Current status of NPP decommissioning education using VR/AR and plans to establish KRID's training system

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1. Introduction

Virtual reality(VR) can be defined as a three-dimensional computer-generated environment, updating in real time, and allowing human interaction. Augmented reality(AR) displays are those in which the image is of a primarily real environment, which is enhanced, or augmented, with computer-generated imagery. Training using VR and AR can present a better educational environment in terms of safety, economic feasibility, and ease of implementation of changes[1]. These technologies are widely used in industry. This is a necessary technology for education and training for NPP decommissioning.

After the Fukushima accident, interest in NPP decommissioning increased in the nuclear industry, and the need for education and training to perform the decommissioning also increased. Since 2015, education related to NPP decommissioning has been conducted in Korea. Most of the education is conducted through theory and field trip education. However, the training required for actual work is insufficient. This study proposes a training plan for decommissioning through VR and AR based training facilities in KRID.

2. NPP Decommissioning educatioin cases

2.1.Domestic NPP decommissioning training cases

The 'Decontamination technology and environment restoration technology course' conducted by the Korean Association for Radiation Application(KARA) in 2015 is the first NPP decommissioning education in Korea. In addition, through convention with organizations with experience in overseas decommissioning, IAEA certification joint education and KHNP-ORANO specialized training for NPP decommissioning are being conducted. These trainings consist of a general course and an expert course, and the level of knowledge of the trainees is considered. It consists of theory education and field trip education.

However, the theory and field trip education have limitations in applying to the actual decommissioning. In actual NPP decommissioning, it is necessary to understand the work process. In the case of NPP decommissioning, it is better to reduce the working time per worker as much as possible in order to minimize the radiation exposure of workers. In order to minimize the working time, reperirive training and image training are required. The application of VR/AR is a way to increase the sense of reality and immersion in the work environment. In addition, immediate correction of errors in the training process and repetitive training can be conducted for work scenarios in which errors occur.

2.2.Overseas NPP decommissioning training cases

In Japan, as shown in Fig. 1, the Naraha Center for Remote Control Technology Development(NARREC) is using a VR system as an education for Fukushima NPP decommissioning.

Fig. 1. Japan - NARREC's VRsystem

The VR system was construct based on point cloud data measured using a laser scanner and CAD and CG data. It includes simulated space monitioring function, radiation dose distrivution display function, lighting setting function, measuring distance between objects and random object input function in simulated space. Through this, robot technology is verified and worker training is conducted according to the decommissioning plan[2].

In France, as shown in Fig. 2, decommissioning education using robots is being conducted in the PRESAGE room where VR technology and haptic technology are applied.

At this time, photogrammetry, 2D plans, and laser scanning were used as input data. And worker training and actual decommissioning assistant training are based on new equipment design, remote handling simulation,

dose rate simulation, human operation simulation, and whole secario simulation[3].

Fig. 2. France - VR system in the PRESAGE room

3. Build of VR/AR training facilities in KRID

In Korea, most of the theoretical education is being conducted. Accordingly, a VR/AR-based training facility is built in the office building of KRID to provide decommissioning process education.

Decommissioning process education is classified into decommissioning work and decommissioning support work. Decommissioning work is VR training content related to dismantling and cutting. The work objects are RV, RVI, and large component. Decommissioning work training is conducted one person at a time. Decommissioning support work is AR training content for workers' provision for preparation of decommissioning and post-processing. Since this is a work that requires a large number of workers to collaborate, it is a communication training content that trains together. Decommissioning process training targets workers and managers, and conducts training and evaluation according to the difficulty of each task.

4. Conclusion

In order to perform NPP decommissioning, simulation training and repeated training based on theoretical education are required. However, in the case of NPP decommissioning, on-site training, such as exposure of workers, has limitations. In response, Japan and France are conducting worker training using VR. This also enables process verification.

In Korea, decommissioning education has been conducted since 2015. However, most of them are theoretical education, and training has limitations. Accordingly, KRID plans to build a VR/AR-based training facility that can simulate training. Through this facility, not only training on cutting work conducted overseas, but also interactive training contents performed by multiple workers can be performed. This is considered to be possible to verify the general decommissioning process.

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