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JAEA staff instructing a walking survey for students

Learning about mapping systems by continuously measuring the air dose rates while moving

JAEA collaborates with human resource development project of Nagaoka University of Technology

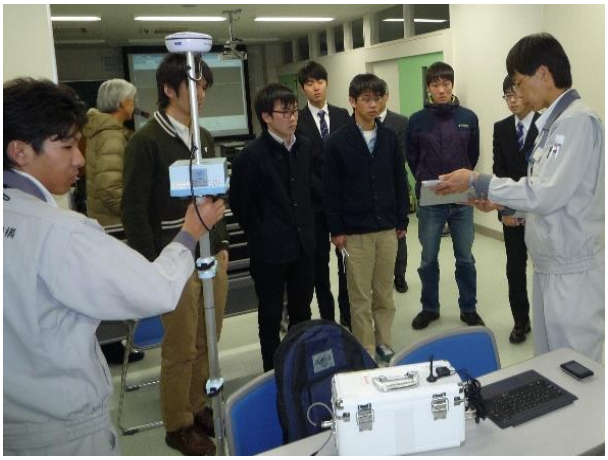
In early March, the Japan Atomic Energy Agency (JAEA) carried out practical training on radiation measurement using survey meters for students of Nagaoka University of Technology (NUT) and technical college (KOSEN) students from all over Japan. This training was adopted as part of fiscal 2015 project “Continuous Education from KOSEN to NUT for Cultivation of Pragmatical Nuclear Engineers by using Radioactive Facilities at NUT” of the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The training was conducted by Nagaoka University of Technology as "Fukushima fieldwork," with the cooperation of the Fukushima National College of Technology and the National Institute of Technology, Ibaraki College. The participants were 13 students from 8 technical colleges, and 11 students of Nagaoka University of Technology. The staff of JAEA took charge of practical training in the measurement of the air dose rate.

After the orientation and the opening ceremony, the first day of training began with a tour of decontamination and temporary storage sites. A staff of Iwaki City in charge of decontamination gave a brief explanation of the decontamination method, and structure and safety of temporary storage places. The staff also talked about the hardships in the meetings with residents.

This was the first time for the students to visit the decontamination site. They felt a keen sense of reality in the stories of hardships told by the staff member, who is a graduate of Fukushima National College of Technology. After that, the venue was moved to Fukushima National College of Technology, and a staff member of Tokyo Electric Power Company (TEPCO) gave a talk on communication with the local community entitled "The Situation of the Fukushima Daiichi Nuclear Power Station and Explanation to the Local Community.

Students listening to explanation by Iwaki city staff

The final lecture on the first day was given by the staff of JAEA. The staff lectured on fundamentals of radiation measurement, principles of radiation meters, and so forth. Then the staff introduced “gamma plotter” and “KURAMA (Kyoto University Radiation Mapping System)”, which were used in fieldwork on the second day, and explained how to use them. In both cases, the air dose rates are measured while moving, in accordance with the specific purpose. Both instruments were developed and came into use after the accident at the Fukushima Daiichi Nuclear Power Station.



The gamma plotter can simultaneously measure

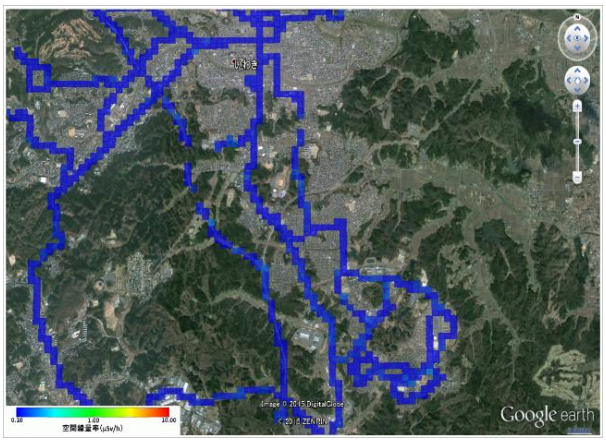
JAEA was in charge of the training on air dose rate measurement on the second day. After leaving the hotel, the students traveled to the field for measurement training. In an unfortunate light rain, the JAEA staff let the students carry instruments, as well as the computer operation for real-time mapping of measurement results. After that, the students measured radiation by turns. All of the students experienced radiation measurements outside using the gamma plotter, and walking surveys using the KURAMA.

KURAMA-II used in training

The gamma plotter is a staff-shaped instrument. It incorporates detectors at positions 5 cm and 100 cm from the front end of narrow tube, and is equipped with a high-performance GPS at the control part and top end. The air dose rates are continuously measured while keeping the staff at a fixed height, and the measured data are sent via Wi-Fi to a PC. In this way, it is possible to draw air dose rates on a geographical map such as Google Earth based on the position information and measured data. The unique feature of this system is that there is no need to record data while holding a survey meter and GPS, so the measurement time is reduced. It is possible to simultaneously measure dose rates at the ground surface and at 1 m

height, thus it is also possible to measure changes in dose rates depending on height. Radiation dose rates at ground level may be higher in athletic fields where there is nothing overhead, while those at 1 m height may be higher in parks etc. where coniferous trees grow.

Car-borne survey is carried out by installing the KURAMA-II instrument developed by Kyoto University on a car or bus, and continuously measuring the air dose rates. The measured data are collected in a server via mobile phone lines (3G or LTE), and displayed at real-time on the Internet and on a monitor in an office building in Fukushima Prefecture using a processing system developed by the JAEA. We can see how the air dose rates change with time at the same location. The students practiced a walking survey by carrying the KURAMA-II in a backpack.



Example of car-borne monitoring results

The students formed groups of three people. When they began to walk carrying an instrument and a PC, the measured data were continuously displayed on Google Earth in the PC. The data showed that the air dose rates at 1 m height are below 0.2 μSv/h (0.2 microsieverts per hour). However, it was found that the air dose rates slightly increase in conifer forests and near soil slopes. They confirmed this fact by stopping and measuring with an NaI (sodium iodide) survey meter.

During a light rain, the instrument was carried in a backpack (right), and the results for the walking

In an actual car-borne survey, the instrument is set inside of a car and the air dose rates outside of the car are measured. This method has the advantage that it is easy to measure a wide area in a short time. But the measured data must be corrected taking the height at which the instrument is mounted and shielding effect by the car body into consideration. In the case of gamma plotter and walking survey, there is nothing to shield radiation, and the height of the detector could be kept at about 1 m. Therefore, it was decided that no height correction would be needed in this training. The gamma plotter also enables measurement at locations where cars cannot enter, but the measurable area is limited, and the measurement is time consuming. Through this training, the students learned about the features of each instrument, the need for instrument calibration and measurement correction, and the need for choosing suitable methods depending on the purpose.

JAEA staff explaining features of gamma plotter

Under the supervision of Tokyo Electric Power Company, the students experienced the screening[1] work that is indispensable in responding to the accident at Fukushima Daiichi Nuclear Power Station. The students also visited the Fukushima Daini Nuclear Power Station, and observed the reproduction of the central control room in the Fukushima Daiichi Nuclear Power Station at the time of the accident using the simulator. In the questionnaire after the training, one student responded that "the tour of the Fukushima Daini Nuclear Power Station and the measurement training were particularly instructive for me." During the walking survey, the students were exchanging their views about the mechanism and improvement of the instruments, like typical students specializing technology.

The JAEA will continue to cooperate with the human resource development projects by the Nagaoka University of Technology, the National Institute of Technology, and Fukushima National College of Technology. We will also continue to make an effort to improve training based on views exchanged with students, requests for training expressed in questionnaire, and discussions with instructors.

1 Medical test that is conducted for many people to confirm that they do not have a particular disease

Presentation of training results (gamma plotters)

Presentation of training results (KURAMA-II)

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