TOPICS Fukushima 2016.9.27 No. 76

How to specify fuel debris in a high dose rate environment?

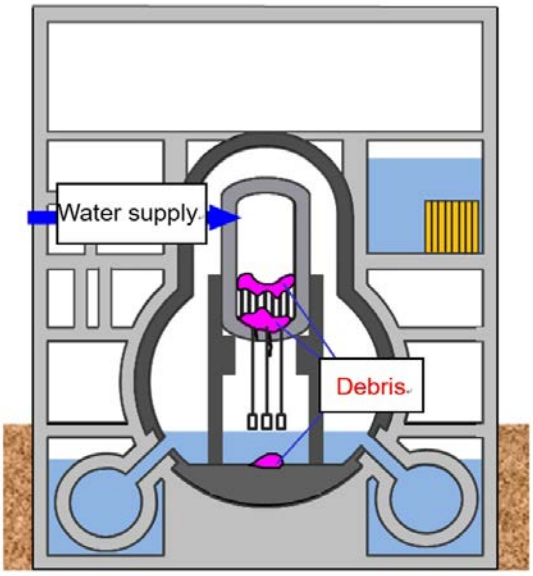
Conference on Radiation Measurements for Decommissioning was held.

Radiation levels in the nuclear reactors of Units 1-3 at the Fukushima Daiichi Nuclear Power Station involved in the accident are still high. Where are the fuel debris* in the reactors? How to observe the debris? How to determine the distribution of radioactive materials attached to building ceilings, walls, rubbles, and so forth? In order to discuss these issues, researchers and engineers in the field of radiation measurement, from both inside and outside Japan, were brought together and for three days engaged in lively discussion about the future direction of the research—aiming at specifying the location of fuel debris, and determining the distribution of contamination by radioactive materials scattered inside the reactor buildings.

*: nuclear fuels once melted and then solidified

This meeting was held by the Collaborative Laboratories for Advanced Decommissioning Science (CLADS), Japan Atomic Energy Agency (JAEA), conducting research and development towards decommissioning of the Fukushima Daiichi Nuclear Power Station (1F) of Tokyo Electric Power Company Holdings, Inc., as a forum for discussing the current state, issues and development situation regarding technology for radiation measurements in high dose

rate environments. The meeting, entitled "Research Conference on Radiation Measurements for Decommissioning of the Fukushima Daiichi NPS" was held from 4th to 6th August, 2016, under training-camp style at the Naraha Cycling Terminal in Naraha Town, Futaba District, Fukushima Prefecture. Fifty-six researchers including 11 researchers from overseas (US, UK, France, and Korea) participated in the conference.



Reactor containment vessel (conceptual illustration)

In the reactors of Units 1–3 at the 1F, fuel debris has been formed through complex melting and mixing of fuel elements and various other components (see right figure). In order to remove the fuel debris, it is necessary to understand the distribution of fuel debris and radioactive materials in the reactor buildings. However, even today, five and a half years after the accident, these distributions have still not been accurately determined. Also, the decontamination inside the reactor buildings has not been adequately carried out. The main reason for this problem is that the radiation dose rates inside the buildings are extremely high which is incomparable to that outside, so it is impossible to apply conventional methods of radiation measurement used in the area where people can easily access.

Presentation by a researcher

CLADS conducts research and development on radiation detectors that can be used even in high dose rate environments. But few examples in this research field have been implemented in the world. In addition, there are many challenging issues in this field. Therefore researchers and engineers in the radiation measurement field, from both inside and outside Japan, discussed the future direction of the research and development by exchanging their views and sharing subjects.

Participants watching actual running of remotely operated equipment at the Test Building of the Naraha Remote Technology Development Center

The discussion focused on three points: (1) Overview of research on radiation measurements relating to decommissioning conducted thus far, (2) Technology for radiation imaging in a high dose rate environment, and (3) Techniques for measuring radiation from fuel debris. In particular, there was a lively debate regarding, 1) methods for acquiring information on the energy of radiation, and detection techniques using neutrons for the purpose of specifying the positions and amounts of fuel debris, and 2) response characteristics and analysis techniques for radiation detectors. The participants reconfirmed that mutual cooperation and exchange of information among researchers inside and outside Japan will be more essential than ever before towards the development of, 1) Compton camera to visualize radiation in order to investigate the scattering and distribution of radioactive materials in the buildings, and 2) technologies for measurement and image analysis using an unmanned aerial vehicle (so called “drone”) equipped with Compton cameras. In addition, there were poster presentations by young researchers (including graduate students) who will play important roles in radiation measurement for decommissioning in the future. They engaged in lively discussions with veteran researchers until late at night.

In addition to the discussion in the meeting room, the participants also visited the 1F site and the JAEA's Naraha Remote Technology Development Center in order to gain on-site information needed for promoting the decommissioning. There was a comment from participants that it will be important to continue to hold meetings like this, corresponding to the progress in decommissioning work and radiation measurements.

The CLADS, JAEA will continue to promote research and development on challenging issues toward decommissioning in collaboration with researchers and engineers inside and outside Japan based on the research results discussed at this conference.

Group photo of conference participants

TOPICS Fukushima No.76

Fukushima Administrative Department

Sector of Fukushima Research and Development

Japan Atomic Energy Agency (JAEA)

Address: 8F Taira Central Building, 7-1 Aza-Omachi, Taira, Iwaki-shi, Fukushima 970-8026 Japan

Phone: +81-246-35-7650 Fax: +81-246-24-4031

Website: http://fukushima.jaea.go.jp/english/