



AEOI

The 1st draft of the SMRs User Requirements: Iran

July, 2019 – IAEA, TWG-SMR



Panel A Conclusion at the 1st meeting:

Future Work

1. Develop the 1st draft of specific User's Requirements Document (RD): the non-developed TWG-SMR members (Jordan, Indonesia, Australia, Iran, Pakistan, India) would prepare the 1st draft of the RD by the next 6 months.
2. Consultancy Meeting in 2018: The other IAEA member countries would be familiar with the SMR and the RD. In this meeting the 1st draft of the developed specific RDs would present to the participants and ask them to develop their documents by the next 6 months.
3. Technical Meeting in 2019: all the developed RDs would be presented and the 1st draft of the generic RD would be developed by the TWG-SMR Panel A members, during the next 6 months.
4. IAEA: in parallel to activities 1-3, IAEA staff try to provide the TWG-SMR Panel A members with the associated criteria.



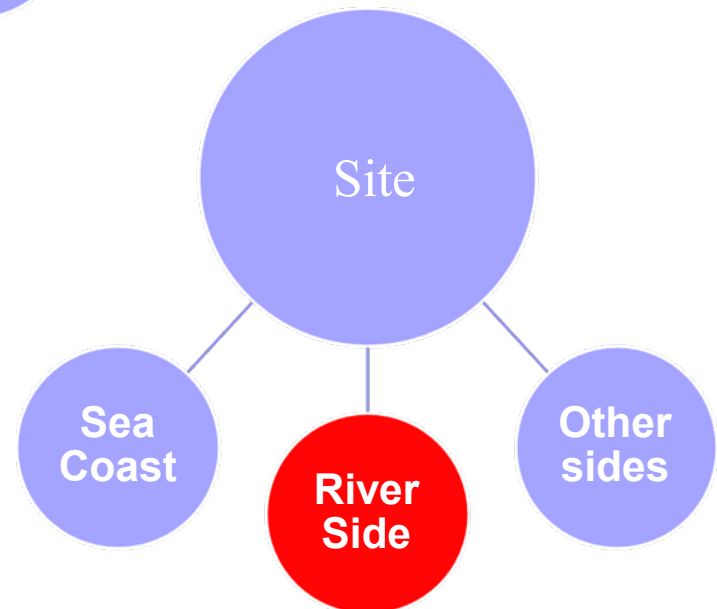
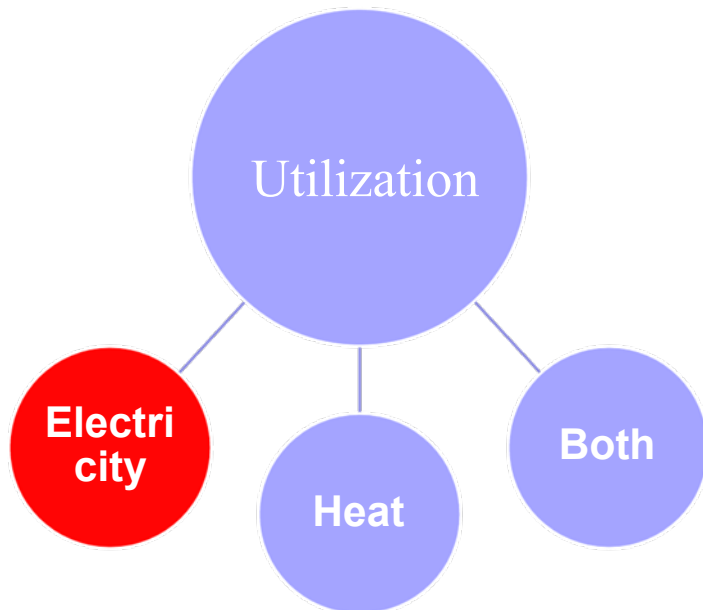
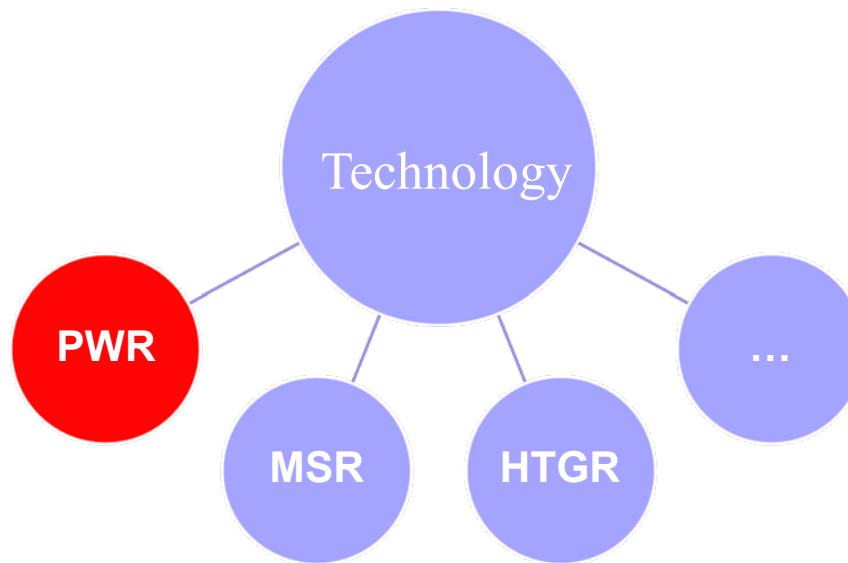
**SMALL AND MEDIUM REACTORS USER
REQUIREMENTS DOCUMENT: IRAN**

DRAFT

December, 2018



Assumptions:





Chapter 1: Introduction to the URD

This chapter includes:

1. Purpose and scope of the URD

The purpose is to provide IRAN's requirements for SMRs to be used for electricity generation, utilizing Pressurized Light Water Reactor technology.

2. Relation to existing technical documents

In this section some of the applicable rules, regulations, codes and standards have been presented. Obviously, the design of SMRs has to be in conformance to these items.



Chapter 2: National Nuclear Energy Program

This chapter includes:

1. IRAN energy profile (Energy mix)
2. Role of nuclear energy
3. Incentives for SMRs
4. Additional considerations



Chapter 2: National Nuclear Energy Program

Major Incentives for SMRs in Iran:

- Reduced construction time
- Better match to the electricity grid requirements
- Greater flexibility in site locations
- Simpler design and easier operation and maintenance
- Modular units
- Increased safety margins
- Potential for low severe-core-damage frequency and minimal accident consequences
- Making use of national infrastructures in order to develop national industry and provide technical knowledge transfer



Chapter 3: Site-Imposed Requirements

In Iran, a large number of points can be intended as suitable sites for the construction of SMRs, having a variety of geographical and climatic conditions. However, in the presented URD a typical site location has been considered for which the following data have been presented.

1. Site conditions
2. External events
3. Site Infrastructure
4. Allowable Radioactivity Release
5. Emergency Preparedness
6. Allowed Proximity to Urban Area



Chapter 3: Site-Imposed Requirements

Site conditions:

Site Name: Darkhovein

Distance to the river: 490 m (approx.)

Site elevation: 3 to 5 m above mean sea level (MSL)

Prevailing wind speed: 6 m/s

Annual mean min./daily/max. temperature: 17.5/25.5/33 °C

Annual mean min./daily/max. humidity : 30 and 85 %

Mean annual precipitation: 200 mm.

Long term min./mean/max. river flow rate: 159/530/1332 m³/sec

Max./min. recorded river water temperature: 36/9 °C

Site water table depth: 2 to 3 m

Site distance to the nearest urban and rural population centers:

5.6 km (city with 5759 people) and 1.5 km (village with 168 people)



Chapter 3: Site-Imposed Requirements

External events:

- Human Induced Events including
 - aircraft crash;
 - explosion, fire, toxic and flammable gases
 - ship collision
 - missiles
- Natural Events
 - extreme meteorological conditions
 - hydrological hazards
 - earthquake
 - volcanism



Chapter 3: Site-Imposed Requirements

Site Infrastructure:

- availability of a 400 kV overhead transmission line
- availability of the river as the site water source
- accessibility to highway located at a distance of 3.4 km from the site
- accessibility to railroad located at a distance of 19 km from the site
- accessibility to airport located at a distance of 26 km from the site
- availability of telecommunication tower
- accessibility to medical center located at a distance of 5.6 km from the site



Chapter 3: Site-Imposed Requirements

Allowable Radioactivity Release:

■ **Occupational Exposure**

- Effective dose: 100 mSv/5year, but do not exceeding 50 mSv for any year

■ **Public Exposure**

- Effective dose: 1 mSv/year (In special circumstances: an effective dose of up to 5 mSv in a single year provided that the average dose over five consecutive years does not exceed 1 mSv per year)



Chapter 4: Licensing Requirements

The plant shall be licensed by the Iran Nuclear Regulatory Authority (INRA) before being established and applied in Iran. To meet this requirement, the licensee should submit the application for licensing to the INRA.

In the presented URD the following topics have been described in detail:

1. National regulations
2. Licensability in the country of origin
3. International guidelines and technical documents



Chapter 5: Technical Requirements

This chapter covers the expected technical requirements for the SMR, concerning its intended application. This requirements have been classified under the following topics:

1. Safety requirements
2. Performance requirements
3. Plant design requirements



Chapter 5: Technical Requirements

Safety requirements:

In the prepared URD, the safety requirements have been explained through the following sections:

1. Accident resistance,
2. Accessibility during accidents,
3. Core damage prevention and mitigation,
4. Passive safety,
5. Instrumentation and control,
6. Radiation protection,
7. Good neighbor policy,
8. Protection against sabotage.



Chapter 5: Technical Requirements

Some of the Core damage prevention and mitigation requirements are as follows:

- Assuring the specified safety system functions by the use of redundant divisions
- Providing independent and separated safety divisions
- Provision of systems to maintain the plant in a safe condition during a station blackout for at least eight hours
- Core Damage Frequency (CDF) of less than 10^{-6} /reactor-year
- A limiting significant release frequency of 10^{-7} /reactor year, assuming no need to any operator action for 72 hours following a design basis accident
- Provision of a combustible gas control system
- Capability for flooding the reactor cavity after a severe accident



Chapter 5: Technical Requirements

Performance requirements:

This section specify the expected performance of the SMR under the following subjects:

1. Applications
2. Interface
3. Availability/reliability
4. Design lifetime
5. Ageing management
6. Maneuverability
7. Assessment methodology



Chapter 5: Technical Requirements

Plant design requirements:

In the prepared URD, the design requirements have been explained through the following sections:

1. Design approach
2. Design margins
3. Human factors and man-machine interface
4. Standardization
5. Proven technology
6. Constructability
7. Modularization
8. Capability against load rejection
9. Reactor type
10. Siting
11. Plant restricted area
12. Ease of operation and maintenance
13. Maintainability
14. Quality management
15. Decommissioning



Chapter 6: Fuel Cycle and Waste Management Requirements

This chapter of the URD, addresses the requirements associated with the fuel cycle and waste management. This chapter includes:

1. Fuel design
2. Fuel supply
3. Spent fuel management
4. Radioactive waste management



Chapter 6: Fuel Cycle and Waste Management Requirements

Fuel design:

Some of the requirements for fuel design are:

- Qualification of the fuel shall be based on proven performance under closely similar conditions as for the intended service in presently operating plants.
- The fuel assemblies shall be designed mechanically to withstand the most limiting design accidents without breach of fuel cladding or impairing the ability to shut down the reactor and remove decay heat.
- Fuel assemblies shall be designed to withstand shipping and handling loads of 4g both before and after irradiation without sustaining any damage.



Chapter 6: Fuel Cycle and Waste Management Requirements

Spent fuel management:

Some of main requirements for spent fuel management are:

- The plant shall have adequate storage to accommodate spent fuel storage for 10 years plus one core off-load, various irradiated equipment, and failed fuel storage.
- Plan and procedure for leaking or damaged spent fuel handling, including measures for its storage must be provided.
- The generation of radioactive waste shall be kept to the minimum practicable level by means of appropriate design measures and procedures, such as the recycling and reuse of material.



Chapter 6: Fuel Cycle and Waste Management Requirements

Radioactive waste management:

This section covers the following subjects:

- Storage
- Waste treatment
- Discharge
- Transfer
- Disposal



Chapter 7: Economic Requirements

Usually economic considerations constitute the dominant factor in any decision to undertake a nuclear energy project, although in a few exceptional cases there may be other overriding reasons for the introduction of an SMR.

This chapter includes:

1. Criteria and evaluation methodology
2. Measures for improved economics
3. Financing

The availability of adequate and secure financial resources is one of the most important requirements affecting the implementation of SMRs.



Chapter 8: Special National Requirements

These requirements include:

1. Manpower development,
2. Infrastructure and national participation,
3. Technology transfer,
4. Licensing support,
5. Contractual options and responsibilities,
6. Extended guarantees and warranties,
7. Nuclear fuel,
8. Special materials and spare parts supply,
9. Technical support,
10. Long term partnerships.



Thank you