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Site Investigation for Detection of KIJANG Reactor Core Center

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1. Introduction

The KIJANG Research Reactor (KJRR) project, which is one of the major national projects for nuclear science and engineering in Korea, was officially launched on the first of April 2012 and it will take six years for its construction and commissioning. It was planned for the end of March 2017 and extended to April 2018 according to the government budget adjustment.

The KJRR project is intended for filling the self-sufficiency of RI demand including Mo-99, increasing the NTD capacity and developing technologies related to the research reactor.

In project, site investigation is the first activity that defines seismologic and related geologic aspects of the site. Site investigation was carried out from Oct. 2012 to Jan. 2014 and this study is intended to describe detail procedures in locating the reactor core center.

2. Methods and Results

2.1 Site Selection

The preferred site, called KIJANG, was selected by the site selection committee, which was formed in July 2010, from nine local autonomous bodies that have expressed their wish to host a new research reactor.

Korean regulations require mainly six siting criteria for nuclear facilities, 1) geologic and seismic criterion, 2) exclusion area criterion, 3) meteorological criterion, 4) hydrological criterion, 5) external human induced criterion, and 6) possible emergency planning criterion.

Based on such regulations, the preliminary geological survey (2010) by the Geological Society of Korea was carried out showing that andesite is widely found with less weathering and erosion at the preferred site. It won't have a problem as basement rock in strength and geological condition. Also, Korea Development Institute (KDI) assessed geography, demography, and human-induced conditions, in 2011, to identify potential hazards before the project was started [1].

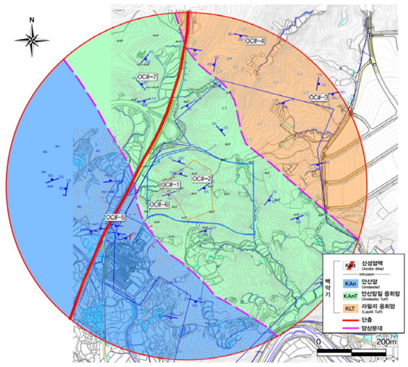
The location of the reactor is preferred to be surrounded by hills that provide favorable physical protection as natural safeguards (Fig. 1).

2.2 Geological and Seismological Investigation

Geological and seismological investigation was established to obtain the geological and seismic data. The investigation was planned using variety of appropriate methods; surface investigation, surface geophysical investigation, subsurface investigation, and in situ testing. Total 19 borings were conducted with 4.3km electrical resistivity survey and 4.5km seismic refraction and reflection survey.

Fig. 1. Bird's eye view of the reactor building, surrounded by hills.

Surface investigation is to prepare topographic maps for regional analysis, determination of faults and fracture patterns, and other feature of interest [2]. As results, Fig. 2 shows fracture patterns of different kind of rocks, mainly perpendicular to the Ilkwang fault.



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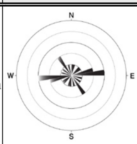
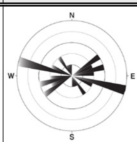
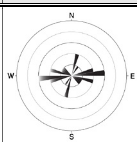
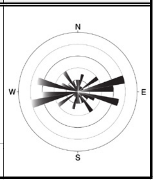
Rose Diagram				
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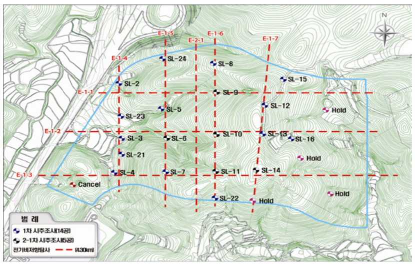
Fig. 2. Fracture patterns of different kind of rocks at the site.

Surface geophysical investigation includes seismic refraction and reflection, surface electromagnetic, and electrical resistivity surveys. These surface geophysical measurements were calibrated with boring logs. The resulting 3-D fence drawings of electrical resistivity and seismic refraction and reflection are shown in Fig. 3 and Fig. 4 respectively.



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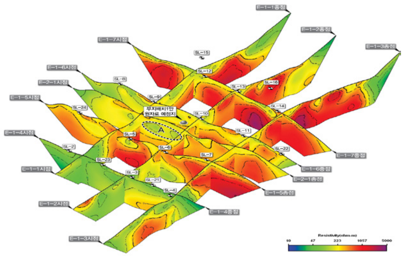
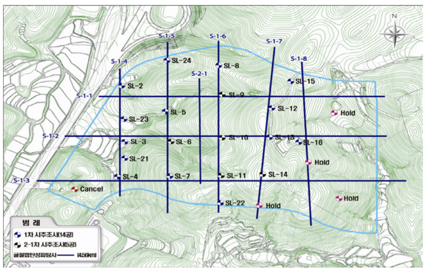


(b)

Fig. 3. (a) grid and (b) 3-D fence drawings of electrical resistivity.



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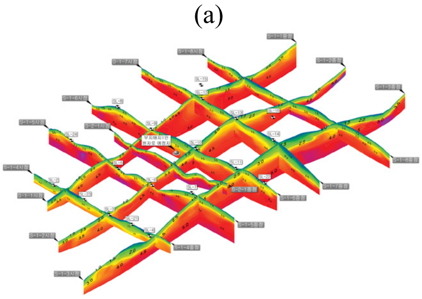


(b)

Fig. 4. (a) grid and (b) 3-D fence drawings of seismic refraction and reflection.

Subsurface investigation serves to explore three-dimensional distribution of both geologic condition and engineering properties at the site. Borings are the most effective method to obtain detail geologic information of the subsurface. Fig. 5 shows contour map of medium rock after 19 borings.

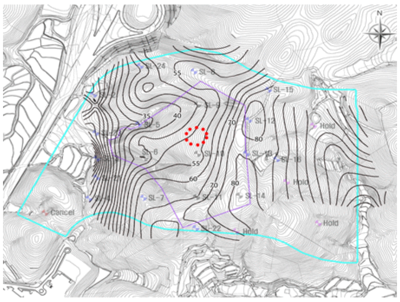


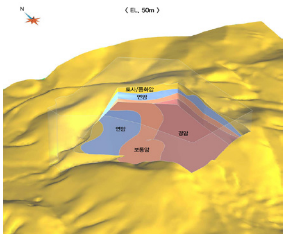
Fig. 5. contour map for medium rock in the site.

Medium rock lies below an elevation (EL) of 10 m on the left side of the site, which is expected to be within influence area of Ilkwang fault. The preferred area at the site is marked with red dot circles in Fig. 5. The medium rock is observed below an EL of 50~55m and hard rock at EL of 45~50m.

3. Conclusions

The location of the reactor core center was determined by collectively reviewing not only geological information but also information from architects engineering.

EL 50m was selected as ground level by levering construction cost. Fig. 6 shows different rock contours at the ground level. Also, four recommended locations (R-1a ~ R-1d) are displayed for the reactor core center.



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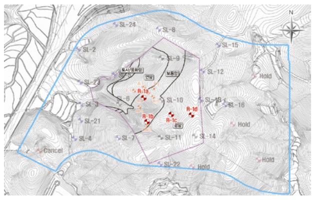

(b)

Fig. 6. (a) rock contour at ground level and (b) four recommended locations for the reactor core center.

R-1a was found optimal in consideration of medium rock contour, portion of medium rock covering reactor buildings, construction cost, physical protection and electrical resistivity. It is noted that engineering properties of the medium rock is TCR/RQD 100/53, elastic modulus 7,710~8,720MPa, permeability coefficient 2.92E-06cm/s, and S-wave velocity 1,380m/s, sound for foundations of reactor buildings.

REFERENCES

[1] KDI Report for Construction Project of a New Research Reactor, 2011.

[2] R.G. 1.132: "Site Investigation for Foundations of Nuclear Power Plants"

[3] 100CFR Part 100 Appendix A: "Seismic and Geologic Siting Criteria for Nuclear Power Plants"

[4] 10CRR 100.11: "Determination of Exclusion Area, Low Population Zone and Population Center Distance"