

## The self-assessment of selected specific infrastructure issues for the first research reactor project in Mongolia

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### 1. Introduction

Mongolia has been considering the utilization of nuclear power in the future based on approved by Parliament of Mongolia on the exploitation of radioactive minerals and nuclear energy, June 25, 2009[1]. In this context, the Mongolian government has been planning to build their first research reactor as a key national facility for development of nuclear science and technology programmes. However, Mongolia has not enough human resource and nuclear infrastructure for their nuclear power program. There are several important issues that must be solved before the actual utilization of nuclear energy. To address these problems, the Mongolian government has commenced a new research reactor project for a corner stone in the development of nuclear power program. The goal of this project is to increase national capacity in nuclear science and technology as well as support national human resource development programme in near future. A research reactor project must be supported by a specialized national nuclear infrastructure. The development and implementation of the supporting infrastructure can be divided into three sequential phases and their corresponding milestones according to assessment approach developed by IAEA [2]. For each milestone, there are nineteen issues that need to be considered carefully such as legislative framework, regulatory framework, human resources development, and so on.

This paper presents self-assessment results of a specific infrastructure issues utilizing the IAEA assessment methodology for the first research reactor project in Mongolia. As an example, a legislative framework of Mongolia has been assessed by comparing to that of Korea in order to identify gaps with its reference model. The results have been indicated overall status of each conditions of phase 1 milestone and some suggestions with respect to legislative framework of Mongolia have been drawn up.

### 2. Methodology

A research reactor project needs to be supported by a specific infrastructure plan. The development of the infrastructure to support a research reactor can be

divided into three sequential phases, each culminating in an infrastructure milestone as shown *Fig.1*[1].

The infrastructure milestones are as follows: in pre-project phase, the country must be ready to make a knowledgeable commitment to a research reactor project. Then in project formulation phase, they must be ready to invite bids for the research reactor. Subsequently in implementation phase, they have to be ready to commission and operate a research reactor.

In this study, the observations and evaluations for the existing infrastructure in Mongolia has been conducted. It is based on "Assessment of the National Nuclear Infrastructure to support a new Research Reactor Project" guidelines developed by the IAEA [4].

This evaluation was carried out at the beginning of phase 1 and again when development of the research reactor infrastructure was approaching Milestone 1. Evaluations were comprised of the following main steps:

1. Defining and identifying the organizations to be involved in the nuclear infrastructure project as well as the method of evaluation and the individuals who will conduct the assessment.
2. Measuring the development status of the research reactor infrastructure against the conditions associated with Milestone 1. Every condition is evaluated basic evaluation requirements.
3. Identifying gaps between the existing development status and required conditions for Milestone 1.

The IAEA guidelines include nineteen issues that must be considered at different phases of complexity during each stage of a research reactor development project.

The following specific nuclear infrastructure issues were selected from the IAEA's nineteen infrastructure issues: legislative frameworks, regulatory frameworks, and human resources development. Each infrastructure issue has one or more conditions to be fulfilled at each Milestone.

Conditions are defined based on the research reactor milestone document provisions for each infrastructure issue at that milestone. Specific evidences are proposed for each condition and examples how the conditions should be fulfilled are included in the Table 1. Evaluation method was prepared in response to the research reactor Milestone request.

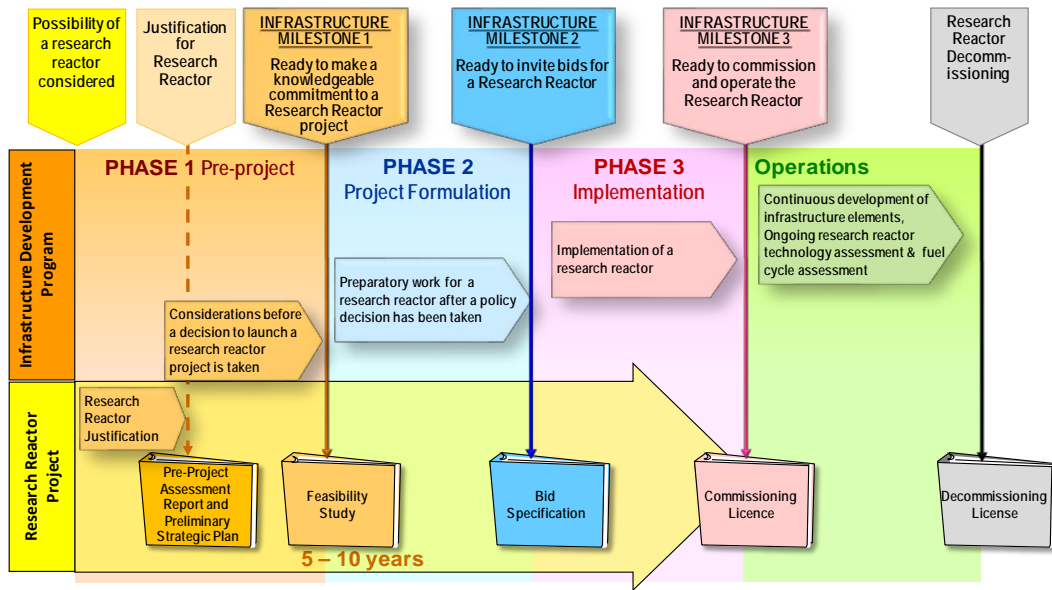


Fig.1. Milestone for a research reactor [1]

Table.1. example of assessment form for each infrastructure issue

1. Legislative Framework	Milestone 1	
1.1. Consultation with national stakeholders about the legislative framework taken place		
<b>Basis of evaluation</b>	<b>Evidence</b>	<b>Observation</b>
1.1.1 Effective stakeholder engagement and an on-going plan for developing and enacting legislation.		
Evaluation:		

### 3. Results of self-assessment and summary

The results of the self-assessment demonstrated the weaknesses and additional works needed to develop its national infrastructure. The main condition of legislative framework is government plans to amend the existing legislation are in place that is described in Table 2. Mongolia has been adhered existing

legislations, but these legislations need to be amendment for implementing of research reactor. Conditions of regulatory framework has summarized as shown in Table 3. Based on amendment of nuclear energy law, Nuclear energy commission was restructured by the Government decision on 02<sup>nd</sup> March 2015. The Regulatory body has been restructured and transferred from NEA into the General Agency for Specialized Inspection /GASI/ as Nuclear and Radiation Inspection Department.

Conditions of human resource development summarized as shown in Table 4. The Nuclear Research Center, National University of Mongolia carry out nuclear engineering every year. Their nuclear engineers haven't practical experience. Because of this reasons, intergraded human resource plan should be to developing and improving for exchange program with another foreign universities and institutes and instructor training for teachers and inspectors.

Table 2.Example of Mongolian legislative framework

1. Legislative Framework	Milestone 1	
1.3. Government plans to amend the existing legislation are in place		
<b>Basis of evaluation</b>	<b>Evidence</b>	<b>Observation</b>
1.3.1. Environmental protection (air and water quality and wildlife protection);	National standard: Surface contamination limit, Permissible concentration of radon indoors	The purpose of Surface contamination limit's standard is to define surface contamination limitation of skin, clothes and work place for workers with open radioactive, and of vehicles. The permissible concentration of radon indoors standard's purpose is to define permissible concentration of radon in work place, house and apartment. These two standards were established since 2006.
1.3.2. Emergency management preparedness and response of any type of emergency, including natural disasters;	The safety guideline of radiation accident	All hazard disaster or emergency response in Mongolia are coordinated by the National Emergency Management Agency (NEMA). Nuclear Energy Commission and GASI play role within a multi-agency response and providing technical advisor in case of nuclear and radiological emergency. They have been follow the safety guideline of radiation accident. The guideline was established since 2013.

1.3.3. Occupational health and safety of workers;	National standard: Radiation dose limits	The radiation dose limits standard has been determine permissible radiation dose for public and radiation worker following international guidelines.
1.3.4. Protection of intellectual property;	Law on protection of intellectual property and the law of Mongolia on nuclear energy.	The purpose of this law is to regulate the author's right to possess, use and dispose of works protected by the applicable rights and protection. The law was amended in 2006.
1.3.5. Local land use controls;	The law of land and the law of Mongolia on nuclear energy	The law of land was amended 2002. This law is to regulate Local land affairs and nuclear and radiation inspection department of GASI have been established local land use control. Existing legislation related to radiation source, so it should be amend and revised for nuclear facility and installation
1.3.6. International trade and customs;	The law of customs and the law of Mongolia on nuclear energy	The law of customs was amended 2008. The existing international trade and customs legislation has been established by border control of GASI and Mongolia customs. The law considered yet specific condition as nuclear material and facility. But radioactive resource is to regulated by this law.
1.3.7. Foreign investment;	The law of investment and the law of Mongolia on nuclear energy	The purpose of this law is to regulate communication related with investment, to determine rights and obligations of investors, to determine rights and obligations of governmental organizations, to stabilize tax environment for support investment, to define public guarantee of legitimate for investment, to protect investment interest for within Mongolian lands. NEC will establish the procedure.
1.3.8. Roles of national government, local government;	The law of Mongolia on nuclear energy law, article 10, para.3.	The Government shall adopt the composition and activity rules of the Commission.
1.3.9. Stakeholders and public involvement;	Regulated by the law of Mongolia on nuclear energy,	To need a plan and training programs for public. Potential stakeholders will be identified, but yet guaranteed.
1.3.10. Research and development	Decision yet completed	Nuclear research center, institute of physics and technology, and other research institutes will conduct research and development.
<p>Korean example: In Korean, all provisions on nuclear safety regulation and radiation protection are entrusted to the Nuclear Safety Act. The Nuclear Safety Act was enacted as the main law concerning safety regulations of nuclear installations. The legal framework for Nuclear Safety consists of four stages: Act (the Nuclear Safety Act), Presidential Decree (the Enforcement Decree of the same Act), Prime Minister's Regulation (the Enforcement Regulations of the same Act), the NSSC Regulation (the Enforcement Regulations Concerning the Technical Standards of Nuclear Reactor Facilities, etc.,)</p> <p>Evaluation: <b>Minor action needed</b> Mongolia has already adhered some regulations and laws related to nuclear field. The law of Mongolia on Nuclear energy has been enacted in 2009 and amended in 2015. This law is one of base document of our nuclear prospect which is included exploitation of radioactive minerals and nuclear energy. But the existing legislations are more focusing for radioactive isotopes and radioactive minerals. Before the starting research reactor project should be amend for implementing research reactor.</p>		

Table.3. Summary of regulatory framework

2. Regulatory framework		Milestone 1
2.1. RRPIC understands the need for and the scope of the regulatory framework and the specific plan needs to be developed		
Basis of evaluation	Evidence	Observation
2.1.1. Establishment of an authorization process and inspection and enforcement capability	The amendment of nuclear energy law by the parliament.	Based on this amendment, Nuclear energy commission was established by the Government decision on 02 <sup>nd</sup> March 2015. The regulatory body has been restructured and transferred from NEA into the General Agency for Specialized Inspection (GASI) as Nuclear and Radiation Inspection Department. GASI established procedure for authorization, inspection and enforcement for practice and control of radiation source users.
2.1.2. Development of regulations and guides covering nuclear and radiation safety and nuclear security	Basic safety regulation on radiation Radiation safety regulation on protection and safety (2015) Regulation on security of radiation sources (2015) Radiation safety regulation on exploration of radioactive mineral Regulation on management of radioactive waste from mining and milling of ores (2015) Regulation on internal control of licensee (2015) Technical regulation for acid in situ leach uranium mining (2015)	Basic safety regulation on radiation has been established in 2015. The purpose of this regulation is to define permissible radiation dose level regarding to international guideline for public and radiation workers, permissible dose of radiation contamination of food, permissible radon limit for working place, house and apartment, permissible level of surface contamination. Radiation safety regulations on protection and safety have been established in 2015. The purpose of this regulation is to define safety requirements for radioactive material and radioactive sources, and to protect people and environment from effect of ionization radiation.

Evaluation: **Minor action needed**

The parliament amended the nuclear energy law in 13<sup>th</sup> February 2015. Based on this amendment, Nuclear energy commission was established by the Government decision on 02<sup>nd</sup> March 2015. According to the amendment of the law and Government decision, the Regulatory body has been restructured and transferred from NEA into the General Agency for Specialized Inspection /GASI/ as Nuclear and Radiation Inspection Department. Nuclear and Radiation Regulatory Department of the GASI is a Regulatory Body in Mongolia and its general functions are following:

- Assessment of applications
- Authorization /licensing/ for radiation sources
- Inspection /verify compliance/
- Enforcement /ensure compliance with requirements/

Table.4. Summary of human resource development

3. Human resource		Milestone 1
3.1. A plan exists to develop and maintain the required human resources at the national level		
Basis of evaluation	Evidence	Observation
3.1.1. At this stage, this will be an integrated plan that can be developed, in a co-ordinated way, into plans for each organization. In particular, the knowledge and skill for the preparation of the BIS or contract specification in phase 2 were identified and specific plan was developed for required HR.	Establishment of the Institute of Physics and Technology, MAS Establishment the Nuclear Research Center, National University of Mongolia Establishment the Mongolian University of Science and Technology (MUST) Intergovernmental agreement and memorandum of understanding.	<i>The Institute of Physics and Technology, MAS</i> is a research institute in Mongolia, which carries out basic researches in theoretical and experimental High Energy Physics <i>The Nuclear Research Center, National University of Mongolia</i> is a research and educational institute in Mongolia, which carries out basic and applied researches in low energy Nuclear Physics. Nuclear engineering (bachelor degree) Nuclear power and nuclear technology (both bachelor and magister degrees) Nuclear technology (Ph.D. degree) <i>The Mongolian University of Science and Technology (MUST)</i> prepares engineers, and there is a long and good experience in training engineers in mechanical, electrical, thermal and power engineering. Non-destructive testing laboratory was set up in MUST. 10 bachelors in field of mining and nuclear energy in Russian according to MOU and intergovernmental agreement. It means, at least 10 nuclear engineers will graduate in every year.
Evaluation: <b>No action need</b> The Nuclear Research Center, National University of Mongolia should be continually carried out nuclear engineering. And if it possible, there should be to developing and improving for exchange program with another foreign universities and institutes.		

#### 4. Conclusions

The self-assessment in this paper shows that it is an essential and useful tool to identify weakness and additional works needed to develop its national infrastructure for implementing new nuclear research reactor project. Three specific issues from IAEA nineteen milestone infrastructure issues have selected and assessed utilizing the IAEA assessment methodology. Some weakness issues of Mongolian legislative framework have been identified as that existing legislation is addressing mainly radioactive minerals and radioactive isotopes. Because of this reason, legislative framework should be amended for nuclear facility including research reactor. In case of regulatory framework, Mongolian regulatory framework was restructured in 2015, and the Nuclear and Radiation Regulatory Department of the GASI is a Regulatory Body in Mongolia and its general functions are following: assessment of applications, authorization for radiation sources, inspection and enforcement. However, this structure should be considered because some functions are conflicted. Human resources have been preparing by national universities and institutes,

and joining to foreign universities in national level. Because they haven't practical experience, integrated knowledge and specific training for staffs is necessary for implementing research reactor project. Before starting a research reactor project, integrated plan for human resources should be developed.

#### Acknowledgement

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