

Development of Soundproof Protection Device for Decommissioning NPPs

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1. Introduction

Hearing protection device is one of the important health and safety gears to the employed workers under the decommissioning nuclear power plant (NPP). The soundproof protector is considered the soundproof sponge kernel type to protect worker's hearing by physical soundproofing. This type of soundproof protection is generally manufactured with sound insulation performance of 20dB ~ 30dB to prevent the disability to catch warning sound caused by excessive protection[1] but the problem is not hearing the surrounding voice when it is used in a quiet space. However, when the decommissioning NPP works such as demolition and cutting of reactor vessel and the related reactor coolant piping is performed, the noise of more than 100 dB[2] would be expected and therefore, the sound insulation effect would be considered to transfer a correct information on the radiation environment conditions; The sound insulation effect of the worker attached is required to effectively transmit the warning sound. This paper presents the soundproof protection device being developed for the employed decommissioning NPP's workers.

2. Methods and Results

2.1 Noise canceling

Noise canceling is a technology that blocks external noises by using offset interference by recognizing external noises and analyzing wavelengths as shown in Fig. 1[3].



Fig. 1. Noise canceling principle

In theory, it can be completely blocked, but it is difficult to achieve perfect sound insulation effect due to the time difference to the emission of anti-phase wavelength, but it is effective sound insulation technology in the field where regular noise occurs. In this way, by selectively adding the available functions, the soundproof protection that can effectively block the noise is designed.

2.2 Soundproof protection

In the case of dosimeters used inside nuclear power plants, an alarm sounds when a dose value of more than a certain value is measured. In the case of low noise work, you can hear the alarm even if you wear soundproof protection, but when dismantling the nuclear power plant, you may not hear the alarm due to various noises. To complement this, the soundproof protection is designed as shown in Fig. 2.

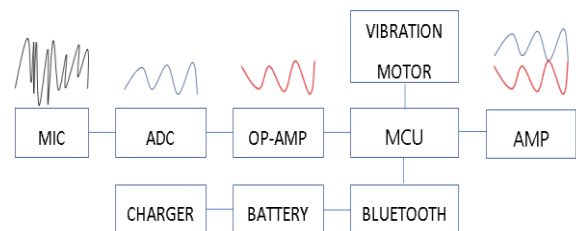


Fig. 2. Schematic diagram of soundproof protective equipment of nuclear power plant decommissioning site

The use of the existing dosimeter and soundproof protection was dualized, but it was designed to receive the information of the dosimeter as soundproof by connecting with the dosimeter using Bluetooth communication. In addition, to compensate for the situation that makes the worker unable to hear due to external noise, it is designed to be immediately confirmed by the wear by giving a vibration with a vibration motor. It is equipped with lithium ion battery to utilize wireless communication, and it is designed to be used without charging battery.

2.3 Warning alarm algorithm

When decommissioning a nuclear power plant, an alarm is required according to the problem situation and an alarm algorithm is required[4]. The server is designed to alert the server when the situation can be judged in the dosimeter and the problem occurs in the nearby area. Table 1 shows the alarm table considered

that can be received through the soundproof protection, and the operator can easily determine the situation according to the alarm.

3. Conclusions

Currently, the soundproof protective device under development shows high soundproofing effect on repeated noises, but it is possible to generate reverse phase wavelengths immediately by analyzing various frequencies to generate high soundproofing effect on irregular and various noises generated at the site of decommissioning NPP. The NESS will develop an algorithm and test how effective it is in such situations as the dismantling of nuclear power plants. In addition, it will be developed to be compatible with various devices that can be used inside nuclear power plants.

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Table 1: Expected Alarms during dismantling NPP

| | Alarm Content | judgment | Alarm way |
|---|--|---|--|
| 1 | Warning when exceeding real time dose value | dosimeter (Immediately) | Vibration, Warning message (Dose criteria exceeded) |
| 2 | Warning about personal cumulative dose values | Radiation Integrated Management System (Alarm after Judgment) | Vibration, Warning message (accumulated dose exceeded) |
| 3 | Warning when there is a problem with nearby work areas | Radiation Integrated Management System (Alarm after Judgment) | Repeat warning message (nearby areas problem) |
| 4 | Warning when there is no change in dose value | Radiation Integrated Management System (Alarm after Judgment) | Warning Message (Dosimeter Check) |
| 5 | Low battery warning | dosimeter (Immediately) | warning message (Low Battery) |
| 6 | normal | dosimeter | - |