

THE DISCHARGE OF ALPS TREATED WATER: ENSURING SAFETY AND PAVING THE WAY TOWARD DECOMMISSIONING

At Tokyo Electric Power Company Holdings' Fukushima Daiichi Nuclear Power Station, where efforts for decommissioning and reconstruction have been underway ever since the accident caused by the Great East Japan Earthquake of March 11, 2011, the discharge of "ALPS treated water" into the sea started in August 2023. The process is being undertaken with safety as the top priority, under strict safety management and in partnership with third-party organizations. Why is the discharge taking place, and what future is envisioned beyond it?

Since the accident at Tokyo Electric Power Company Holdings' Fukushima Daiichi Nuclear Power Station (NPS), which occurred shortly after the Great East Japan Earthquake struck the area on March 11, 2011, the company has been advancing decommissioning work to reduce the risk from

radioactive materials to local people and the environment. Such efforts are now reaching a major turning point. Concentrations of radioactive materials in the surrounding sea area have sufficiently decreased, and so have the radiation levels measured at monitoring posts at the site

boundary. Although at the time of the accident it was impossible to enter the site without wearing protective clothes, workers can now wear regular work clothes in about 96% of the area.

"The major challenge from now on will be the retrieval of 'fuel debris,' which is a mixture of melted fuel inside the reactor and reactor materials that have solidified," says Professor OKAMOTO Koji of the Graduate School of Engineering, the University of Tokyo, who has been involved from the start in the decommissioning process. Fuel debris retrieval is one of the most difficult challenges during that process, but according to the professor, "it is necessary to overcome this challenge in order for decommissioning to proceed further."

An essential step in taking on this difficult task is the discharge of ALPS treated water into the sea, which began in August 2023. This is water that contains radioactive materials from inside the buildings of Fukushima Daiichi NPS, and

has been purified and treated by the Advanced Liquid Processing System (ALPS) until it satisfies safety standards for all radioactive materials other than tritium. The tanks for storing ALPS treated water on the site are large and their number is increasing, already exceeding a thousand. In order to safely proceed with the decommissioning work, the space occupied by the tanks is needed for the construction of new facilities. It thus became necessary to discharge the water and reduce the number of tanks.

The ALPS treated water is discharged under strict safety management and monitoring. All radioactive materials are removed by ALPS to meet the regulatory standards, with the exception of tritium. And for the level of tritium to also fully satisfy safety standards, the water is diluted with seawater before discharge to reduce the tritium concentration to under 1,500 Becquerels/L, which is approximately one-seventh of the World Health Organization

(WHO) standards for drinking water.

"Japan has made a huge effort to ensure that radiation doses for people and the environment are extremely low," says Jim Smith, a professor of environmental science at the University of Portsmouth in England, who studies the effects of radioactive materials on the environment and people. "The release will be conducted over 30 years, which is much longer than would strictly be needed to meet safety standards. This means that annual radiation doses to people and the environment are vanishingly small."

In addition to thorough confirmation prior to discharge that the ALPS treated water satisfies the discharge limit, the concentration of tritium and other nuclides in the surrounding seawater and marine products are monitored both before and after the start of the discharge, with the results posted on the Internet.* To further ensure transparency, the International Atomic Energy



Top: Storage tanks containing ALPS treated water line the grounds of the Fukushima Daiichi NPS. Reducing the number of tanks by discharging the water into the sea will make it possible to build the facilities needed for further decommissioning work. JU

Bottom: Professor OKAMOTO Koji has held his post at the Graduate School of Engineering, the University of Tokyo, since 2004. While conducting research on decommissioning, he regularly visits the Fukushima Daiichi NPS, and discusses and advises on issues faced in the field. Since 2018, he has concurrently been serving as the Director General of the Collaborative Laboratories for Advanced Decommissioning Science of the Japan Atomic Energy Agency.

Agency (IAEA) has been and will be conducting monitoring—in addition to setting up an office in the Fukushima Daiichi NPS area with personnel on site—and will continue to review the safety of the discharge.

Under this system, the first discharge of about 7,800 m³ of water was fully implemented from August 24 to September 11, 2023. Tritium concentrations confirmed by monitoring were well below the regulatory standard. "The fact that the discharge was carried out safely is a very big step forward in terms of paving the way to fuel debris retrieval," says Okamoto. To protect people and the environment, Japan will progress, step by step, with the discharge of ALPS treated water and decommissioning efforts, with safety as the top priority. ●



The discharge of ALPS treated water into the sea has begun at Tokyo Electric Power Company Holdings' Fukushima Daiichi Nuclear Power Station (center). Decommissioning work has been conducted carefully, with safety as the top priority. THE ASAHI SHIMBUN COMPANY/JUJI PRESS PHOTO



Left: On August 22, 2023, IAEA personnel witnessed the sampling of water treated by ALPS and diluted with seawater, prior to its first discharge at the Fukushima Daiichi NPS. In July, the IAEA released a comprehensive report on the safety review of the ALPS treated water, concluding that Japan's approach and activities regarding the

discharge of the water into the sea are "consistent with relevant international safety standards," and that the discharge "will have a negligible radiological impact on people and the environment." TEPCO/AFPA/ALO
Right: Professor Jim Smith of the University of Portsmouth, England, is an environmental scientist who has long studied the impacts of the nuclear accidents at Chernobyl and Fukushima on people and the environment. SAMSHAW

*For detailed information on the monitoring of ALPS treated water

Fisheries Agency (<https://www.jfa.maff.go.jp/e/inspection/index.html>) Ministry of the Environment (<https://shorisui-monitoring.env.go.jp/en/>)

Nuclear Regulation Authority (<https://radioactivity.nra.go.jp/en/list/309/list-1.html>)

Ministry of Economy, Trade and Industry (https://www.meti.go.jp/earthquake/nuclear/hairo_osensui/english/shirou_alps/monitoring/)