External support organizations and potential contractors should begin to build competence and quality management systems for ensuring safety.

66 The regulatory body and the operating organization should plan arrangements for overseeing the activities performed by their respective external support organizations and contractors.

8 Leadership and management for safety

Basis Requirements 1, 19 and 35 of GSR Part 1;

GS R 3 as a whole;
Requirement 5 of GSR Part 3 [8] (revision of BSS);
Requirement 7 of GSR Part 5;
Requirements 6.1–6.9 of NS R 3;
Requirement 2 of SSR 2/2;
Requirement 306 of TS R 1.

75 The regulatory body and the operating organization should start developing and implementing effective management systems in their respective organizations and should promote a strong safety culture.

76 The regulatory body and the operating organization should develop competences in managing the growth of and change in the organization.

77 The regulatory body and the operating organization should make appropriate arrangements for measurement, assessment (both ‘selfassessment’ and independent assessment) and continuous improvement of their management systems.

9 Human resources development

Basis Requirements 1, 11 and 18 of GSR Part 1;

Requirements 4.1, 4.3–4.5 of GS R 3;
Requirements 2–4 and 26 of GSR Part 3 [8] (revision of BSS); Requirements 4 and 7 of SSR 2/2;
Requirements 311–315 of TS R 1.

90 All relevant organizations should implement a strategy to attract and retain high quality trained personnel.

91 All relevant organizations should support the safety related training of prospective nuclear staff in nuclear organizations in other States.

92 The regulatory body and the operating organization should actively recruit staff so as to ensure capability in areas relevant to safety in a timely manner.

93 The government and relevant organizations should establish new institutes or new curricula relevant to safety, as identified in Phase 1.

94 All relevant organizations should commence the education and training in academic and vocational institutions of the necessary number of persons for ensuring safety.

10 Research for safety and regulatory purposes

Basis Requirements 1 and 11 of GSR Part 1; Requirement 3 of GSR Part 5.

101 The operating organization and the regulatory body should be involved in identifying areas for safety research.

102 The government should implement plans to establish new

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Requirements 43–46 and

Schedule IV of GSR Part 3 [8] (revision of BSS);
Requirements 2.1–2.6, 3.1–3.20, 5.2–5.30 of GS-R-2;
Requirement 18 of SSR-2/2;
Requirements 304 and 305 of TS-R-1.

135				The government should specify the national institutions with responsibilities for emergency preparedness and response.
136				The government should specify the general approach for emergency preparedness and response on the basis of the probability and severity of the emergency.
137				The government should start implementing new arrangements as identified in Phase 1 for strengthening the infrastructure for emergency preparedness and response.
138				The regulatory body should develop basic regulations on emergency planning, as necessary for the development of infrastructure.
139				The operating organization should start developing a general emergency preparedness programme for nuclear power plants.

Implementing the IAEA Specific Safety Requirements for Safety Infrastructure

15 Operating organization

Basis				Requirements 5, 6 and 11 of GSR Part 1; Requirement 4 of GSR Part 3 [8] (revision of BSS); Requirements 1–5 of SSR-2/2.
149				The operating organization should be formed, if it has not already been formed, and it should be expressly assigned its primeresponsibility for safety.
150				The operating organization should appoint managers and key experts, should specify its organizational structure, and should establish its policy for human resources development for discharging its responsibility for safety.
151				The operating organization should establish a management system in which safety has the overriding priority.
152				The operating organization should establish a suitable working relationship with the regulatory body and with relevant national and international organizations.
153				The operating organization should establish a bidding process and should specify the safety requirements to be included in the call for bids, consistent with national regulations.
154				The operating organization should make provision to include matters relating to the transfer of safety knowledge in the bid specifications, consistent with governmental policy.

16 Site survey and site evaluation

Basis				Requirement 31 of GSR Part 3 [8] (revision of BSS); Requirements 2.1–2.29, 3.1–3.55, 4.1–4.15, 6.1–6.9 of NS-R-3.
161				The regulatory body should establish specific safety requirements for site evaluation, including requirements for the process for authorizing the site selected, in compliance with the relevant IAEA safety standards.
162				The operating organization should complete the investigations relating to the acceptability of the candidate sites and should select the preferred candidate site for the first nuclear power plant, making use of specific data, information and studies, and assessments conducted on the fullest possible temporal and spatial scales of investigation.
163				The operating organization should prepare the site evaluation report and should submit it to the regulatory body, on the basis of a full assessment of the site selected and including the confirmation of site acceptability and the characterization of the site for the definition of the site-related design-basis parameters.
164				The regulatory body should review and assess the site evaluation report and should make a decision regarding the acceptability of the site selected and the site-related design-bases.
165				The operating organization should use all the appropriate information relevant to safety and to regulatory control that is related to or derived from the site assessment to prepare the bid specifications for the nuclear power plant.
166				The operating organization should start to evaluate and modify the site and radiological environmental monitoring programme as necessary after the site evaluation report has been approved.

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17 — Design safety

Basis Requirements 5, 15, 16 and 29 of GSR Part 3 [8] (revision of BSS);□

SSR 2/1 as a whole;□

Requirements 6.43–6.51 of NS R 5.

- 172 All the relevant organizations should obtain an in depth understanding of the safety principles and safety requirements applicable in the design of a nuclear power plant.
- 173 The operating organization should conduct a thorough market survey of the available nuclear power technologies and should investigate their safety features.
- 174 The regulatory body should prepare and enact national safety regulations on design that are necessary for bid specification.
- 175 The government and the operating organization as applicable should start to implement plans for improving the national technical infrastructure, as necessary to fill in previously identified gaps in the capabilities necessary for ensuring safety.
- 176 The operating organization should include in the bid specification all the safety and regulatory aspects that should be considered in the design, with account taken of the status of the national technical infrastructure.

18 — Preparation for commissioning

		No action in Phase 2.
19	Transport safety	
Basis	Requirement 7 of GSR Part 4;□	
	Requirement 2 of GSR Part 3 [8] (revision of BSS);□ TS R 1 as a whole.	
190		All relevant organizations should make a plan on how to meet the relevant international safety requirements and should start to fill□ the gaps identified in Phase 1.
191		The regulatory body and the organizations in charge of the transport of radioactive material should participate in international activities and networks to provide mutual support.

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20 — Interfaces with nuclear security

Basis Requirement 12 of GSR Part 1;□

Requirement 2.1 of GS R 3;□

Requirement 5 of GSR Part 5;□ Requirement 5.16 of GS R 2.

- 194 All the relevant organizations should coordinate safety and security aspects from the early stages of development, establishing maximum synergy and, where necessary, integration.
- 195 The government should define the responsibilities of the operating organization and other competent authorities in relation to security.
- 196 The government should develop mechanisms to communicate to the public appropriate information regarding safety and nuclear security.

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PHASE 3

Action No.	Responsible entities (main)			Actions to be taken to implement the IAEA safety standards in Phase 3, and bases for these actions
	Government-legislators	Regulatory body	Operating organization	
Implementing the IAEA General Safety Requirements for Safety Infrastructure				
1 — National policy and strategy for safety				
Basis	Requirement 1 of GSR Part 1; □ (Rev. 1) [5] Requirements 10 and 29 of GSR Part 3 [8] (revision of BSS);□ Requirement 2 of GSR Part 5- [9] Requirement 2 of GSR Part 7 [10]			
-9				The government should continue to implement the national policy and strategy for safety.
10				The government should ensure that the regulatory body and the operating organization are fulfilling their responsibilities.
2 — Global nuclear safety regime				
Basis	Requirements 1 and 14 of GSR Part 1; □ (Rev. 1) [5] Requirement 13 of GSR Part 2 [17] Requirements 6.3–6.67 and 17 of GS-R-3 ; □ GSR Part 7 [10] Requirement 24 of SSR-2/2- (Rev. 1) [18]			
17				All the relevant organizations should ensure continued participation in international activities and international networks for strengthening safety.
18				The operating organization should implement a cooperation programme with the vendor and with other organizations operating nuclear power plants of the same type as that selected, for the purpose of strengthening safety.
19				The regulatory body should implement a cooperation programme with the vendor State and with other regulatory bodies that have experience of oversight of nuclear power plants of the same type as that selected.
3 — Legal framework				

Basis	Requirements 1–4 of GSR Part 1 [5] Requirement 2 of GSR Part 3 [8] (revision of BSS) Requirement 1 of GSR Part 5 [9] Requirement 4 of GSR Part 6 [19] Requirements 3.32 and 3.420 of WS-R-5 GSR Part 7 [10]		
23			The government should ensure that the legal framework for the safety infrastructure is fully in place and that the legislation is complied with by the relevant organizations.
4 — Regulatory framework			
Basis	Requirements 1, 3, 4, 7, 11, 16–18 and 21–33 of GSR Part 1 (Rev. 1) [5] Requirement 3 of GSR Part 2 [17] Requirements 2 and 3 of GSR Part 3 [8] Requirements 1 and 3 of GSR Part 5 [9] Requirement 5 of GSR Part 6 [19] Requirement 2 of GSR Part 7 [10]		
33			The regulatory body should maintain suitable working relations with the operating organization.
34			The regulatory body should plan and conduct all the required licensing and oversight activities to be conducted during the licensing process, including during siting, construction, commissioning and operation, consistent with the regulatory approach that was selected.
35			The regulatory body should establish a consistent procedure for issuing, revising and revoking regulations and guides.
36			The regulatory body should ensure that a full and comprehensive set of regulations and guides is in place for regulating construction, commissioning and operational activities at the appropriate time.
37			The regulatory body should implement its programme for inspection and enforcement during construction including, as applicable, the design and manufacture of safety related components.
38			The regulatory body should review and assess programmes to be implemented by the operating organization, as appropriate.
5 — Transparency and openness			

<u>Basis</u>	Requirements 1, 21, 34 and 36 of GSR Part 1 (Rev. 1) [5] Requirements 5 and 14 of GSR Part 2 [17] Requirement 3 of GSR Part 3 [8] Requirements 1 and 3 of GSR Part 5 [9] Requirements 10 and 13 of GSR Part 7 [10] Requirement 2 of SSR-2/2 (Rev. 1) [18]		
<u>43</u>			All relevant organizations should seek to establish and maintain the confidence and trust of the public and other interested parties on safety issues.
<u>44</u>			All relevant organizations, as appropriate to their role, should continue to explain to the public and other interested parties the risks and benefits of the introduction of nuclear power and the measures taken to limit the risks.
<u>45</u>			The regulatory body should communicate to the public and other interested parties about the licensing process, safety requirements and regulatory oversight.
<u>46</u>			The operating organization and the regulatory body should communicate with interested parties about safety issues in construction and the commissioning programme.
<u>47</u>			The operating organization and the regulatory body should maintain a transparent approach on safety issues with the public and other interested parties, including suppliers, during the construction programme, regarding any problems and difficulties encountered.
6 — Funding and financing			
<u>Basis</u>	Requirements 1, 3, 10 and 11 of GSR Part 1 (Rev. 1) [5] Requirement 9 of GSR Part 2 [17] Requirement 1 of GSR Part 5 [9] Requirement 9 of GSR Part 6 [19] Requirement 2 of GSR Part 7 [10] Requirements 1, 3 and 4 of SSR-2/2 (Rev. 1) [18]		
<u>56</u>			The government should provide sustainable funding for the efficient and effective conduct of the regulatory body's activities and for the emergency arrangements of respective response organizations.
<u>57</u>			The operating organization should ensure that funding is sufficient for ensuring the safe operation of the nuclear power plant.

58				The operating organization should ensure that arrangements are in place for the funding of radioactive waste management and decommissioning.
59				The regulatory body should verify, as part of the licensing process, that the operating organization has sufficient financial resources.
60				The government or the regulatory body should verify that a system for the funding of decommissioning activities and radioactive waste management, and spent fuel management including disposal, is in place.
7 — External support organizations and contractors				
Basis	Requirements 4, 11, 13, 17 and 20 of GSR Part 1 (Rev. 1) [5] Requirements 3, 10 and 11 of GSR Part 2 [17] Requirements 2, 3 and 20 of GSR Part 3 [8] Requirements 3 and 31 of SSR-2/2 (Rev. 1) [18]			
67				The regulatory body should establish a framework for the qualification of technical services that are significant for nuclear safety.
68				External support organizations should continue the recruitment of staff and the building of competence in safety related matters.
69				All the relevant organizations should ensure clarity in specifying the roles and responsibilities of external support organizations.
70				All the relevant organizations should make appropriate arrangements to avoid conflicts of interest when obtaining external support.
71				The regulatory body and the operating organization should oversee the activities performed by their respective external support organizations and contractors, and should assess the quality of the services provided, in accordance with their management systems.
8 — Leadership and management for safety				

<u>Basis</u>	Requirements 1, 19, 35 of GSR Part 1 (Rev. 1) [5] GSR Part 2 as a whole [17] Requirement 5 of GSR Part 3 [8] Requirement 7 of GSR Part 5 [9] Requirement 26 of GSR Part 7 [10] Paragraphs 6.1–6.9 of NS-R-3 (Rev. 1) [27] Requirement 2 of SSR-2/1 (Rev. 1) [29] Requirements 2, 8, 9 and 15 of SSR-2/2 (Rev. 1) [18] Paragraph 306 of SSR-6 (Rev. 1) [28]		
<u>78</u>			The senior management of all the relevant organizations should provide effective leadership and effective management for safety to ensure a sustainable high level of safety and a strong safety culture.
<u>79</u>			All the relevant organizations should continue the implementation of a management system that promotes the concept that requirements for safety shall be paramount within the organization, overriding all other demands.
<u>80</u>			The operating organization and the regulatory body should ensure that the effectiveness of their integrated management systems is monitored and measured, and that self-assessments as well as independent assessments are conducted regularly for continuous improvement.
<u>81</u>			All the relevant organizations should ensure that appropriate arrangements for management of safety related knowledge (including record management and report management) and knowledge transfer are in place.
<u>82</u>			All the relevant organizations should ensure that leadership and succession development programmes are in place to develop future leaders with a strong emphasis on safety.
<u>83</u>			The operating organization should describe the provisions for managing for safety in the corresponding chapter of the safety analysis report.
<u>84</u>			The regulatory body should review and assess the operating organization's programme on safety management.
<u>9 — Human resources development</u>			

<u>Basis</u>	<u>Requirements 1, 11 and 18 of GSR Part 1 (Rev. 1) [5]</u> <u>Requirements 9 of GSR Part 2 [17]</u> <u>Requirements 2–4 and 26 of GSR Part 3 [8]</u> <u>Requirements 21 and 25 of GSR Part 7 [10]</u> <u>Requirements 4 and 7 of SSR-2/2 (Rev. 1) [18]</u> <u>Paragraphs 311–315 of SSR-6 (Rev. 1) [28]</u>		
<u>95</u>			<u>The operating organization, the regulatory body, external support organizations and relevant response organizations should ensure the availability of sufficient competent human resources for the efficient and effective conduct of all activities at the appropriate time.</u>
<u>96</u>			<u>The operating organization should prepare a human resources management programme (including staffing, qualification and training) as well as the corresponding parts of the safety analysis report.</u>
<u>97</u>			<u>The regulatory body should review and assess the operating organization's programme with regard to human resources management.</u>
<u>98</u>			<u>The government should continue promoting the development of education in the nuclear field so as to continue providing a flow of qualified people in areas relevant to safety.</u>
<u>10 — Research for safety and regulatory purposes</u>			
<u>Basis</u>	<u>Requirements 1 and 11 of GSR Part 1 (Rev. 1) [5]</u> <u>Requirement 3 of GSR Part 5 [9]</u>		
<u>104</u>			<u>Research centres and other relevant organizations should focus their research on the features and safety aspects of the nuclear power plant that will be constructed, including features and aspects specific to the actual plant site.</u>
<u>11 — Radiation protection</u>			
<u>Basis</u>	<u>Requirement 7 of GSR Part 1 (Rev. 1) [5]</u> <u>Requirements 1–4, 6–16, 19–32, of GSR Part 3 [8]</u> <u>Paragraphs 4.1–4.15 of NS-R-3 (Rev. 1) [27]</u> <u>Requirements 78 and 79 of SSR-2/1 (Rev. 1) [29]</u> <u>Requirement 21 of SSR-2/2 (Rev. 1) [18]</u> <u>Paragraphs 301–303 of SSR-6 (Rev. 1) [28]</u>		
<u>114</u>			<u>The operating organization should establish a radiation protection programme, should continue implementing an environmental radiological monitoring programme, and should prepare the corresponding chapters of the safety analysis report.</u>

115				The regulatory body should review and assess the operating organization's programmes with regard to radiation protection and relevant environmental protection, and should verify compliance with the regulatory requirements.
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4 Regulatory framework

Basis	Requirements 1, 3, 4, 7, 11, 16-18, 21-33 of GSR Part 1;□ Requirements 2 and 3 of GSR Part 3 [8] (revision of BSS);□ Requirements 1 and 3 of GSR Part 5;□ Requirements 3.5 and 3.6 of WS-R 5;□ Requirement 3.7 of GS-R 3.			
33				The regulatory body should maintain suitable working relations with the operating organization.
34				The regulatory body should plan and conduct all the required licensing and oversight activities to be conducted during the licensing process, including siting, construction, commissioning and operation, consistent with the regulatory approach that was selected.
35				The regulatory body should establish a consistent procedure for issuing, revising and revoking regulations and guides.
36				The regulatory body should ensure that a full and comprehensive set of regulations and guides is in place for regulating construction, commissioning and operational activities at the appropriate time.
37				The regulatory body should implement its programme for inspection and enforcement during construction including, as applicable, the design and manufacture of safety related components.
38				The regulatory body should review and assess programmes to be implemented by the operating organization, as appropriate.

5 Transparency and openness

Basis	Requirements 1, 21, 34 and 36 of GSR Part 1;□ Requirements 3.6, 5.26 and 5.27 of GS-R 3;□ Requirement 3 of GSR Part 3 [8] (revision of BSS);□ Requirements 1 and 3 of GSR Part 5;□ Requirements 4.53, 4.54, 4.82-4.84 of GS-R 2;□ Requirement 2 of SSR 2/2.			
43				All relevant organizations should seek to establish and maintain the confidence and trust of interested parties, including the public, on safety issues.

44 All relevant organizations should continue to explain to interested parties the risks and benefits of the introduction of nuclear power and the measures taken to limit the risks.

45 The regulatory body should communicate with interested parties about the licensing process, safety requirements and regulatory oversight.

46 The operating organization and the regulatory body should communicate with interested parties about safety issues in construction and the commissioning programme.

47 The operating organization and the regulatory body should maintain a transparent approach on safety issues with all interested parties involved in the construction programme, including suppliers, regarding the problems and difficulties encountered.

6 Funding and financing

Basis Requirements 1, 3, 10 and 11 of GSR Part 1;□
Requirement 4.1 of GS-R 3;□
Requirement 1 of GSR Part 5;□

Requirements 6.1–6.5 of WS-R 5;□
Requirements 1, 3 and 4 of SSR 2/2.

56 The government should provide appropriate funding for the efficient and effective conduct of the regulatory body's activities.

57 The operating organization should ensure that funding is sufficient for ensuring the safe operation of the nuclear power plant.

58 The operating organization should ensure that arrangements are in place for the funding of radioactive waste management and decommissioning.

59 The regulatory body should verify, as part of the licensing process, that the operating organization has sufficient financial resources.

60 The government or the regulatory body should verify that a system for the funding of decommissioning activities and radioactive waste management, spent fuel management including disposal, is in place.

7 External support organizations and contractors

Basis Requirements 4, 11, 13, 17 and 20 of GSR Part 1;□
Requirements 3.14, 5.14, 5.15–5.20, 5.23–5.25 of GS-R 3;□
Requirements 2 and 3 of GSR Part 3 [8] (revision of BSS);□
Requirement 37 of SSR 2/1;□
Requirements 3 and 31 of SSR 2/2.

- 67 The regulatory body should establish a framework for the qualification of technical services that are significant for nuclear safety.
- 68 External support organizations should continue the recruitment of staff and the building of competence in safety-related matters.
- 69 All the relevant organizations should ensure clarity in specifying the roles and responsibilities of external support organizations.
- 70 All the relevant organizations should make appropriate arrangements to avoid conflicts of interest when obtaining external support.

71 The regulatory body and the operating organization should oversee the activities performed by their respective external support organizations and contractors, and should assess the quality of the services provided, in accordance with their management systems.

8 Leadership and management for safety

Basis Requirements 1, 19 and 35 of GSR Part 1;□

GS-R-3 as a whole;□

Requirement 5 of GSR Part 3 [8] (revision of BSS);□

Requirement 7 of GSR Part 5;□

Requirements 5.37–5.39 of GS-R-2;□

Requirements 6.1–6.9 of NS-R-3;□

Requirement 2 of SSR-2/1;□

Requirements 2, 8, 9 and 15 of SSR-2/2;□

Requirement 306 of TS-R-1.

78 The senior management of all the relevant organizations should provide effective leadership and effective management for safety to ensure a sustainable high level of safety and a strong safety culture.

79 All the relevant organizations should continue the implementation of a management system that promotes the concept that requirements for safety shall be paramount within the organization, overriding all other demands.

80 The operating organization and the regulatory body should ensure that the effectiveness of their management systems is monitored and measured, and that self-assessments as well as independent assessments are conducted regularly for continuous improvement.

81 All the relevant organizations should ensure that appropriate arrangements for management of safety-related knowledge (including record management and report management) and knowledge transfer are in place.

82 — All the relevant organizations should ensure that leadership and succession development programmes are in place to develop future leaders with a strong emphasis on safety.

83 — The operating organization should prepare a safety management programme as well as the corresponding chapter of the safety analysis report.

84 — The regulatory body should review and assess the operating organization's programme on safety management.

9 — Human resources development

Basis — Requirements 1, 11 and 18 of GSR Part 1; □

Requirements 4.1, 4.3–4.5 of GS-R-3; □

Requirements 2–4 and 26 of GSR Part 3 [8] (revision of BSS); □

Requirements 4 and 7 of SSR-2/2; □

Requirements 311–315 of TS-R-1.

95 — The operating organization, the regulatory body and external support organizations should ensure the availability of sufficient competent human resources for the efficient and effective conduct of all activities at the appropriate time.

96 — The operating organization should prepare a human resources management programme (including staffing, qualification and training) as well as the corresponding parts of the safety analysis report.

97 — The regulatory body should review and assess the operating organization's programme with regard to human resources management.

98 — The government should continue promoting the development of education in the nuclear field so as to continue providing a flow of qualified people in areas relevant to safety.

10 — Research for safety and regulatory purposes

Basis — Requirements 1 and 11 of GSR Part 1; □

Requirements 3 of GSR Part 5.

104 — Research centres and other relevant organizations should focus their research on the features and safety aspects of the nuclear power plant that will be constructed, including features and aspects specific to the actual plant site

11 — Radiation protection

Basis — Requirement 7 of GSR Part 1; Requirements 1–4, 6–33, 43, 44, Schedule III and Schedule IV of GSR Part 3 [8] (revision of BSS); □

Requirements 4.1–4.15 of NS-R-3; □

Requirements 78 and 79 of SSR-2/1; □

				Requirement 21 of SSR 2/2;□ Requirements 301–303 of TS R-1.
114				The operating organization should establish a radiation protection programme, should continue implementing an environmental radiological monitoring programme, and should prepare the corresponding chapters of the safety analysis report.
115				The regulatory body should review and assess the operating organization's programmes with regard to radiation protection and relevant environmental protection, and should verify compliance with the regulatory requirements.

Basis	Requirements 7 and 8 of GSR Part 1 (Rev. 1) [5] Requirement 43–46 and Schedule IV of GSR Part 3 [8] Requirements 1–26 and Appendices I and II of GSR Part 7 [10] Requirement 18 of SSR-2/2 (Rev. 1) [18] Paragraphs 304 and 305 of SSR-6 (Rev. 1) [28]			
140				The regulatory body should establish detailed regulations on emergency planning.
141				The operating organization should develop and implement an emergency plan and emergency procedures for the nuclear power plant, and should put in place adequate arrangements to support preparedness for an effective response.
142				The government and the regulatory body should develop and implement emergency plans and emergency procedures and should put in place adequate arrangements to support preparedness for an effective response at the local, national and, as appropriate, international level.
143				The government and the regulatory body should establish arrangements for coordination between the emergency plan of the nuclear power plant and the plans of the relevant response organizations that would be involved in emergency response.
144				The regulatory body should review and assess the emergency plan and procedures for nuclear power plants, to the extent necessary to verify compliance with the regulatory requirements.
145				The government, the regulatory body and the operating organization should demonstrate their emergency response capabilities by conducting appropriate exercises that include all the organizations concerned, people who are potentially affected, and the news media.
Implementing the IAEA Specific Safety Requirements for Safety Infrastructure				
15 —Operating organization				
Basis	Requirements 5, 6 and 11 of GSR Part 1 (Rev. 1) [5] Requirement 3 of GSR Part 2 [17] Requirement 4 of GSR Part 3 [8] Requirement 2 of GSR Part 7 [10] Requirement 1 of SSR-2/1 (Rev. 1) [29] Requirements 1–32 of SSR-2/2 (Rev. 1) [18] Requirements 58, 63 and 68 of SSR-4 [41]			
131				The regulatory body should implement its regulatory oversight programme for facilities and activities for radioactive waste management and spent fuel management.
132				All the relevant organizations should be aware of international efforts and progress with regard to the disposal of radioactive waste.
14 —Emergency preparedness and response				
Basis	Requirements 7 and 8 of GSR Part 1; Requirement 43–46 and Schedule IV of GSR Part 3 [8] (revision of BSS); Requirements 2.1–2.6, 3.1–3.20, 4.1–4.100, 5.2–5.39 of GS R 2; Requirement 18 of SSR-2/2; Requirements 304 and 305 of TS R 1.			
140				The regulatory body should establish detailed regulations on emergency planning.
141				The operating organization should develop and implement an emergency preparedness programme, and emergency plans and procedures for nuclear power plants, and should prepare the corresponding chapter of the safety analysis report.
142				The government and the regulatory body should develop and

implement

- 143 The government and the regulatory body should establish arrangements for coordination between the emergency response plan of the nuclear power plant and the plans of the relevant national institutions that would be involved in emergency response.
- 144 The regulatory body should review and assess the emergency programme, plans and procedures for nuclear power plants, and should verify compliance with the regulatory requirements.
- 145 The government, the regulatory body and the operating organization should demonstrate emergency response capabilities by conducting appropriate exercises that include local authorities and local communities.

Implementing the IAEA Specific Safety Requirements for Safety Infrastructure

15 —

Operating organization

Basis Requirements 5, 6 and 11 of GSR Part 1;□

Requirement 3.7 of GS-R-3;□

Requirement 4 of GSR Part 3 [8] (revision of BSS);□

Requirement 1 of SSR-2/4;□

Requirements 1-32 of SSR-2/2;□

Requirements 9.4, 9.49-9.53 of NS-R-5.

155				The operating organization should implement a safety policy that includes goals and objectives that give safety matters the highest priority, as part of its management system.
156				The operating organization should give primary consideration to safety aspects during the evaluation of bids, or contract negotiations.
157				The operating organization should, in coordination with the vendor as necessary, prepare all the safety documentation as required in the licensing process for submission to the regulatory body.
158				The operating organization should develop all necessary programmes for operational management (including programmes for operations, maintenance and training) and should submit them to the regulatory body, as appropriate.
159				The operating organization should ensure the completion of construction of the nuclear power plant in accordance with the design bases/basis licensing conditions and with primary consideration given to safety aspects.
16 — Site survey and site evaluation				
Basis				Requirement 31 of GSR Part 3 [8] (revision of BSS);□ Requirements Paragraphs 2.1–2.29, 3.1–3.55, 4.1–4.15, 5.1, 6.1–6.9 of NS-R-3- (Rev. 1) [31]
167				The operating organization should prepare the chapter on site evaluation of the safety analysis report on site evaluation, and then update it, taking into account the specificities of the reactor/nuclear power plant selected and the data and information gathered during the pre-operational stage.
168				The operating organization should implement necessary safety improvements to the site, if required, as site protection measures determined as a result of the tasks of external hazard assessment.
169				The operating organization should continue to implement the environmental programme and the site monitoring programme.
17 — Design safety				

Basis	Requirements 5, 15, 16 and 29 of GSR Part 3 [8] (revision of BSS); -SSR-2/1 (Rev. 1) [29] as a whole; Requirements 10 and 11 of SSR-2/2 (Rev. 1) [18] Requirements 6.43-6.54, 15 and 16 of NS-R-5, SSR-4 [41]		
177			The operating organization should establish a 'design entity authority' that will maintain the knowledge of the safety design and its configuration management over the lifetime of the
178			The operating organization should conduct an adequate safety review of the designs proposed by the vendors in the submitted bids or contract negotiation, including an assessment of the associated sets of codes and standards.
179			The operating organization should establish a proper interaction with the selected vendor for preparation of the safety documents.
180			The government and the operating organization should ensure the completion of all the required improvements of the national technical infrastructure consistent with the plant design.
181			The operating organization should prepare and provide to the regulatory body the safety documents required in the licensing process.
182			The regulatory body should review and assess the safety documentation such as the safety analysis reports, and should verify compliance of the design with regulatory requirements.
183			The operating organization should ensure the adequate validation and verification of the design of the nuclear power plant and its structures, systems and components, and the regulatory body should review this validation and verification.
184			The operating organization and the regulatory body should implement their respective processes to address modifications made to the design during construction and afterwards.
18 — Preparation for commissioning			
Basis	Requirement 25 of SSR-2/2 (Rev. 1) [18]		
185			The regulatory body should issue requirements on commissioning, including the establishment of a severe accident management programme.
186			The operating organization should establish a comprehensive commissioning programme, should prepare the corresponding chapter of the safety analysis report, as appropriate, and should ensure that there are a sufficient number of operating staff to be involved in commissioning activities.
187			The operating organization should establish mechanisms for the transfer of responsibilities for safety with the constructor at the end of Phase 3.
188			The regulatory body should review and assess the commissioning programme, should verify compliance with requirements and should prepare a programme to oversee the commissioning of systems important to safety in the next phase.
19 – Transport safety			
Basis	Requirement 7 of GSR Part 1 (Rev. 1) [5] Requirement 2 of GSR Part 3 [8] Requirement 2 of GSR Part 7 [10] SSR-6 (Rev. 1) [28] as a whole		
192			The regulatory body and the organizations in charge of the transport of radioactive material should fully implement the changes to the national requirements and arrangements for the transport of radioactive material in accordance with the plan developed in Phase 2.

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20 — Interfaces with nuclear security			
Basis	Requirement 12 of GSR Part 1 (Rev. 1) [5] Requirement 6 of GSR Part 2 [17] Requirement 5 of GSR Part 5 [9] Requirement 2 and 23 of GSR Part 7 [10] Requirement 8 of SSR-2/1 (Rev. 1) [29] Requirement 17 of SSR-2/2 (Rev. 1) [18]		
195			The regulatory body (possibly consisting of several authorities) should ensure that security regulations do not compromise safety and that safety regulations do not compromise security.
196			All the relevant organizations should ensure that emergency preparedness and response plans in the fields of safety and nuclear security are complementary, coherent and well-coordinated among the entities involved.
197			The operating organization and the regulatory body should continue to promote safety culture and nuclear security culture in their respective organizations.
179			The operating organization should establish a proper interaction with the selected vendor for preparation of the safety documents.
180			The government and the operating organization should ensure the completion of all the required improvements of the national technical infrastructure consistent with the plant design.
181			The operating organization should prepare and provide to the regulatory body the safety documents required in the licensing process.
182			The regulatory body should review and assess the safety documentation such as the safety analysis reports, and should verify compliance of the design with regulatory requirements.
183			The operating organization should ensure the adequate validation and verification of the design of the nuclear power plant and its structures, systems and components, and the regulatory body should review this validation and verification.
184			The operating organization and the regulatory body should implement their respective processes to address modifications made to the design during construction and afterwards.
18 — Preparation for commissioning			
Basis	SSR 2/2		
185			The regulatory body should issue requirements on commissioning.
186			The operating organization should establish a comprehensive commissioning programme, should prepare the corresponding chapter of the safety analysis report as appropriate, and should ensure that there are a sufficient number of operating staff to be involved in commissioning activities.
187			The operating organization should establish mechanisms for the transfer of responsibilities for safety with the constructor at the end of Phase 3.
188			The regulatory body should review and assess the commissioning programme, should verify compliance with requirements and should prepare a programme to oversee the commissioning of systems important to safety in the next phase.
19 — Transport safety			
Basis	Requirement 7 of GSR Part 1;□		

	Requirement 2 of GSR Part 3 [8] (revision of BSS); □ TS-R-1 as a whole.	
192		The regulatory body and the organizations in charge of the transport of radioactive material should fully implement the changes to the national requirements and arrangements for the transport of radioactive material in accordance with the plan in Phase 2.
20 — Interfaces with nuclear security		
Basis	Requirement 12 of GSR Part 1; □ Requirement 2.1 of GS R-3; □ Requirement 5 of GSR Part 5; □ Requirement 5.16 of GS R-2.	
197		The regulatory body (possibly consisting of several authorities) should ensure that security regulations do not compromise safety and that safety regulations do not compromise security.
198		The operating organization should prepare a physical protection programme and should submit it to the regulatory body as appropriate.
199		All the relevant organizations should ensure that emergency-preparedness and response plans in the fields of safety and nuclear security are complementary, coherent and well-coordinated among the entities involved.
200		The operating organization and the regulatory body should continue to promote safety culture and nuclear security culture in their respective organizations.

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