Tokyo Tech Research Units

Advanced Nuclear Fuel Cycle Unit

Overview

The Advanced Nuclear Fuel Cycle Unit develops technology for the processing of high-level radioactive waste produced in the nuclear fuel cycle. The unit' s goal is to establish a safe, environmental preservation-type low-emission nuclear fuel cycle that significantly reduces environmental load and radiation risk. The unit also develops technology to remove radioactive materials from the ground and treats contaminated water at the Fukushima Daiichi nuclear power plant. The Advanced Nuclear Fuel Cycle Unit makes proposals for the removal of contaminated water, promotes the exchange of opinions with local residents, and creates scenarios to form agreements that lead to problem solving.

Research goals

Conventional wisdom holds that high-level radioactive waste generated by spent nuclear fuel should be vitrified at a reprocessing plant and cooled at an interim storage facility before final burial underground. The unit follows this concept in promoting research and development in vitrification (Fig. 1-2). The Advanced Nuclear Fuel Cycle Unit also develops technology to recover and separate platinum-group elements, which produce a large amount of solids in the vitrified objects (Fig. 1-3), and centrifugal extractors that separate highly radiotoxic fission product elements, which reduce storage efficiency (Fig. 1-4). The unit's five-year plan is to develop these technologies, increase their scale, verify efficiency, and pursue commercialization.

Separating minor actinide (MA), a transuranium element, from high-level radioactive waste and burning MOX fuel with uranium (U), plutonium (Pu), and MA significantly reduces radiotoxin in the waste. This will make it possible in the future to control waste at ground level. The unit also conducts research on fast breeder reactors with the goal of significantly improving uranium usage and reducing waste generation (Fig. 1-5).

Research Unit Leader **Kenji Takeshita**

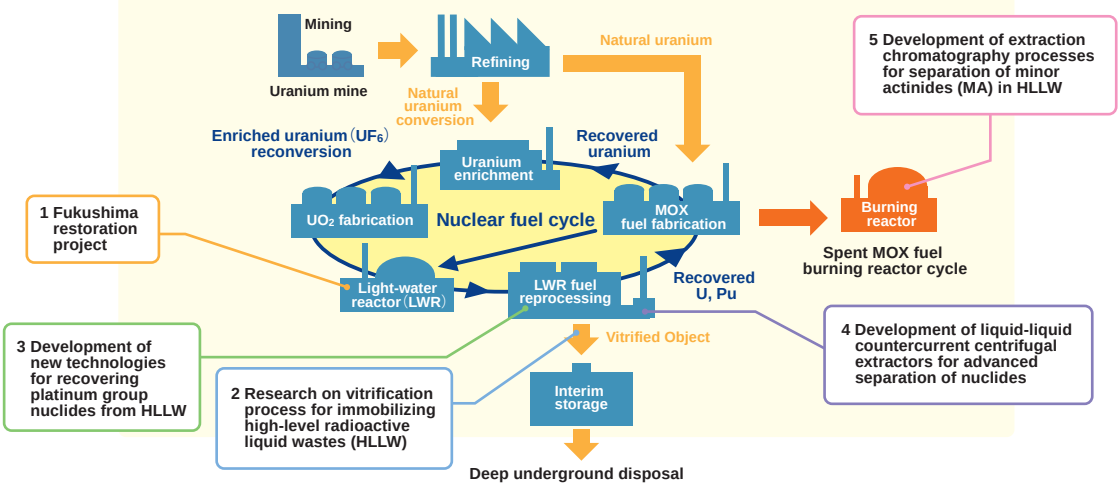
Profile

2016 Professor, Institute of Innovative Research, Tokyo Institute of Technology
2010 Professor, Research Laboratory for Nuclear Reactors, Tokyo Institute of Technology
1996 Associate Professor, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology
1992 Chief Researcher, Institute of Research and Innovation
1987 Researcher, Institute of Research and Innovation
1987 Doctor of Engineering, Department of Nuclear Engineering, Graduate School of Science and Engineering, Tokyo Institute of Technology

Unit members

- Researcher Yusuke Inaba
- Researcher Miki Harigai
- Professor Emeritus Yoshio Nakano
- Adjunct Specialist Kazuo Utsumi
- Researcher Hideharu Takahashi
- Researcher Makoto Nishikawa
- Professor Emeritus Masaki Ozawa
- Professor Tetsuji Yano
- Professor Jun Onoe, Nagoya University
- Adjunct Lecturer Shinta Watanabe, Nagoya University
- Yasuo Ayame, Japan Atomic Energy Agency
- Ippei Amamoto, Japan Atomic Energy Agency
- Takashi Onishi, Japan Atomic Energy Agency
- Tsuyoshi Yaita, Japan Atomic Energy Agency
- Hirochika Naganawa, Japan Atomic Energy Agency

Fig.1 Environmental preservation-type nuclear fuel cycle



Expanding the Nuclear Fuel Cycle Project to reduce global warming and secure energy for the future

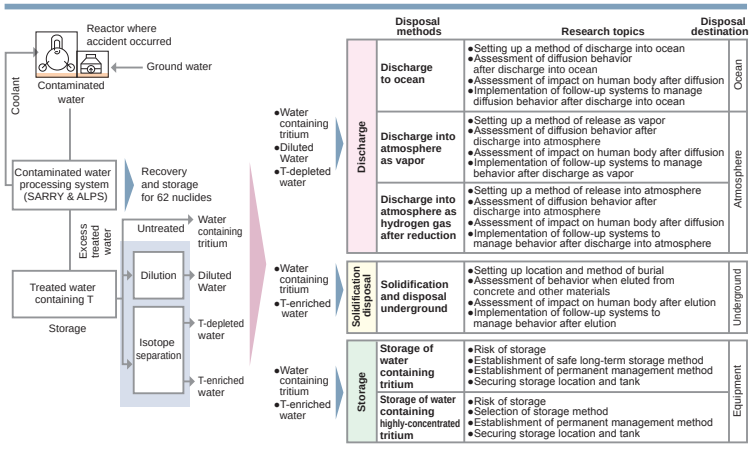
Q Why was this research unit established?

The Nuclear Fuel Cycle Project started in 2008 with a focus on the five sub-projects explained in the Research goals to address issues in the development of an environmental preservation-type nuclear fuel cycle. The Advanced Nuclear Fuel Cycle Unit utilizes previous research findings to establish a wide range of measures based on technology and the social sciences in response to energy policy. In the near future, we will be required to strike the best balance of a wide range of energy policy options. To prepare for this we must consider such options now. The unit places priority on expanding the Nuclear Fuel Cycle Project to contribute to the reduction of global warming and securing energy for the future.

Q What are the strengths of this research unit?

Tokyo Tech is proud of its many specialists in the fields of technology and social sciences, and is strong at creating multidisciplinary teams of specialists in the physical sciences, environmental engineering, nuclear power, and a wide range of other areas. Specialists with differing viewpoints from outside Tokyo Tech also participate to ensure balance. The Advanced Nuclear Fuel Cycle Unit continues to apply knowledge and skill in technology and the social sciences to provide a wide range of solutions to social issues associated with nuclear power.

Fig. 2 Creation of technical scenario for tritium recovery from contaminated water



Q What is the path to achieving the unit's goals?

We have conducted research on vitrification for seven years, and technical development to recover platinum-group elements for five years. The goal is to complete both technologies within the next five years.

The Advanced Nuclear Fuel Cycle Unit is moving forward to achieve stable energy supply utilizing the fast-breeder reactor cycle by 2080. We have already used five years for research on MA separation technology, which is essential for the fast-breeder reactor cycle. The Japan Atomic Energy Agency (JAEA), where I am a research fellow, is planning to promote joint research on advanced separation of MA with the United States Department of Energy National Laboratories.

Through the Fukushima Daiichi nuclear power plant project, we will perform technical development for the processing of contaminated soil, and provide scenarios for the processing and treatment of contaminated water in several years, and attempt to reach an agreement with residents within two years after that. As an example, Fig. 2 shows a treatment method for tritium contained in contaminated water. The unit will provide technical scenarios for the separation and concentration of tritium, discharge through dilution, and evaporation processing, and engage in discussions with residents at an early stage to reach an agreement. The process of forming an agreement with residents will help the national government make its decisions.

Contact us

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