

Rokkasho: Japanese Site for ITER

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Abstract. The Atomic Energy Commission of Japan authorized ITER as the core machine of the Third Phase Basic Program of Fusion Energy Development. After a series of discussions in the Atomic Energy Commission and the Council of Science and Technology Policy, Japanese Government concluded formally with the Cabinet Agreement on 31 May 2002 that Japan should participate in the ITER Project and offer the Rokkasho-Mura site for construction of ITER to the Negotiations among Canada (CA), the European Union (EU), Japan (JA), and the Russian Federation (RF). The JA site proposal is now under the international assessment in the framework of the ITER Negotiations.

1. Introduction

The site proposal for ITER is to be made in accordance with the “the site requirements and site design assumptions” defined by the extended-EDA Parties (EU, JA, RF) during the ITER Engineering Design Activities (EDA)^[1], which include the issues such as land, heat sink and water supply, electric power supply, transportation and shipping, technological and socio-cultural infrastructure, regulation and decommissioning. In addition, some aspects are considered for international joint assessments such as the relation between the ITER legal entity and the host country, licensing process, operation and decommissioning costs.

Japanese Government (MEXT) set up a site assessment committee in mid-2001 and completed its assessments for three candidate sites in Japan, i.e., Naka, Rokkasho, and Tomakomai. As a conclusion, it was confirmed that the Rokkasho site shown in Fig. 1 could satisfy the generic site requirements and site design assumptions with some additional works. The key features of the Rokkasho site are described in this paper.

* Comprised of Japanese Government (MEXT:), Aomori Prefectural Government, and JAERI.

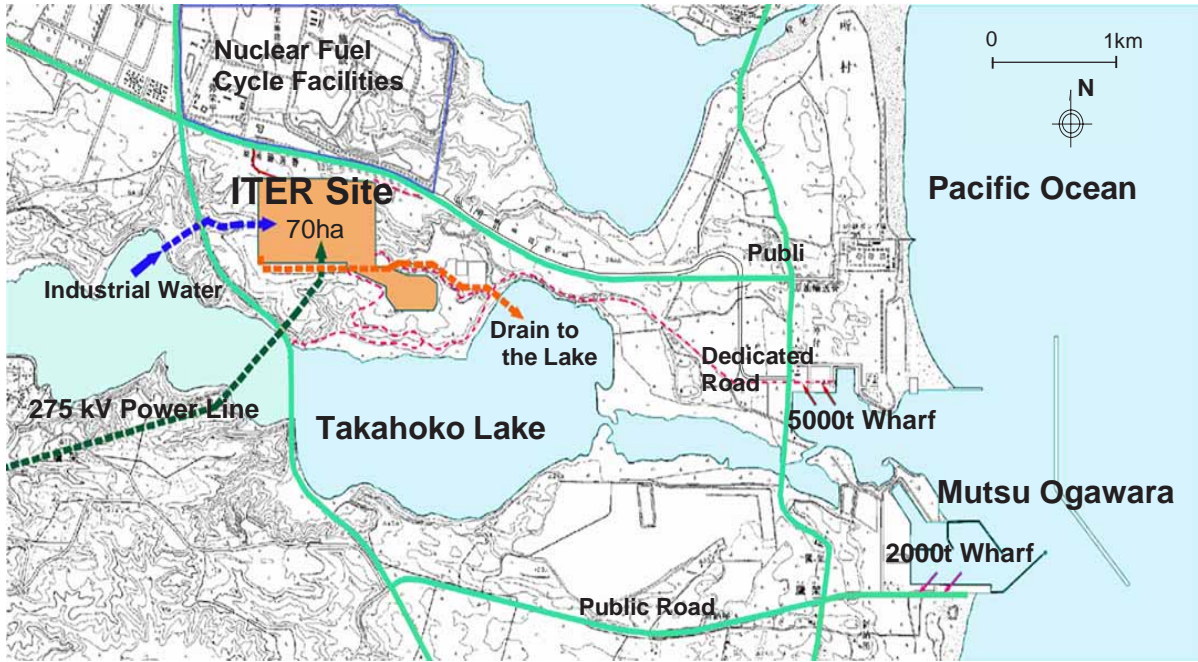


Fig. 1. Rokkasho-Mura site for ITER.

2. Technical Aspects of Site Requirements

2.1. Land and geotechnical characteristics

The land area of 40 hectares is required basically and additional 30 hectares are necessary for a temporary use. The geological investigations indicate as shown in Fig. 2 that the site has a good supporting rock-bed (Neogene Takahoko Strata) at a shallow depth with a long-term stable bearing capacity larger than 200 tons/m².

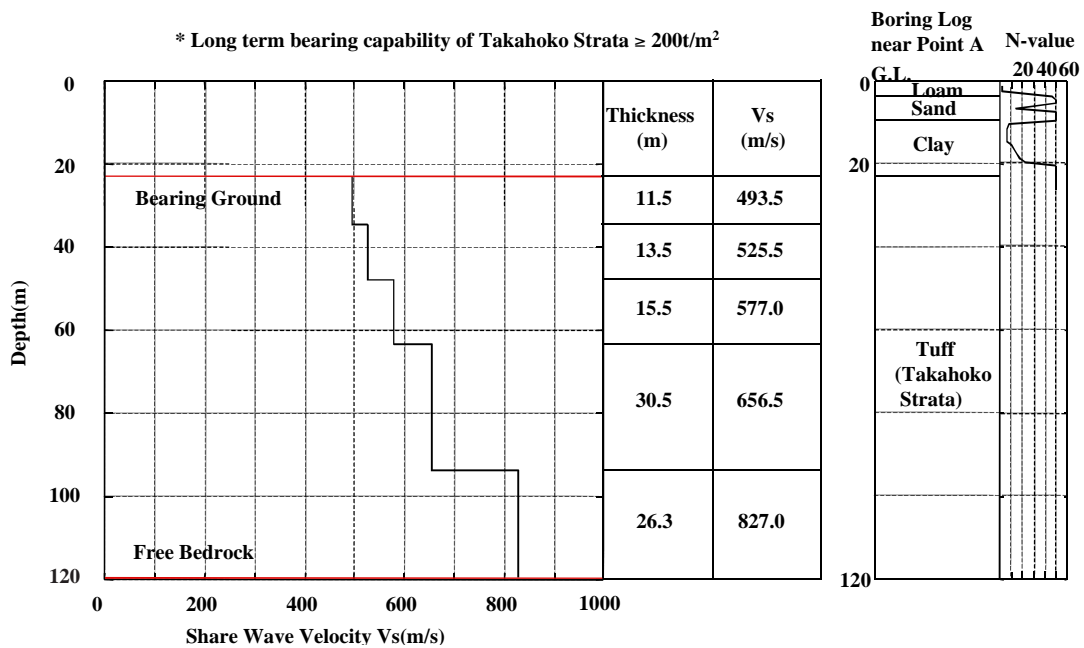


Fig. 2. Geological profile around Rokkasho-Mura site.

The design basis earthquake is given at the free bed rock surface with a shear wave velocity over 700 m/s. Seismic isolation with laminated rubber bearings is adopted against the design basis earthquake with a peak acceleration of about 230 gal. The structure and its assembling are shown in Fig. 3.

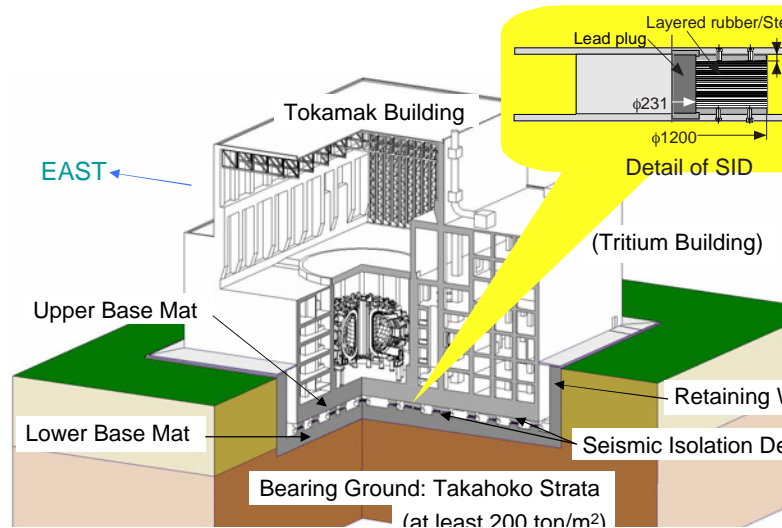


Fig. 3. Seismic isolation of Tokamak building.

2.2. Heat rejection and cooling water supply (Fig. 4)

The site is located beside a fresh water lake and is also close the seashore as shown in Fig. 1. Water supply for either direct cooling or evaporation cooling is afforded sufficiently to reject the 450 MW average heat. A standard option of cooling tower system requires the fresh water supply of 16 m³/min. (23,000 m³/day), which is drawn from the Takahoko Lake. The direct cooling can be done by rejecting the heat into the Mutsu-Ogawara Port.

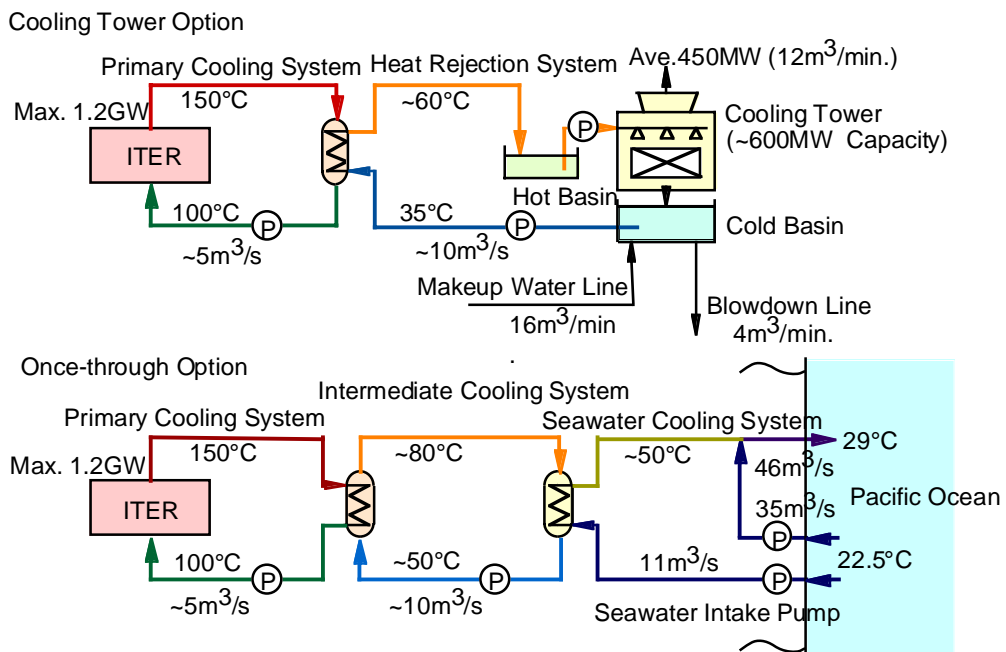


Fig. 4. Possible heat rejection of ITER at Rokkasho site.

2.3. Electrical power supply

A steady state as well as pulsed electric power required for the ITER operation will be supplied by a 275 kV utility line. The utility power line around the ITER site is given in Fig. 5. Reactive power compensators and high-pass filters will be required to suppress the voltage fluctuations and the higher harmonics generation. A fast active power will be supplied by a variable-speed motor-generator with a flywheel, which is effective in reduction of the network frequency disturbance as well as of the output fluctuations of the nearest neighbor nuclear power generator for a pulsed load of ITER up to 270 MW.

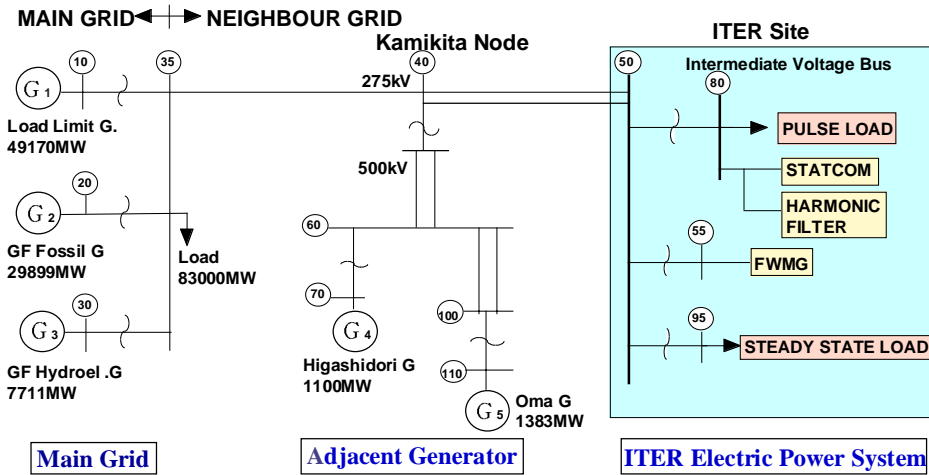


Fig. 5. Utility power line for ITER.

2.4. Shipping and Transportation

The Mutsu-Ogawara Port faced to the Pacific Ocean locates about 5 km away in the east from the site as shown in Fig. 1. A 5,000 tons class ship can be docked at this Port and components as heavy as 1,000 tons can be unloaded and transported to the site by using a barge ship as shown in Fig. 6 through the existing public road. The outer most PF coils and the assembled CS coil will possibly be transported, indicating no on-site manufacturing work of these coils.

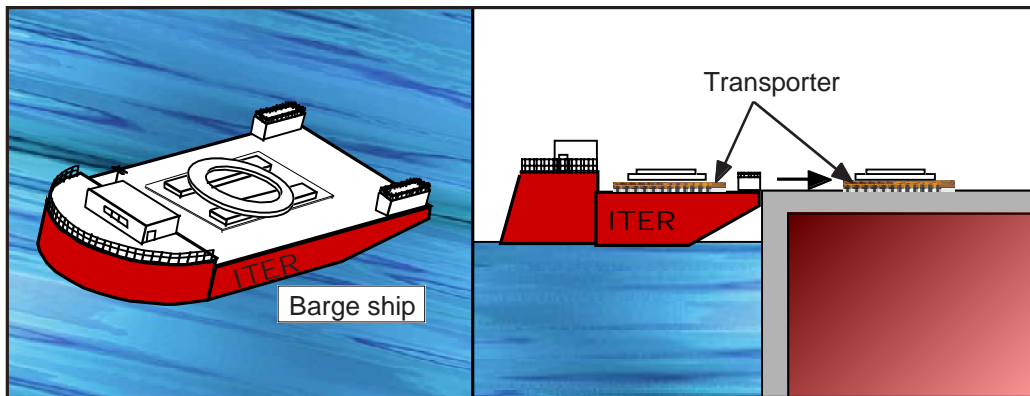


Fig. 6. Shipping by barge ship for 1,000 tons class equipment.

2.5. Tritium transport

Tritium is firstly assumed to be procured from Canada. One sea-container can carry three 50g-T transport packages and consequently six shipments per year will be sufficient for the ITER consumption of Tritium; 0.9 kg-T/year averaged over 20 years of operation. The transport package will be approved as a BU-type package stipulated in the IAEA regulation.

3. Scientific and Industrial Infrastructures

A large-scale nuclear-fuel reprocessing plant is now under construction in Rokkasho-Mura and a few thousands of engineers and technicians are working here. Sufficient industrial infrastructures and workforce are available. People in the region tend to have good understanding in the nuclear energy development with these circumstances.

Fusion research in Japan is promoted as a national program. Many fusion scientists and fusion laboratories/institutes are ready to support the ITER project when constructed in Japan.

4. Socio-cultural Infrastructure

Establishment of an international school is planned in Rokkasho-Mura, which will provide instruction for the children of foreign residents. A comfortable residential environment will be provided in the surrounding area as well. There are many medical facilities, including hospitals, clinics, and dental offices, and treatment in English is available. Various sports and cultural attractions, as well as shopping centers, are found in this area.

5. Licensing Aspects

The ITER facilities as a principle will be regulated by laws and regulations concerning the nuclear safety regulation, which comes under the Atomic Energy Basic Law, because the facilities generate radiation and hold radioactive materials such as Tritium. Taking into account the intrinsic safety features of ITER, the Nuclear Safety Commission and the regulatory authority are to take a reasonable approach for ensuring the ITER safety. The major safety requirements are appropriate radiation protection, prevention of accidents and mitigation of consequences of accidents. It is not necessary in the case of ITER to assume preparedness for nuclear disaster, which is obligated to the fission facilities.

6. Rad-Waste Disposal

Japanese Government and the local governments (Aomori Prefecture and Rokkasho-Mura) stated to accept the final disposal of the entire ITER rad-waste in the site or in its

vicinity. The actual disposal (Fig. 7) will be conducted along the technical guidelines provided by the Atomic Energy Commission of Japan in 1998.

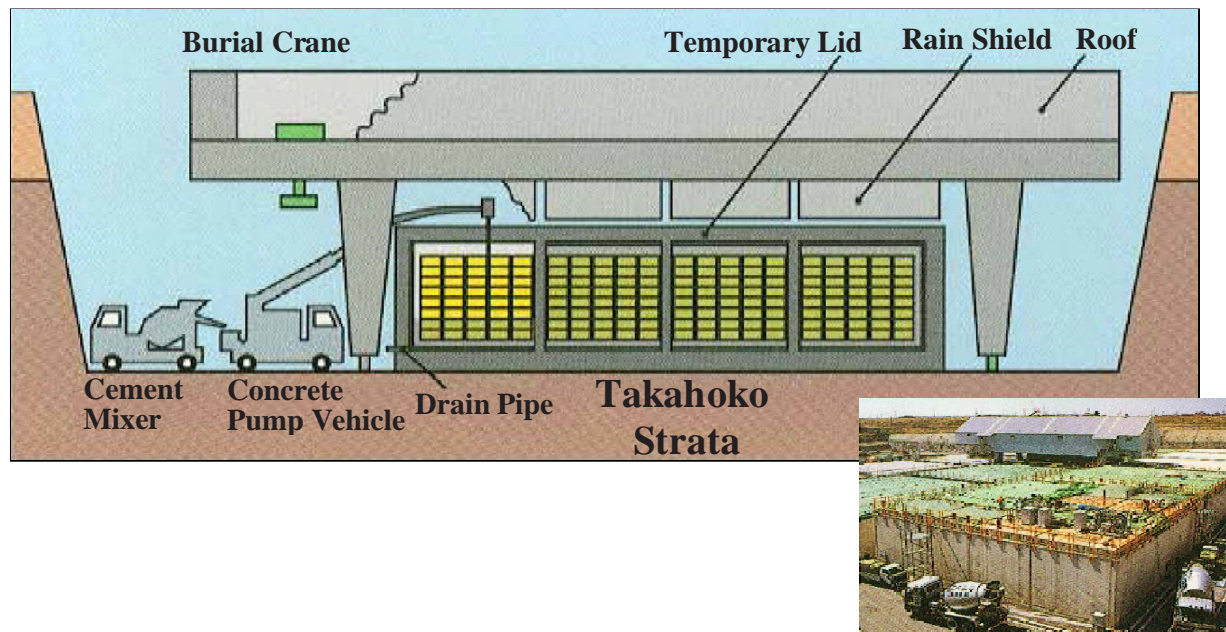


Fig. 7. Low level rad-waste disposal at Japan Nuclear Fuel Ltd.

7. Summary

The Rokkasho site satisfies the ITER site requirements and site design assumptions defined in the ITER Engineering Design Activities (EDA). The flexibility of land area and its topology, sufficient capability of electric power and water supply, transportation capability of heavy components and high quality and affordable skills and workforce ensure the safe and reliable construction and operation of ITER. A specific benefit of the site is the availability of the rad-waste disposal in the site or its vicinity. The Nuclear Safety Commission and the regulatory authority of Japan consider to regulate the ITER facilities to ensure its safety in flexible and practical manners.

Reference

[1] ITER Technical Basis (ITER EDA Documentation Series No.24), 2002, IAEA.