

1. Introduction

The most powerful earthquake on record was 9.0-magnitude earthquake centered in Tohoku region in the Pacific that occurred on March 11, 2011(Fig 1). This earthquake triggered an over 20m high massive tsunami on the pacific coast, which caused the destructive damages such as over 19,000 people missing and dead. Fukushima No1 nuclear power plant (here in after called F1) was hit by tsunami, which caused the flood damage in almost all of F1. Due to the flooding F1 lost the power and was unable to cool down the nuclear reactors, thus, causing massive amount of hydrogen to generate in the nuclear reactor. Because of hydrogen build up an explosion occurred, releasing the radioactive materials into atmosphere, which contaminated the surrounding environment such as soil, rivers and forests and a wreckage. Therefore, residents living around F1 have been forced to be prolonged life as evacuees.

This paper describes the role of radiation safety control to protect the residents from released radioactive materials after F1 accident ¹⁾.

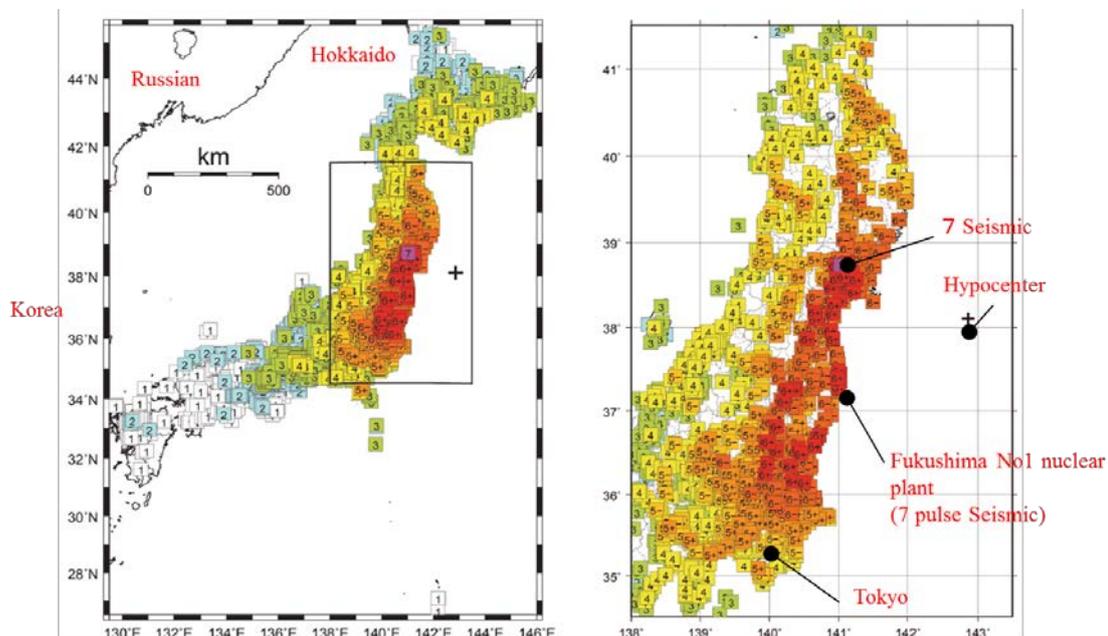


Fig1. Great East Japan Earthquake on 11th March (Seismic intensity)

2. Distance from F1 and required radiation sensor

Figure 2 shows the relationship between distance from F1 and required radiation sensor and equipment. Area can be classified three areas such as the inside of F1, refuge area and outside of refuge area depend on the distance from F1. In addition, radiation safety control can be classified three categories such as the human control, the environmental control and the article/food contamination control (Fig 2 and Fig 3). Applicable radiation sensors and equipment differ according to areas to be used. Particularly, this paper describes the personal dosimeter, the environmental monitoring post and the food contamination monitor.

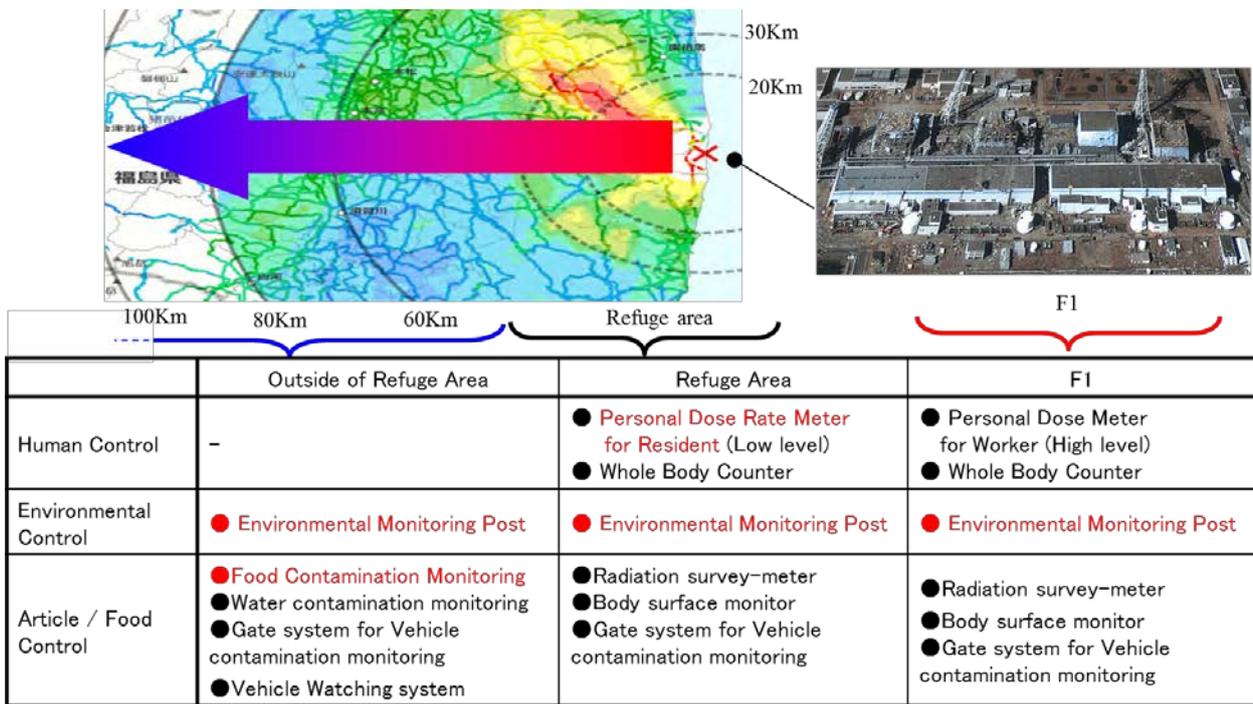


Fig2. Requirement of the radiation monitoring

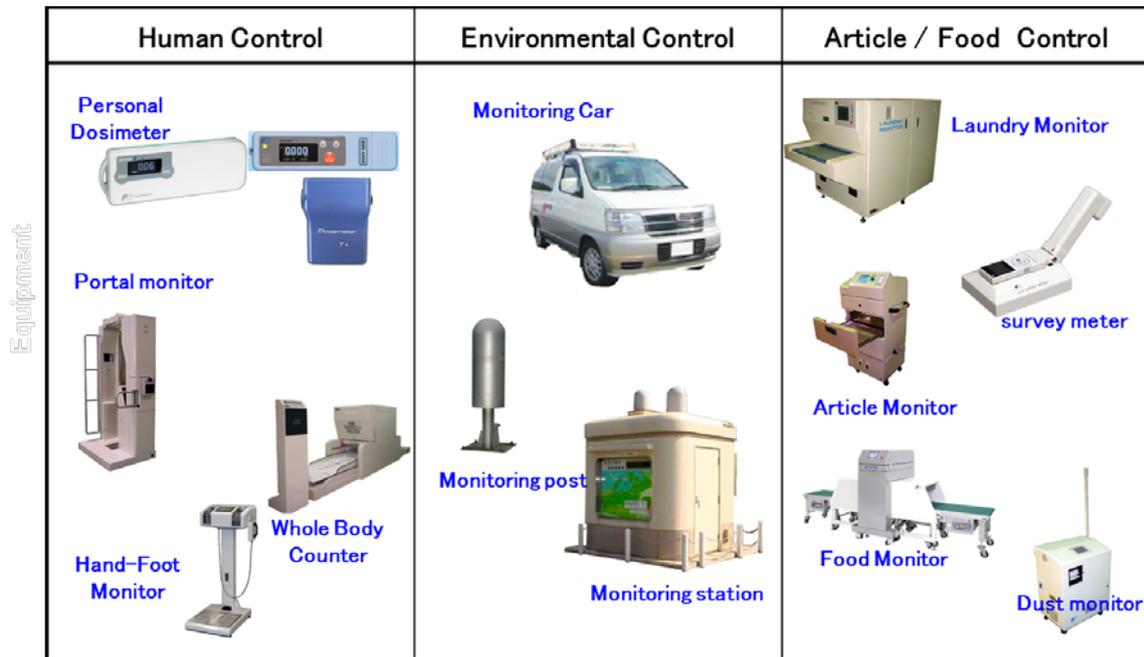


Fig3. Radiation monitoring equipment

2.1 Personal dosimeter

Figure 4 shows the personal dosimeter to detect the external exposure in refuge area for the residents. This personal dosimeter is used for control of daily exposure and detecting the hotspot where radiation materials are piled. In addition, it is almost same size as smart-phone, light weight, and water-resistant, which equipped the semiconductor radiation detector with high-sensitivity. This personal dosimeter is capable of measuring the radiation from nature radiation level and measuring the dose rate with high accuracy (radiation dose per hour), that is highly effective to detect the hotspot.

Figure 5 shows a small size personal survey meter. This survey meter also equipped the semiconductor radiation detector, which is compact with one hand and driven for 72 hours by AA battery. It is capable of measuring from $0.01\mu\text{Sv/h}$ to 99.9mSv/h for the environmental radiation measurement. In addition, data can be sent to PC through the USB connection.



Fig4. Personal DOSE Rate Meter for Resident



Fig5. Personal Survey Meter

2.2 Environmental monitoring post

Figure 6 shows the environmental monitoring post to detect the radiation dose in the environmental space. It is used for detecting the air dose from nature radiation level with high-sensitivity. After F1 accident, many environmental monitoring posts were installed at educational institute and local autonomy etc. around the Fukushima prefecture and adjacent prefectures. In case of power outage or under the situation power is not be supplied, this environmental monitoring post can operate successively with built-in solar battery. Furthermore, it has the function to collect the air dose from each location's environmental monitoring post every ten minutes over the mobile phone lines.

2.3 Food contamination monitor

Safety requirements for food contamination caused by the radioactive materials are increasing after accident of F1. Especially it is required to detect the radioactive materials in food rapidly. Food contamination monitor can measure and determine the radioactive cesium of the food or foodstuff without removing the package as shown Fig 7. Food contamination monitor is unnecessary pretreatment such as cutting the food etc. and technical knowledge of radiation measurement. This monitor is capable of detecting the food contamination in the 200 pieces of cardboards in an hour approximately and detects the radioactive materials in the food rapidly.



Fig6. Environmental Monitoring Post

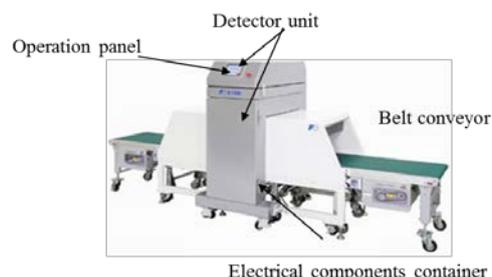


Fig7. Food Contamination Monitor

3. Conclusion

Radiation sensor and equipment, which were used only at nuclear power plant and radiation controlled facility, has come to be known to general public after F1 accident in Japan. We will provide the user-friendly radiation sensor and equipment to the public in future.

Reference

- 1) Yuji Matsuzoe: Clean Technology(J). 5, 2013.
- 2) Nakashima Sadao, Ishikura Takeshi, Matsushita Tomoyuki: Fuji Electric Review(J), 87, 2014, p23.