



Hands-on training on irradiation experiment for radiation effect

In August 2018, students of the National Institute of Technology (NIT), Fukushima College and the Nagaoka University of Technology (NUT) experienced the hands-on training on radiation effects, which is closely related to the decommissioning of the Fukushima Daiichi Nuclear Power Station (1F), Tokyo Electric Power Company Holdings Inc.

This program is a part of the Japan Atomic Energy Agency (JAEA)'s project aimed to give internship opportunities to students during summer vacation. This is a report on the students who learned for two weeks about radiation effects on water and adsorbents, how to operate analysis instruments, and experiments on gamma-ray irradiation on samples.

~ Internship for widening students' horizon through hands-on training ~

To promote the understanding of nuclear energy and develop human resources in nuclear energy field, the JAEA has been inviting students to join summer internship programs covering a wide range of subjects. The programs are also expected to facilitate wide interaction and deep collaboration with universities and colleges by accepting the internship students.

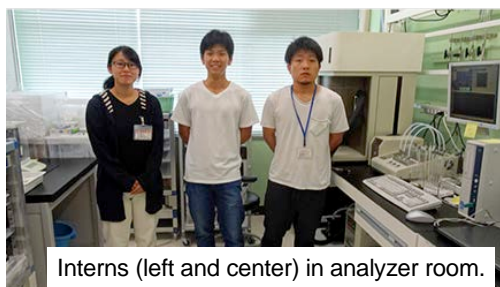
The Storage Equipment Soundness Evaluation Group of Collaborative Laboratories for Advanced Decommissioning Science, progressing the research and development focusing on methods for managing contaminated water and secondary waste at 1F, offered two radiation research internship courses this year. One is "Radiolysis of water", and the other is "Radiation effects on solid adsorbents". Each course was attended by one student.

~ Overview of the internship ~

A student is in the fourth year of NIT, and the other student is in the first year of the graduate school of NUT. They are both in a tentative state going from passively attending lectures to positively pursuing their own research goals under the direction of their instructors. They already knew the basics of interaction between radiation and materials. But they seem to be not familiar with the topic “What kinds of physical and chemical phenomena happen when a material absorbs the energy of radiation?” Therefore, the courses were conducted in accordance with their knowledge.

The first week of the course began with the lectures on the explanation of overview (guidance), the introduction of radiochemistry on which the program was based, and the calculation required for evaluating experimental data on irradiation (unit conversion and dose assessment), which

corresponds to “**time to think**”. Then, as a training before the irradiation experiment, they learned the basic operation of instruments (for gas analysis and absorptiometry analysis), the preparation of samples for irradiation experiment, and analysis of the physical properties of the sample materials. These studies correspond to “**time to learn and understand.**”



After the overview sessions, the two students worked together to calculate, evaluate, operate instruments and prepare samples, under the direction of the course assistants who are the same generation as the students. The assistants, who have more experience, had to restrain their

urge to directly help them so that the students could learn the entire process through trial-and-error, proceeding step by step.

In the training before the irradiation experiment, it seemed to be not interesting for the students only to exercise the operation and preparation. Therefore, the assistants made efforts to include the mock-up experiments for irradiation.

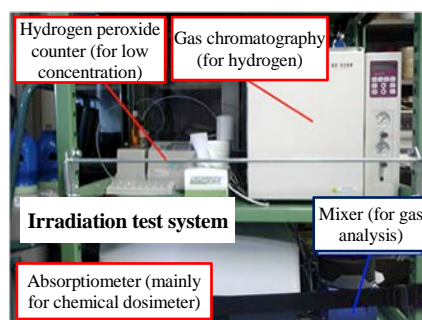


~ Experiencing irradiation using valuable samples “on-site” ~

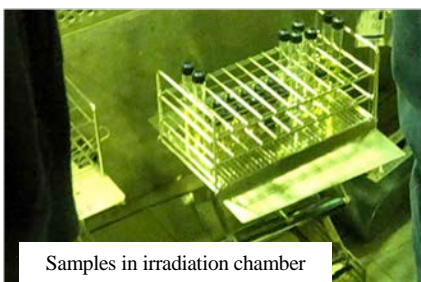
After spending a pleasant weekend with ex-trainees now working at JAEA, the students worked throughout the second week to apply their knowledge and skills obtained in the first week to the irradiation experiment by cobalt-60 gamma rays at the Takasaki Advanced Radiation Research Institute of the National Institutes for Quantum and Radiological Science and Technology (top picture). They evaluated the experimental data and summarized the results obtained in the internship program.

The test samples for irradiation experiment were several kinds of aqueous solution including sea water and solid-liquid mixture where two kinds of zeolite were immersed in water. These samples were chosen because they are important to evaluate the radiation effect in 1F after the accident.

The effect of radiation on the samples was measured by



hydrogen generation, which is causing problems at many places in 1F. Damage to the adsorbents could



have been tested as well, but this would require the long-time irradiation. As the main purpose of the internship was to experience the entire process from sample preparation to the analysis and evaluation, only the hydrogen generation was investigated this time.

During the irradiation experiment, there was unfortunately a trouble in the gas chromatography instrument. But thanks to the efficient work by the interns, all the other experiments went well. After the experiment, they began to analyze and evaluate the data from the next day after returning from the facility. While the students learned that the evaluation results were significantly affected by their handling of instruments, they obtained excellent results on the effect of radiation on hydrogen generation,



as the organizer had expected (concerning the promotion of the radiation effect by the salt concentration and the existence of solids in water, and its reduction by the sample height).

~What was learned in the internship~

After the training course, the students talked about their impression as follows. “Although the program had many things in common with what I learn every day in college, processing the test

data took much more time and effort than expected. I realized my understanding had not been deep enough.”

“I was able to understand the nature of hydrogen and its generation mechanism through the lectures and various irradiation experiments. I would like to use that knowledge for my ongoing research.”

Listening to their words, I had an impression that both interns were interested in the Group’s research as well as JAEA itself.

TOPICS Fukushima No.84

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: <https://fukushima.jaea.go.jp/en/>