Status of Kijang Resarch Reactor Project

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1. Introduction

The High-flux Advanced Neutron Application Reactor (HANARO) is a multi-purpose reactor in Korea Atomic Energy Research Institute (KAERI) and is being utilized for neutron scattering experiments, material and fuel tests for nuclear power plants, radio-isotope (RI) productions, silicon doping, neutron activation analysis, and neutron radiography.

In medical applications, the majority of RIs produced using HANARO are I-131 and Ir-192. Other RIs such as Mo-99 are coming from imports. The self-sufficiency of RI demand becomes an important issue for the public health service in Korea. In this regard the Kijang Research Reactor (KJRR) project was officially launched on the first of April 2012 in need to provide the self-sufficiency of RI demand including Mo-99, increase the neutron transportation doping (NTD) capacity and develop technologies related to the research reactor.

This paper is intended to describe overall status of the project and future plan.

2. Progress of KJRR

KJRR project includes the installation of a reactor facility, fission molly production facility (FMPF), utility facility, radio isotope production facility (RIPF), and rad-waste treatment facility (RWTF). The major design characteristics of the reactor are as follows; reactor power 15MWth, pool type, neutron flus 3.0×10^{14} n/cm^2 s, operation day 300days/year, design life 50 years, LEU U-Mo plate, and Beryllium reflector.

The site is very close to Busan which is the second largest city in Korea. Busan has an international airport and harbors which will provide good accessibility for people as well as easy transportation of products.

A company for architects engineering (AE) was contracted in April 2014. The AE company confirmed the site layout based on geological and seismological investigation and have development a general arrangement. Also, KAERI ensured absolute ownership of lands within exclusion area before the application of construction permit (CP) application. In November 2014, the application of CP was submitted. Currently, safety review is undergoing since November 2015.

2.1 Site Grading Work

The site grading work was completed as seen in Fig. 1.

Fig. 1. Site grading work.

Site has been graded in two elevations. In the elevation EL+67m, main facilities including a reactor facility, FMPF, RIPF and WRTF will be located. In the elevation EL +61m, auxiliary facilities such as a colling tower, demi-water system, pump house, and natural evaporation facility are arranged. Fig. 2 shows the current development of the site layout.

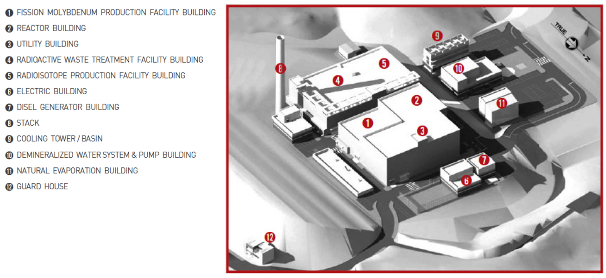

Fig. 2. Current development of site layout.

2.2 General Arrangement

The general arrangement for reactor facilities has been developed. The reactor facility is 20meter height above ground and four stories below. The foundation is placed at 24 meter below the ground level. The reactor is of open-pool design. The reactor pool is connected to the service pool that provides working area and storage space for the spent fuel. The irradiated fission molybdenum (FM) target is transferred through the service pool to the processing hot cells in FMPF.

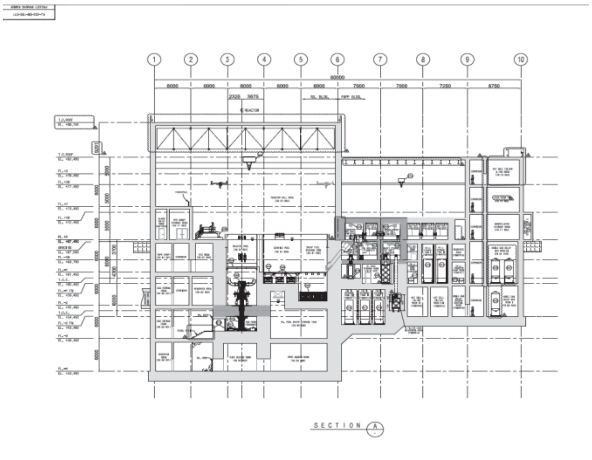

Fig. 3. Section view in general arrangement.

2.3 Licensing

KAERI applied a CP in November 2014 to ensure that the technical standards for the location, structure, facility, and performance of research reactor are met. Documents submitted for CP are a radiation environment report (RER), preliminary safety analysis report (PSAR), quality assurance program (QAP) for construction, and description of technical capability (DTC). Reviewing schedule is 12 months in the light of changes. OL is scheduled to be submitted in September 2017. It is additionally to perform safety review on the operating capability and accident management.

2.4 Project Progress Measurement

The project management progress plan is prepared by the proportion of overall project physical progress. There are engineering progress plan by engineering deliverables for each category, where the weight of engineering deliverables is based on the estimated man-hours. The procurement progress plan includes equipment and bulk materials to be purchased by a contractor, where the weights are based on the costs. The construction progress plan covers mobilization, demobilization, management, temporary facilities and permanent facilities. The overall progress plan can be prepared by integrating each progress plan.

Table I: Overall Progress Baseline

PHASE	WEIGHTED %
ENGINEERING	27.6
PROCURMENT	23.1
CONSTRUCTION	49.3
OVERALL TOTAL	100.00%

The overall project progress is the sum of the product of the weight factor and the physical progress for each discipline. The project S-curve can be developed and used to monitor the performance of the project.

The steps for the development of the progress curve is as follows; 1) collect project requirements and scope, 2) develop work breakdown structure (WBS), 3) develop schedule, 4) assign planned hours in each activity or each deliverables such as engineering documents, 5) calculate relative weights, 6) distribute the percentage over the time line, and 7) calculate the progress for each WBS.

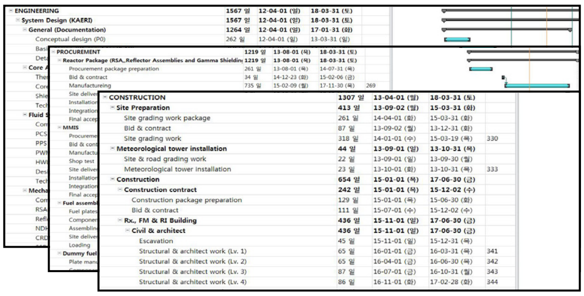

Fig. 4. Work breakdown structure for engineering, procurement and construction.

The project is considered 45 percent complete at December 2015.

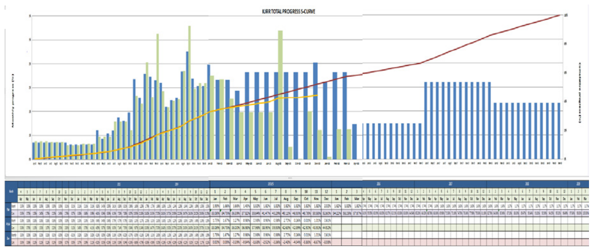

Fig. 4. Total Progress Curves.

3. Conclusions

When CP is granted, the first excavation is planned to start at the end of this year. In next year, pouring the first concrete and energizing 154kV will follow. In 2018, it is planned to complete utility building construction and reactor building construction. The man-machine interface system and reactor assembly package will be installed at the end of 2018. In 2019, initial fuel loading and the first criticality is schedule.

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