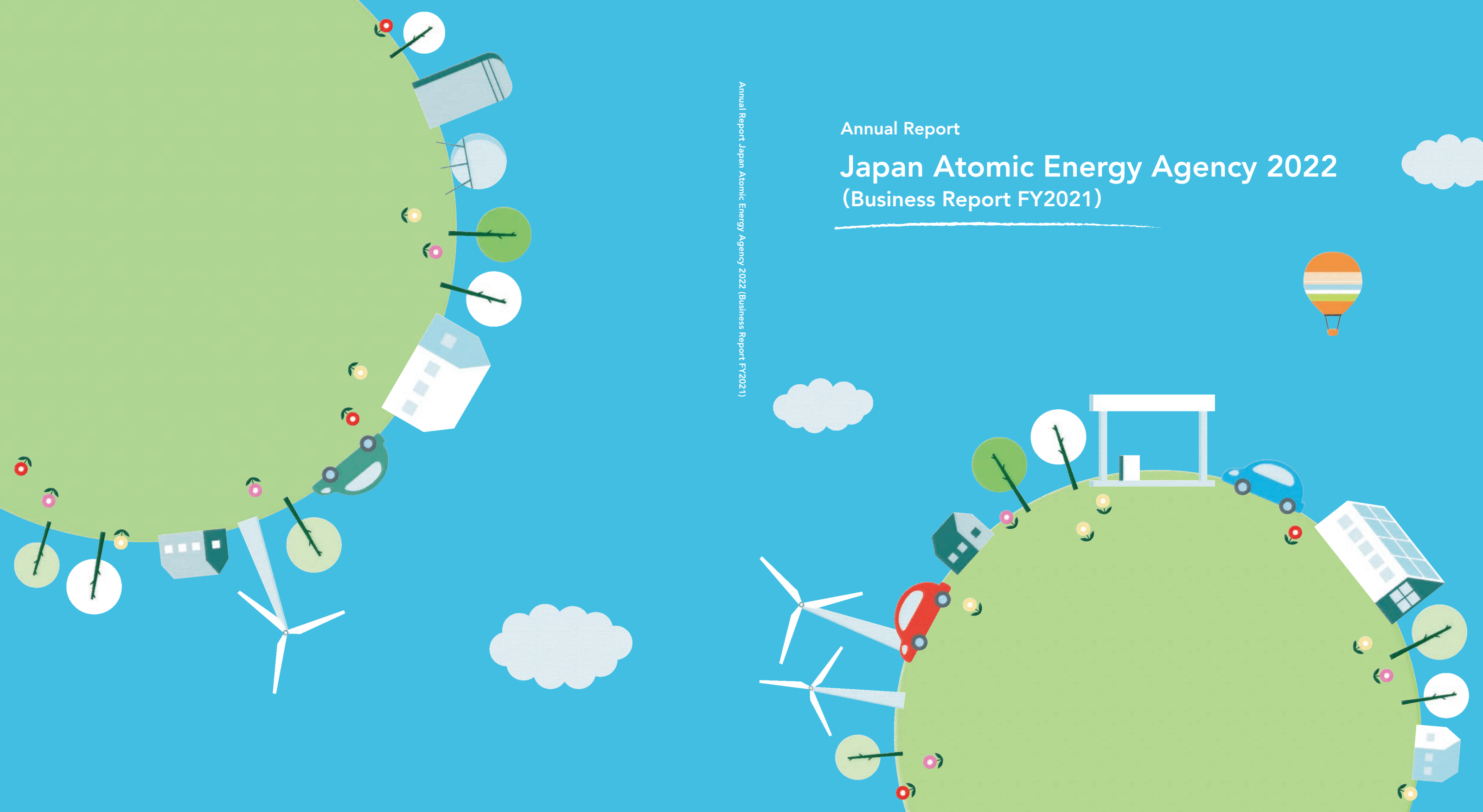


Annual Report

Japan Atomic Energy Agency 2022 (Business Report FY2021)

Annual Report Japan Atomic Energy Agency 2022 (Business Report FY2021)



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Please write 'Annual Report Japan Atomic Energy Agency 2022 (Business Report FY2021)' in the subject column. Your feedback is greatly appreciated.

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Japan Atomic Energy Agency

National Research and Development Agency
Japan Atomic Energy Agency

未来へげんき
To the Future / JAEA

Annual Report 2021

The Japan Atomic Energy Agency (JAEA), a National Research and Development Agency, submits an annual business report to the competent ministers together with financial statements in accordance with the Act on General Rules for Incorporated Administrative Agencies. This report presents an abstract of JAEA's research and development (R&D) and various other activities. In the light of its corporate social responsibilities as a National Research and Development Agency, a comprehensive outline is also given of its environmental report publication, the operation of its information disclosure system, its participation in regional activities, and its technology transfer activities.

The main part of the report concerns JAEA's operations and the state of its R&D for FY2021 (April 2021 – March 2022). The report also includes a summary of the 3rd Medium-/Long-Term Objectives (April 2015 – March 2022).

Through this report, we seek to promote your understanding and support of JAEA's operations and R&D.

● Reporting period

The reporting period is basically FY2021 (April 2021 – March 2022). However, the report also includes certain information on the 3rd Medium-/Long-Term Objectives (April 2015 – March 2022) and from the period after FY2021.

● Reference Guidelines, etc.

- © Guidelines on the Annual Report of Incorporated Administrative Institutions (Ministry of Internal Affairs and Communications) https://www.soumu.go.jp/main_content/000572212.pdf
- © ISO 26000: 2010 Guidelines Concerning CSR <https://www.iso.org/standard/42546.html>
- © Environmental Reporting Guidelines 2018 version (Ministry of the Environment) <https://www.env.go.jp/content/000042339.pdf>
- © GRI Standards <https://www.globalreporting.org/standards>

● Notation Method

Figures are rounded in principle to the nearest whole number for the unit provided. The total shown may therefore differ from the sum of the relevant individual items.

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Message from the President

Contributing to the welfare and prosperity of human society through nuclear science and technology

My name is KOGUCHI Masanori, and I was appointed President of the Japan Atomic Energy Agency from April 1, 2022.

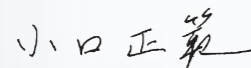
I have now finalized our FY2021 business report and submitted it to the competent ministers. I would be glad to see this summary widely read by Japanese citizens.

I would like all JAEA staff members to renew their understanding and shared sense of purpose in the work entrusted to us by society so as to work together in the same direction to produce more results that lead to social implementation and to disseminate those results in an easy-to-understand, precise, and timely manner. By accomplishing this goal, I would like to lead JAEA to public recognition as an organization that continues to contribute to society.

I seek your understanding and support for the R&D activities that JAEA undertakes.

President, the Japan Atomic Energy Agency

KOGUCHI Masanori



Kodama Toshio, Former President, the Japan Atomic Energy Agency (Term of Office April 2015 to March 2022)

Review of FY2021

In FY2021, the last fiscal year of the 3rd Medium-/Long-Term Objectives period, JAEA proceeded with its operations, prioritizing safety, including ensuring security and safety of facilities, while continuing to adopt new working styles such as telecommuting due to the spread of the coronavirus since the previous fiscal year and keeping in mind both “maximization of R&D achievements” and “appropriate, effective, and efficient operations.”

As for the response to the accident at TEPCO’s Fukushima Daiichi Nuclear Power Station (1F), we took action in accordance with the Mid-and-Long-Term Roadmap towards the Decommissioning of 1F, including conducting a study to “visualize” high radiation dose areas on 3D maps by applying a radiation determination system inside the 1F site and making preparations for analysis of fuel debris.

Regarding advanced reactors, we resumed operation of the gas-cooled High-Temperature Engineering Test Reactor (HTTR), while in the development of fast reactors, under the support of the U.S. Department of Energy, we concluded a memorandum of understanding with Japanese and US companies on fast reactor technologies to bolster Japan-US collaboration toward carbon neutrality.

In the area of decommissioning, at the Monju site, we completed the transfer of 146 fuel assemblies from the ex-vessel fuel storage tank to a fuel pool as planned and proceeded with preparations for the transfer of

sodium. At the Fugen site, we made progress in the dismantling of the peripheral facilities of the reactor and the preparations for the retrieval of spent fuel. We also proceeded with the plan for the decommissioning of the Tokai Reprocessing Plant, and, as part of research and development (R&D) related to geological disposal technology, completed the backfilling of the underground facilities of the Mizunami Underground Research Laboratory and undertook local community consultation on the extension of the Horonobe Underground Research Laboratory by a depth of 500 m.

In the field of nuclear science research, JAEA proceeded with studies on the evaluation of properties and development of materials with the assistance of neutrons and synchrotron radiation utilizing its facilities and equipment including JRR-3 and the Japan Proton Accelerator Research Complex (J-PARC).

For research reactors, activities toward resuming their operation are in steady progress. In addition, in order to encourage the use of large-scale facilities of the kind only available to JAEA and other general equipment, JAEA started operating a one-stop open facility platform, and accelerated its initiatives toward the creation of innovation, including the approval of a venture company originating from JAEA and the establishment of the JAEA Innovation Hub, an organization to promote innovation activities.

Summary of the Past Seven Years

Under the National R&D Agency system newly introduced in April 2015, placing the utmost priority on safety, JAEA has been working on the maximum utilization of its R&D results and the achievement of the various tasks set forth in the 3rd Medium-/Long-Term Plan. During that period, in April 2016, part of its R&D on nuclear fusion and applied quantum beam technology was transferred to the National Institutes for Quantum and Radiological Science and Technology, and the fast breeder reactor Monju entered a decommissioning phase based on the government policy announced in December 2016. Amid such major changes in the situation surrounding JAEA, we advanced our initiatives toward ensuring safety and establishing an effective and efficient management system.

In addition, we formulated the Medium-/Long-Term Management Plan for JAEA Facilities, presenting a comprehensive plan to implement, in an integrated manner, a threefold strategy: selection and consolidation of facilities; measures to ensure the safety of facilities; and management of back-end issues. Further, in a bid to enhance its initiatives for social implementation of R&D achievements, JAEA formulated the Future Vision “JAEA 2050 +,” revised the “Innovation Creation Strategy” toward the realization of “new-era nuclear science and technology (S&T)” that contributes to society by collaboration and integration with other study fields as set forth in “JAEA 2050 +,” developed human resources, and transferred R&D results to industry.

The JAEA is Japan’s sole comprehensive nuclear research and development institute.

Based on its own Medium-/Long-Term Objectives, JAEA works on the response to the accident at the Fukushima Daiichi Nuclear Power Station of Tokyo Electric Power Company Holdings, Inc. (TEPCO), conducts research on the enhancement of nuclear safety, carries out R&D on the nuclear fuel cycle and on radioactive waste treatment and disposal technology, and engages in basic and fundamental research in the nuclear field.

[Management Principles]

- Thoroughly ensure safety
- R&D filled with creativity
- Focus on on-site activities
- Efficient work management
- Trust of society

[Conduct Standards]

JAEA has specified its management principles in a stratified and integrated manner. Based on the purpose of its establishment and its mission (roles), JAEA has laid down basic policies and conduct standards and set forth a management philosophy to serve as norms for the conduct of operations by its management and employees.

Management Principles: https://www.jaea.go.jp/about_JAEA/philosophy.html (in Japanese)



Management by the President

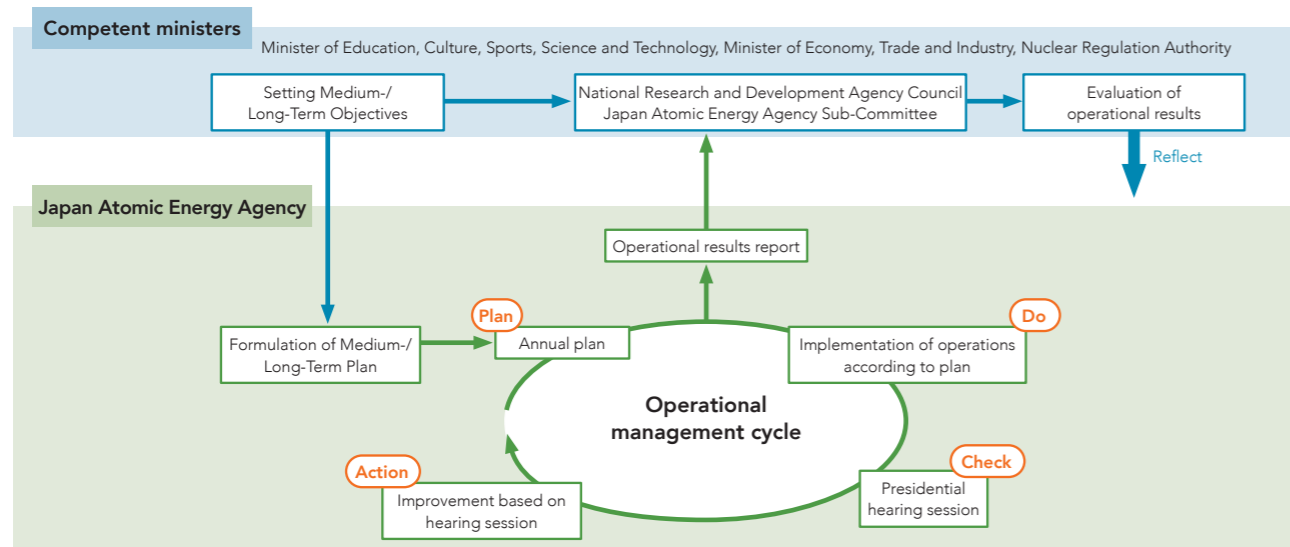
JAEA runs its management cycle — a method for the continuous improvement by repetition of the Plan, Do, Check, and Act (PDCA) cycle — through board meetings led by the president and presidential hearing sessions held twice a year. During the 3rd Medium-/Long-Term Objectives period, under strong presidential leadership additionally supported by the insights

of the corporation, JAEA worked to clarify its operations by introducing the concepts of Mission, Vision, and Strategy (MVS) and Balanced Score Card (BSC*¹) throughout the organization and sought further to visualize its operations by introducing individual MVS and BSC criteria for each business division and checking progress using Key Performance Indicators (KPI*²).

*1 A method to manage operations by specifying targets and performance indicators from the viewpoints of organization and operation processes, finance and facilities, human resource development, and the customer

*2 Quantitative indicator to measure the operational achievement level

Management by the President



MVS of JAEA

Mission	Contribute to the welfare and prosperity of human society through nuclear science and technology
Vision	<p>To meet the expectations of Japanese citizens as Japan's sole comprehensive nuclear research and development institute (we shall aim for the following)</p> <ul style="list-style-type: none"> An organization that contributes to the development of nuclear science and technology, to the peaceful use of global nuclear energy and to regional development An organization that promotes research into improving nuclear safety An organization that creates innovation through interaction and collaboration with other fields of technology An organization that contributes to the solution of global climate change, to ensuring energy stability and to the achievement of Society 5.0 <p>To lead nuclear research and development with a high organizational IQ</p> <ul style="list-style-type: none"> An organization with high organizational IQ that always ensures safety first, always thinks independently and always continues to improve its efficiency An organization that can best utilize limited resources (budget, assets, manpower)
Strategy	<p>To share a sense of value and uplift the level of job quality e.g. formulation and implementation of "JAEA 2050 +" strategies and policies</p> <p>To enhance efforts toward establishment of public acceptance e.g. placing utmost priority on safety, R&D incorporating external needs</p> <p>To promote job prioritization, job streamlining, introduction of information technology and introduction of all cutting-edge technology e.g. redistribution of resources, gate control, Kaizen activities</p> <p>To enact management reform with the establishment of clear and straightforward plans e.g. targets, policies, KPIs, PDCA cycle, governance, safety management, internal control</p>



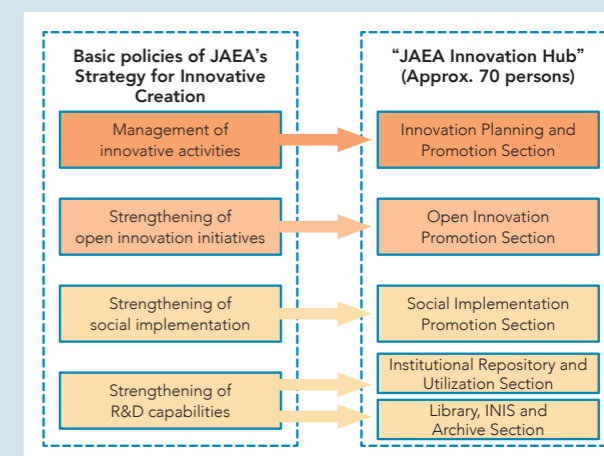
Efforts for effective and efficient management

JAEA implemented two major organizational reforms in FY2021 to maximize R&D results as part of its efforts for effective and efficient management. These were the establishment of the "JAEA Innovation Hub" to accelerate efforts to create innovation and the "LWR (light water reactor) Research Management Office" to promote LWR research.

Establishment of JAEA Innovation Hub

on October 1, 2021

- ◆ In 2019, JAEA announced its future vision to continue contributing to society as "JAEA 2050 +", and in 2020 it formulated and published a revised version of its Strategy for Innovative Creation in order to strengthen its efforts to create innovation.
- ◆ In order to respond with accelerated efforts to create innovation, the Intellectual Resources Management and R&D Collaboration Department was merged with the Policy Planning, and Administration Department's Office of Strategy for Innovation to form a new organization, the "JAEA Innovation Hub," effective October 1, 2021.
- ◆ To promote collaboration additionally further with external parties, external personnel with extensive experience in activities such as industry-academia-government collaboration was invited to serve as the director and as senior advisors.



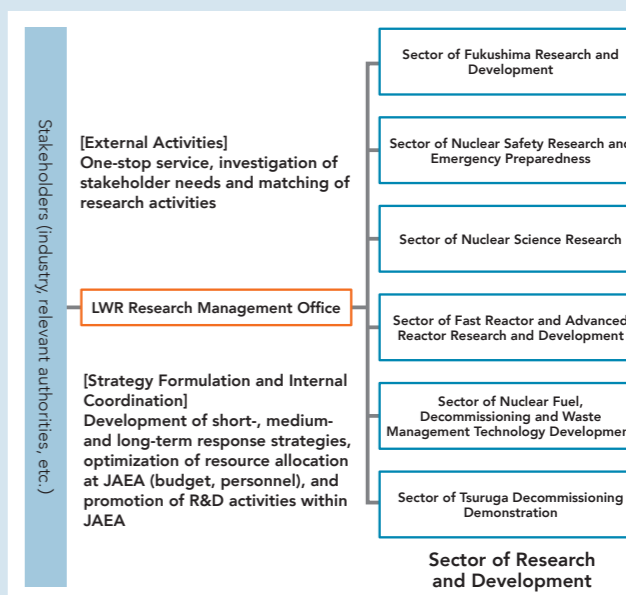
Establishment of "JAEA Innovation Hub" (Announcement): <https://www.jaea.go.jp/02/press2021/p21100103/> (in Japanese)



Establishment of LWR Research Management Office

on January 1, 2022

- ◆ JAEA held numerous meetings for exchange of opinion with stakeholders to investigate the issues in LWR research to be addressed by JAEA in order to contribute to and support further enhancement of LWR safety, long-term LWR operation, and nuclear fuel cycle projects in Japan.
- ◆ In response to stakeholders' expressed needs, on January 1, 2022, JAEA established a new body, the "LWR Research Management Office", to promote LWR research within its organization.
- ◆ The office provides a one-stop service related to LWR research at JAEA, investigates the needs of stakeholders such as industry and relevant authorities, and coordinates external collaboration.
- ◆ The office develops LWR research strategies for JAEA including internal cross-sector collaboration, and provides support for research and development outputs.



Establishment of "LWR Research Management Office" (Announcement): <https://www.jaea.go.jp/02/press2021/p22010102/> (in Japanese)



JAEA's Position and Role in Japan's National Policy

Purpose of the Corporation

In accordance with the basic policy stipulated in Article 2 of the Atomic Energy Basic Act, JAEA was established to comprehensively, systematically, and efficiently conduct basic and applied research on nuclear energy, the development of fast breeder reactors to establish the nuclear fuel cycle and the associated necessary nuclear fuel materials, and the development of technologies related to nuclear fuel material reprocessing and high-level radioactive waste disposal; to disseminate the outcomes of the research; and thereby to contribute to the welfare of human society and to raising the standard of living of Japan's citizens.

[Article 4 of Act on the Japan Atomic Energy Agency, National Research and Development Agency: <https://elaws.e-gov.go.jp/document?lawid=416AC000000155> \(in Japanese\)](https://elaws.e-gov.go.jp/document?lawid=416AC000000155)



Operations

In order to achieve its purpose as set out in Article 4 of the Act on the Japan Atomic Energy Agency, National Research and Development Agency, JAEA conducts the operations below (excluding those that fall under operations listed in Article 16, item (i) and (ii), of the Act on the National Institutes for Quantum Science and Technology).

- (i) Basic research on nuclear energy
- (ii) Applied research on nuclear energy
- (iii) The following operations required to technologically establish the nuclear fuel cycle:
 - a. Development of fast breeder reactors (excluding where the building of a demonstration reactor is involved) and the associated necessary research
 - b. Development of the nuclear fuel materials necessary for the operations shown in a. above and the associated necessary research
 - c. Development of technology related to nuclear fuel material reprocessing and the associated necessary research
 - d. Development of technology related to the processing and disposal of the high-level radioactive waste generated in association with the operations shown in c. above and the associated necessary research
- (iv) Dissemination and promotion of the use of the results of the operations shown in (i) to (iii) above
- (v) The following operations related to radioactive waste disposal (excluding those that fall under operations of the Nuclear Waste Management Organization of Japan)
 - a. Final disposal, by means of burying, of the radioactive waste generated in association with the operations of JAEA and radioactive waste entrusted to JAEA for disposal by external organizations (excluding waste generated by commercial nuclear power reactors, etc.)
 - b. Construction, improvement, maintenance and other management of facilities for burial disposal, closure of disposal facilities after completion of burial disposal, and management of disposal facility sites after closure
- (vi) Provision of JAEA's facilities and equipment for R&D related to science and technology and for activities related to the development and use of nuclear energy
- (vii) Development of researchers and technicians related to nuclear energy and improvement of their quality
- (viii) Collection, arrangement, and provision of information related to nuclear energy
- (ix) In addition to activities carried out as part of the operations shown in (i) to (iii) above, nuclear energy-related testing, research, investigation, analysis, or assessment where deemed necessary and entrusted to JAEA by the head of a related administrative organization or local public organization
- (x) Operations relating to investment and physical and technological support as stipulated in Article 34-6, Paragraph 1, of the Act on Activation of the Creation of Science and Technology Innovation (Act No.63 of 2008) and that are additionally specified by Cabinet Order
- (xi) Operations incidental to the operations from (i) to (x)
- (xii) Operations stipulated in Article 5, Paragraph 2, of the Act on the Promotion of Public Utilization of the Specific Advanced Large Research Facilities (Act No.78 of 1994)
- (xiii) In addition to the operations from (i) to (xii), within the range that does not interfere with the performance of these tasks, operations to store and/or dispose of nuclear source materials (referring to nuclear source materials as stipulated in Article 3, Item (iii), of the Atomic Energy Basic Act), nuclear fuel materials, or nuclear waste entrusted to JAEA by national government, local public organizations or other persons specified by Cabinet Order.

[Article 17 of Act on the Japan Atomic Energy Agency, National Research and Development Agency: <https://elaws.e-gov.go.jp/document?lawid=416AC000000155> \(in Japanese\)](https://elaws.e-gov.go.jp/document?lawid=416AC000000155)



Policy framework for JAEA

[National Policy]

Atomic Energy Basic Act

(Sets the framework for Japan's nuclear research and utilization including JAEA)

[Atomic Energy Basic Act: <https://elaws.e-gov.go.jp/document?lawid=330AC100000186> \(in Japanese\)](https://elaws.e-gov.go.jp/document?lawid=330AC100000186)



Sixth Science, Technology, and Innovation Basic Plan
Basic Policy for Nuclear Energy
Basic Policy for Nuclear Research and Development
Strategic Energy Plan

Plan for Global Warming Countermeasures
Long-Term Strategy under the Paris Agreement
Green Growth Strategy Through Achieving Carbon Neutrality in 2050,
etc.

[Act on the Japan Atomic Energy Agency, National Research and Development Agency]

(Sets out the purpose and operational scope of JAEA)

[JAEA's Activities in the 3rd Medium-/Long-Term Objectives (Plan)]

- I. Measures to be taken for attaining targets concerning business operations with placing top priority on safety
- II. Measures to be taken for attaining targets concerning maximizing R&D outcomes and raising quality in other areas
 - 1) R&D pertaining to the response to the accident at TEPCO's Fukushima Daiichi Nuclear Power Station
 - 2) Technical supports for nuclear safety regulation and safety research for their purposes
 - 3) R&D for improving nuclear safety and activities that contribute to nuclear non-proliferation and nuclear security
 - 4) Basic and fundamental research and human resources development in the nuclear field
 - 5) R&D on fast reactors and advanced reactors
 - 6) R&D related to the nuclear fuel cycle, such as reprocessing, fuel manufacturing and treatment and disposal of radioactive waste
 - 7) Activities for sector of Tsuruga decommissioning demonstration
 - 8) Activities to strengthen industry-academia-government collaboration and secure the trust of society
- III. Measures to be taken for attaining targets related to enhancing the efficiency of business operations
- IV. Measures to be taken for attaining targets related to improving the state of finances
- V. Important matters concerning other business operations

Overview of Medium-/Long-Term Objectives, Medium-/Long-Term Plan, and Annual Plan

Following the Act on General Rules for Incorporated Administrative Agencies, JAEA's operations are conducted in accordance with the Medium-/Long-Term Plan formulated based on the Medium-/Long-Term Objectives specified by the competent ministers and an annual plan laid down every fiscal year for achieving the Medium-/Long-Term Plan.

The competent ministers set forth Medium-/Long-Term Objectives for the seven years from FY2015 to FY2021. FY2021 is the seventh and final year of that period. In the Medium-/Long-Term Objectives, JAEA's operations include R&D activities 1.-7. in the above Policy framework for JAEA.

The FY2021 annual plan was formulated with the ultimate aim of achieving the Medium-/Long-Term Objectives. This plan required the enhancement of initiatives to create innovation in accordance with the revised version, formulated and published in FY2020, of JAEA's Strategy for Innovative Creation. As one of its initiatives to create innovation, JAEA is promoting the strengthening of support systems for spin-off venture companies following the revision of the Act on Activation of the Creation of Science and Technology Innovation, which enables JAEA to invest in venture companies launched from within its organization.

[Medium-/Long-Term Objectives, Medium-/Long-Term Plan, and Annual Plan: \[https://www.jaea.go.jp/about_JAEA/business_plan.html\]\(https://www.jaea.go.jp/about_JAEA/business_plan.html\) \(in Japanese\)](https://www.jaea.go.jp/about_JAEA/business_plan.html)



Medium-/Long-Term Objectives and Plan

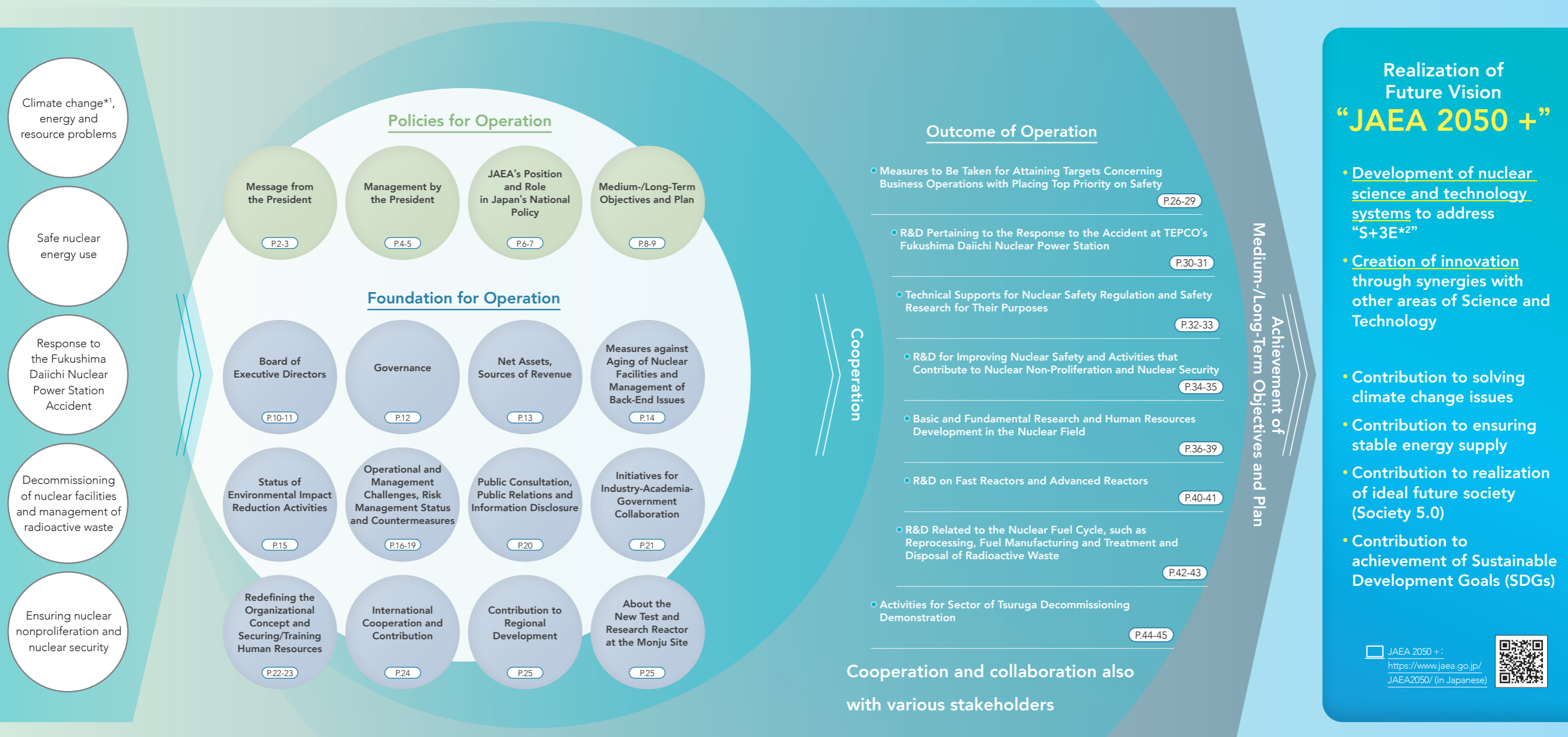
JAEA will achieve the Medium-/Long-Term Objectives specified by the competent ministers and actively contribute to the development and use of nuclear energy throughout Japan, improvement of the safety of nuclear energy in Japan and overseas, and the creation of innovation.

Social Issues

in JAEA's environment

Activities to achieve targets

Contribution to society



*1 Climate change has received much attention as a social agenda. The "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" was formulated in December 2020 to reduce the emission of greenhouse effect gas to zero overall, that is, to realize Carbon Neutrality in 2050.

*2 The fundamental energy policy is to achieve Energy Security, Economic Efficiency and Environmental Adaptation as premises for Safety.

Board of Executive Directors

The Board of JAEA is composed of the President, the Vice President, six Executive Directors and two Auditors. The President represents JAEA in all aspects and is responsible for the overall management of JAEA, while the Vice President assists the President and acts on his/her behalf when deemed necessary or appropriate. The Executive Directors share the responsibilities of divisional management assigned to them with their strong and abundant experience and knowledge, and the Auditors audit the overall work of JAEA.



(as of June 2022)

A President
KOGUCHI Masanori

Career Outline

- April 2022 President, Japan Atomic Energy Agency
- June 2020 Counselor, Mitsubishi Heavy Industries (MHI)
- June 2018 Board Member, Executive Vice President, CFO, MHI
- April 2018 Board Member, Executive Vice President, CFO, Director of the Office of Strategic Planning and Promotion, MHI
- June 2015 Board Member, Managing Director, CFO, Director of the Office of Strategic Planning and Promotion, MHI
- April 2014 Board Member, Operating Officer of the Office of Strategic Planning and Promotion, MHI
- April 1978 Joined MHI

B Executive Vice President
ITAKURA Yasuhiro

Career Outline

- April 2022 Executive Vice President, Japan Atomic Energy Agency (JAEA)
- July 2021 Executive Officer, JAEA
- July 2020 Director-General of the Science and Technology Policy Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- April 2018 Executive Director of the National Institutes for Quantum Science and Technology
- June 2016 Deputy Director-General, Research Promotion Bureau, MEXT
- January 2014 Director of the Promotion Policy Division, Research Promotion Bureau, MEXT
- January 2012 Director of the Life Science Division, Research Promotion Bureau, MEXT
- April 2010 Director of the Atomic Energy Division, Research and Development Bureau, MEXT
- April 2007 Director of the Atomic Energy Research and Development Division, Research and Development Bureau, MEXT
- April 1987 Joined Science and Technology Agency

C Executive Director
YOSHIDA Kunihiro

Career Outline

- July 2020 Executive Director, Japan Atomic Energy Agency
- June 2019 Senior Executive Officer, Deputy Executive General Manager, in charge of Tsuruga Head Office, Japan Atomic Power Company (JAPC)
- June 2016 Senior Executive Officer, Deputy Executive General Manager, in charge of Tsuruga Head Office and General Manager of Community Relations & Co-operation Dep., JAPC
- June 2015 Senior Executive Officer, Acting Executive General Manager, in charge of Tsuruga Head Office and General Manager of Community Relations & Co-operation Dep., JAPC
- June 2014 Executive Officer, Deputy Executive General Manager, in charge of Tsuruga Head Office and Superintendent of Tsuruga Plant Construction Arrangements Office, JAPC
- June 2012 Senior General Manager, Deputy Executive General Manager, in charge of Tsuruga Head Office and Superintendent of Tsuruga Plant Construction Arrangements Office, JAPC
- July 2010 Acting General Manager, Decommissioning Project Department, JAPC
- July 1997 Manager, Projects Development Department, JAPC
- April 1980 Joined JAPC

D Executive Director
MIURA Nobuyuki

Career Outline

- April 2021 Executive Director, Japan Atomic Energy Agency (JAEA)
- May 2019 Deputy Senior Director General of Decommissioning and Radioactive Waste Management Head Office, JAEA
- April 2018 Deputy Director General of Sector of Nuclear Fuel, Decommissioning and Waste Management Technology Development, JAEA
- April 2017 Director General of Nuclear Fuel Cycle Engineering Laboratories, Sector of Decommissioning and Radioactive Waste Management, JAEA
- April 2015 Director of Tokai Reprocessing Technology Development Center, Nuclear Fuel Cycle Engineering Laboratories, Sector of Decommissioning and Radioactive Waste Management, JAEA
- April 2014 Director of Technology Development Department, Tokai Reprocessing Technology Development Center, Nuclear Fuel Cycle Engineering Laboratories, Sector of Decommissioning and Radioactive Waste Management, JAEA
- May 2011 Director of Vitrification Technology Development Department, Tokai Reprocessing Technology Development Center, Nuclear Fuel Cycle Engineering Laboratories, Tokai Research and Development Center, JAEA
- July 2006 Senior Principal Engineer, Nuclear Fuel Cycle Technology Development Directorate, JAEA

E Executive Director
OHSHIMA Hiroyuki

Career Outline

- April 2021 Executive Director, Japan Atomic Energy Agency (JAEA)
- April 2018 Deputy Director General of Orarai Research and Development Institute and Director General of Fast Reactor Cycle System Research and Development Center, Sector for Fast Reactor and Advanced Research and Development, JAEA
- April 2014 Director of Fast Reactor Computational Engineering Department, Advanced Fast Reactor Cycle System Research and Development Center, Sector of Fast Reactor Research and Development, JAEA
- July 2011 Deputy Director of JSFR Systems Development Planning Office, Advanced Nuclear System Research and Development Directorate, JAEA
- July 2010 Senior Principal Researcher, Advanced Nuclear System Research and Development Directorate, JAEA

F Executive Director
OIGAWA Hiroyuki

Career Outline

- April 2021 Executive Director, Japan Atomic Energy Agency (JAEA)
- April 2019 Deputy Director General of Sector of Nuclear Science Research and Director General of Nuclear Science Research Institute, JAEA
- April 2016 Director of R&D Program Management Department, JAEA
- April 2015 Senior Principal Researcher and Director of R&D Program Management Department, JAEA
- April 2014 Deputy Director of Office of Strategic Planning, JAEA
- October 2010 Director of Research Co-ordination and Promotion Office, Nuclear Science and Engineering Directorate, JAEA
- July 2010 Senior Principal Researcher, Nuclear Science and Engineering Directorate, JAEA

G Executive Director
FUNAKI Kentaro

Career Outline

- April 2021 Executive Director, Japan Atomic Energy Agency
- July 2019 Chief Nuclear Officer for International and Technology Affairs, Director-General's Secretariat, Agency for Natural Resources and Energy (ANRE), Ministry of Economy, Trade and Industry (METI)
- July 2016 Senior Nuclear Safety Specialist, OECD Nuclear Energy Agency
- August 2014 Managing Director, Nuclear Damage Compensation and Decommissioning Facilitation Corporation
- August 2013 Director of R&D Strategy Planning Department, International Research Institute for Nuclear Decommissioning
- August 2012 Director of Nuclear Accident Response Office, Nuclear Energy Policy Planning Division, Electricity and Gas Industry Department, ANRE, METI
- July 2010 Director for Nuclear Energy Policy, General Policy Division, Director-General's Secretariat, ANRE, METI
- April 1991 Joined Ministry of International Trade and Industry

H Executive Director
HORIUCHI Yoshinori

Career Outline

- April 2022 Executive Director, Japan Atomic Energy Agency
- August 2020 Deputy Director-General, Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- July 2019 Deputy Director-General for Science, Technology, and Innovation, and Okinawa Institute of Science and Technology Graduate University Project Office, Cabinet Office
- July 2018 Director for Economic and Fiscal Management, Office of the Director General for Science, Technology and Innovation Policy, Cabinet Office
- July 2017 Director of the Research and Development Policy Division, Research and Development Bureau, MEXT
- August 2015 Director of the Space Development and Utilization Division, Research and Development Bureau, MEXT
- January 2014 Director of the Life Science Division, Research Promotion Bureau, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- July 2011 Director of the Policy Planning Division, Institute of Physical and Chemical Research (RIKEN)
- October 2009 Director of the Ocean and Earth Division, Research and Development Bureau, MEXT
- April 1990 Joined Science and Technology Agency

I Auditor
TANAKA Teruhiko

Career Outline

- September 2019 Auditor, Japan Atomic Energy Agency
- July 2018 Representative, Tanaka Teruhiko Audit Firm
- May 2002 Appointed as a representative partner of the Shinwa Audit Corporation
- October 1979 Joined Shinwa Audit Corporation (Currently KPMG AZSA LLC.)

J Auditor (part-time)
AMANO Reiko

Career Outline

- September 2019 Auditor, Japan Atomic Energy Agency
- October 2014 Deputy Director-General of the Research Center for Reinforcement of Resilient Function, National Research Institute for Earth Science and Disaster Resilience
- February 2014 Dedicated Officer of the Intellectual Property and License Department, Kajima Corporation
- April 2011 Director of the Intellectual Property and License Department, Kajima Corporation
- April 2005 Manager, Civil Engineering Technology Department, Civil Engineering Management Division, Kajima Corporation
- March 2004 Visiting Professor, Institute of Industrial Science, the University of Tokyo
- April 1980 Joined Kajima Corporation

Former Board Directors (as of March 2022)

* Retired on March 31, 2022

President
KODAMA Toshio*

Career Outline

- April 2015 President, Japan Atomic Energy Agency
- February 2015 Board Member, Vice President, Director General of Technology Management, Mitsubishi Heavy Industries (MHI)
- June 2013 Board Director, Managing Executive Officer, Director General of Technology Management, MHI
- April 2009 Executive Officer, Deputy Director General of Technology Headquarters, MHI
- April 1976 Joined MHI

Executive Vice President
ITO Yoichi*

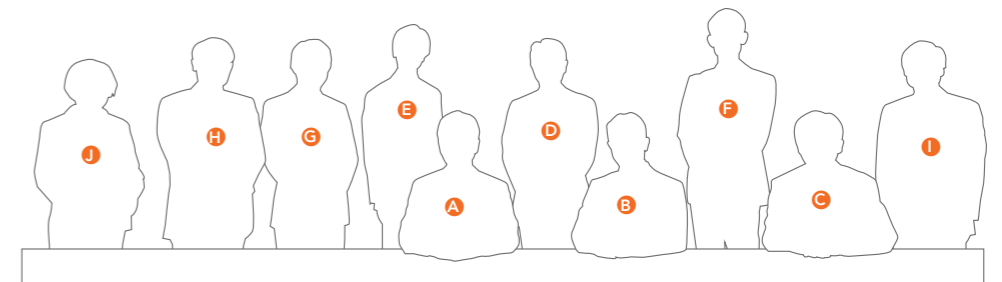
Career Outline

- April 2019 Executive Vice President, Japan Atomic Energy Agency (JAEA)
- July 2017 Senior Deputy Minister of Education, Culture, Sports, Science and Technology, Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- January 2016 Director-General, Science and Technology Policy Bureau, MEXT
- August 2015 Assistant Minister for Policy Coordination, MEXT
- January 2012 Executive Director, JAEA
- July 2010 Deputy Director-General, Lifelong Learning Policy Bureau, MEXT
- January 2001 Director, Private School Department, Higher Education Bureau, MEXT
- April 1982 Joined Science and Technology Agency

Executive Director
SUDO Kenji*

Career Outline

- April 2019 Executive Director, Japan Atomic Energy Agency
- January 2018 Director, National Space Policy Secretariat, Cabinet Office
- April 2016 Director, Department of General Affairs, National Institutes for Quantum and Radiological Science and Technology
- April 2014 Professor, Tokyo University of Agriculture and Technology
- August 2012 Deputy Director General, Research Strategy Department, Japan Aerospace Exploration Agency
- July 2009 Director for Resource Allocation, Bureau of Science, Technology and Innovation, Cabinet Office
- April 1989 Joined Science and Technology Agency



Governance

Competent ministers

(according to Article 28 of Act on the Japan Atomic Energy Agency, National Research and Development Agency)

Operations item in the Medium-/Long-Term Plan	Competent ministers		
	Minister of Education, Culture, Sports, Science and Technology	Minister of Economy, Trade and Industry	Nuclear Regulation Authority
I. Measures to be taken for attaining targets concerning business operations placing top priority on safety	●	●	● *
II. Measures to be taken for attaining targets concerning maximizing R&D outcomes and raising quality in other areas			
1. R&D pertaining to the response to the accident at TEPCO's Fukushima Daiichi Nuclear Power Station	●	●	● *
2. Technical supports for nuclear safety regulation and safety research for their purposes	●		● *
3. R&D for improving nuclear safety and activities that contribute to nuclear non-proliferation and nuclear security	●	●	● *
4. Basic and fundamental research and human resources development in the nuclear field	●		● *
5. R&D on fast reactors and advanced reactors	●	●	● *
6. R&D related to the nuclear fuel cycle, such as reprocessing, fuel manufacturing and treatment and disposal of radioactive waste	●	●	● *
7. Activities for sector of Tsuruga decommissioning demonstration	●	●	● *
8. Activities to strengthen industry-academia-government collaboration and secure the trust of society	●	●	
III. Measures to be taken for attaining targets related to enhancing the efficiency of business operations	●	●	
IV. Measures to be taken for attaining targets related to improving the state of finances	●	●	
V. Important matters concerning other business operations	●	●	

* (Safety assurance matter)

JAEA's Governance System

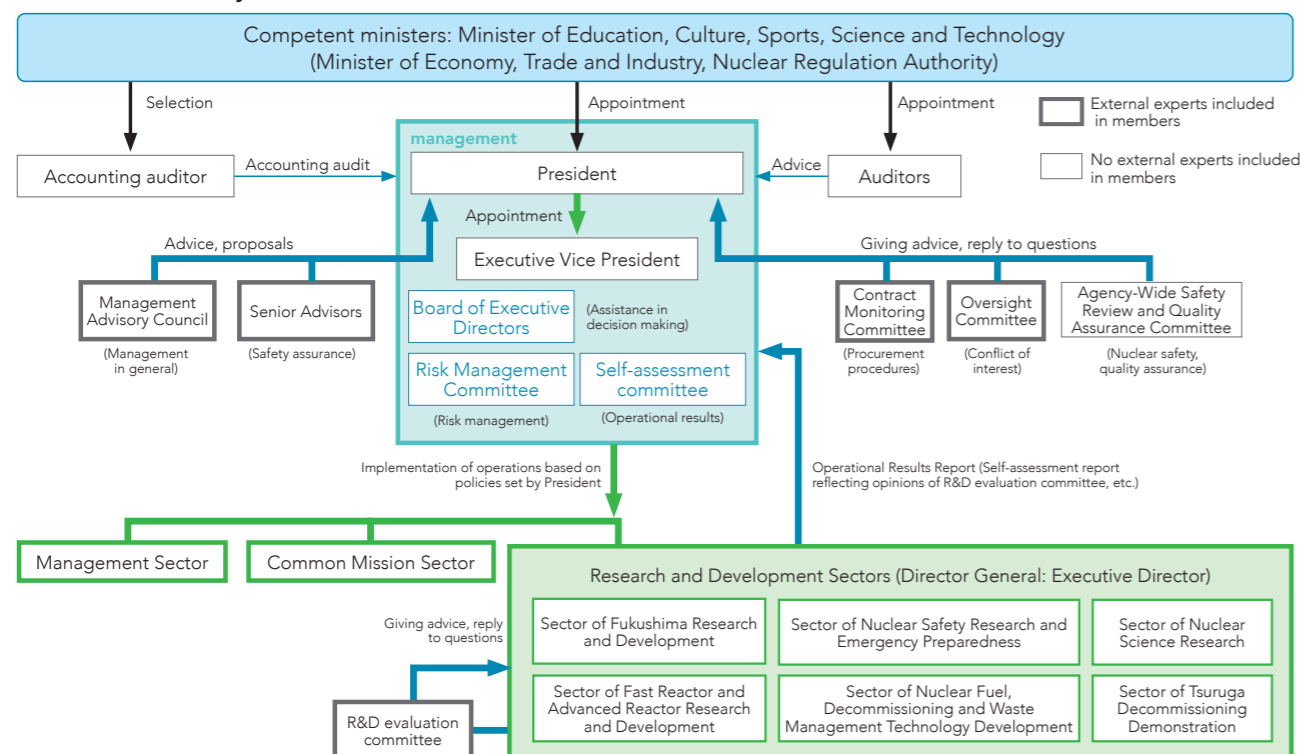
The figure below shows JAEA's governance system. JAEA's statement of operation procedures sets out the rules for decision making led by the President, the internal control promotion system, auditing by auditors, and other relevant systems as a framework to ensure the conformity of the execution of duties by the directors and employees of JAEA with relevant laws and regulations such as the Act on General Rules for Incorporated Administrative Agencies and to ensure the appropriateness of JAEA's operations.

For the details of the internal control system, please read our statement of operation procedures.

[Statement of operation procedures: https://www.jaea.go.jp/about_JAEA/business_plan.html \(in Japanese\)](https://www.jaea.go.jp/about_JAEA/business_plan.html)



JAEA's Governance System



Net Assets, Sources of Revenue

Net Assets

(1) Capital Stock

(¥ million)

Items	Starting balance	Increase in the fiscal year	Decrease in the fiscal year	Ending balance
Government investment	801,505	2,260	93	803,672
Private investment	16,292	—	6	16,286
Total capital stock	817,797	2,260	99	819,958

The capital stock (government investment) at the end of FY2021 was 803,672 million yen, of which the general account accounted for 280,636 million yen and the power usage account for 523,036 million yen.

(2) Appropriated Retained Earnings, etc.

In the burial disposal business account, a gross profit of 1,738 million yen was generated for the fiscal year. In accordance with Article 21, paragraph (4), of the Japan Atomic Energy Agency Act, this must be appropriated as a fund for burial disposal and related operations in the next and subsequent fiscal years and need not be reported as appropriated retained earnings.

The reversal of reserves carried over from the previous Medium-/Long-Term Objectives period is a reversal of 75 million yen, an amount equivalent to the cost incurred in FY2021 proportional to the accounting profit (general account of 3,442 million yen) that was recorded prior to the 2nd Medium-/Long-Term Objectives period and carried over to the 3rd Medium-/Long-Term Objectives period after obtaining approval from the Competent Ministers.

Sources of Revenue

(1) Breakdown of Sources of Revenue

JAEA's main income source is funding from the national treasury, namely, government funding for operational grant of 131,903 million yen and subsidies of 15,069 million yen. In addition, as self-generated income, JAEA acquired competitive funds of 427 million yen by making proactive applications and obtained external funds of 11,943 million yen from government-related organizations for entrusted research and other research activities.

(2) Explanation of Self-Generated Income

JAEA worked to secure self-generated income by identifying research needs at external organizations, then concluding income-generating joint research contracts and making proactive applications to competitive research funds.

JAEA's main self-generated income is:

- Income from entrusted research (11,943 million yen)
- Competitive research funding (427 million yen)
- Income from joint research (162 million yen)
- Income from external use of facilities (473 million yen)

Measures against Aging of Nuclear Facilities and Management of Back-End Issues

Approach to “Nuclear Legacy” arising from R&D activities

More than 60 years has passed since the Atomic Energy Basic Act of Japan came into effect in 1955, accumulating peaceful use of atomic energy, and various facilities have completed their mission and are moving to the decommissioning stage. Efforts to address back-end issues, including treatment and disposal of radioactive waste produced by nuclear facilities, have therefore become important.

JAEA has various facilities which have supported R&D on nuclear science and technology and have completed their mission, together with various types of radioactive waste generated from these facilities. It is essential for us to steadily work on the nuclear legacy, radioactive waste management, and decommissioning evolution in order to gain the trust of

society and make nuclear science and technology sustainable well into the future.

Management of radioactive materials: Aiming to promote more efficient means of radioactive waste treatment and disposal, we will conduct R&D on the reduction of the volume and radiotoxicity of radioactive waste through partitioning and transmutation technology.

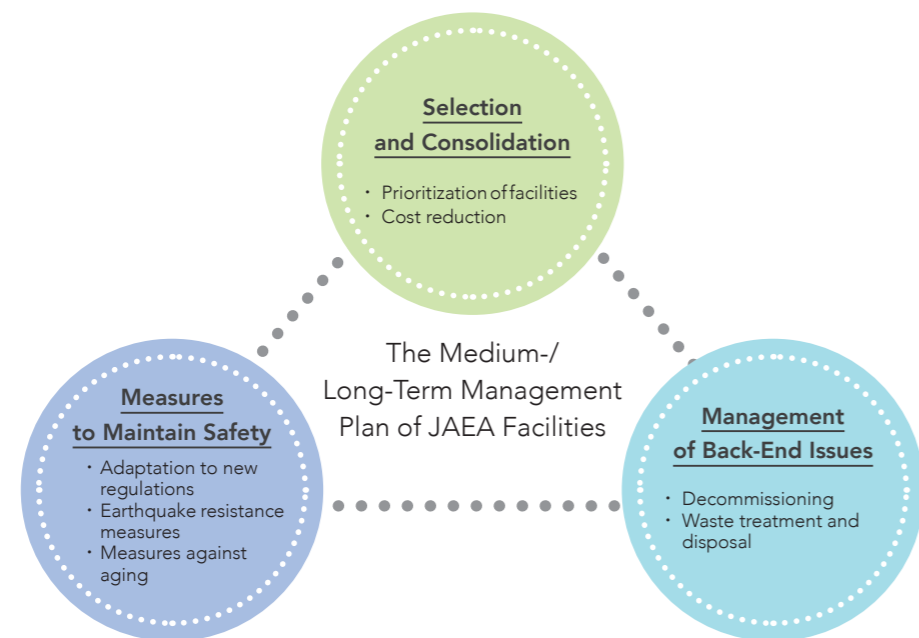
Decommissioning evolution: We will optimize the entire process of decommissioning including technology development, and steadily advance with the safe, speedy, and efficient decommissioning of our various retired facilities using state-of-the-art technologies.

Development of the Medium-/Long-Term Management Plan for JAEA Facilities

JAEA issued the Medium-/Long-Term Management Plan for JAEA Facilities on April 1, 2017, in order to maximize the use of resources and maintain and develop R&D functions in the future. This comprehensive plan focuses on three objectives: selection and consolidation of JAEA’s nuclear facilities; measures to maintain the safety of facilities; and management of back-end issues. The Medium-/Long-Term Management Plan for JAEA Facilities is updated every fiscal year based on its progress. In fiscal 2021, JAEA completed the response to the new regulatory requirements for the HTTR, which was scheduled to be restarted for the HTGR safety demonstration test, and resumed its operation in July

2021. Moreover, regarding safety measures for the High Active Liquid Waste Storage (HAW) and Tokai Vitrification Facility (TVF) in the Tokai Reprocessing Plant (TRP) against the new regulatory requirements for earthquake and tsunami, which is one of measures having the highest priority from the perspective of reducing the risks associated with holding highly radioactive liquid waste, JAEA completed the application for approval of changes to the decommissioning plan of TRP in September 2021 and made steady progress in safety measures construction by strengthening the project management. In addition, measures for aging and back-end measures were implemented almost as planned.

[The Medium-/Long-Term Management Plan for JAEA Facilities:](https://www.jaea.go.jp/about_JAEA/facilities_plan/)
https://www.jaea.go.jp/about_JAEA/facilities_plan/ (in Japanese)



Status of Environmental Impact Reduction Activities

Environmental Management

JAEA regards consideration for the environment as a high priority in its operations, and has formulated Rules on Environmental Management. In addition, under the Basic Environmental Policy, we set Environmental Targets and proactively undertake environment-conscious activities.

Moreover, to systematically promote environment-conscious activities, we have set up an environmental management framework, which includes an Environmental Committee and a Meeting of Section Heads in Charge of Environmentally Conscious Activities.

[Safety assurance activities page:](https://www.jaea.go.jp/about_JAEA/safety/)
https://www.jaea.go.jp/about_JAEA/safety/ (in Japanese)



The chart below shows how we plan and implement our environment-conscious activities in each fiscal year. The activity results undergo review by the relevant committees, including the Environmental Committee, and are incorporated into the following year’s Basic Environmental Policy and Environmental Targets.

Results of FY2021 Environment-Conscious Activities

Major action	1Q			2Q			3Q			4Q		
	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Formulation of Environmental Policy and Targets and compiling of activity results	Evaluate target achievement in previous fiscal year and report results to Environmental Committee			Promote environment-conscious activities based on Basic Environmental Policy and Environmental Targets			Evaluate activity results and formulate corresponding plan for following fiscal year, including Basic Environmental Policy and Environmental Targets					
Implementation of measures to comply with environmental laws and regulations (e.g. Act on Rationalizing Energy Use, Act on Promotion of Global Warming Countermeasures)				Prepare periodic and other environment-related reports required by Acts and submit to national authority								
Preparation and publication of Environmental Report 2021 (in Japanese)				Prepare Environmental Report			Publish (end of Sep.)					
Training session on environment-conscious activities							Organize training session on environment-conscious activities					

Every year, JAEA invites an external lecturer to give training and hosts a meeting to encourage an exchange of views. These training sessions are expected to serve the purpose of promotion and active implementation of environment-conscious activities at its laboratories and improvement of the skills of relevant personnel.



Training Session on Environment-Conscious Activities

Initiatives to Promote Energy-Saving Activities

JAEA promotes environment-conscious activities for energy conservation. JAEA’s research institutes* at six locations are designated Energy Management Factories under the Act on Rationalizing Energy Use (hereinafter “Energy Conservation Act”). Accordingly, these research institutes promote energy conservation activities in line with Medium-/Long-Term Plans drawn up based on the Energy Conservation Law. Other laboratories also engage in energy conservation efforts.

* Nuclear Science Research Institute (including J-PARC), Nuclear Fuel Cycle Engineering Laboratories, Oarai Research and Development Institute, Fugen Decommissioning Engineering Center, Prototype Fast Breeder Reactor Monju, Ningyo-toke Environmental Engineering Center

Consideration for the Environment

In accordance with the Act on Promotion of Contracts of the State and Other Entities, Which Show Consideration for Reduction of Emissions of Greenhouse Gases, etc., JAEA works continuously for environment-conscious agreements and procurement and on other activities relating to the input materials required for its operations. Additionally, JAEA’s research institutes and laboratories proactively implement initiatives to improve and beautify the environment inside and outside their compounds, such as planting trees and flowers, weeding, and cleaning up.

JAEA implements its operations in an environment-conscious manner with a strong awareness of its corporate social responsibility.

[Information on JAEA’s environment-conscious activities:](https://www.jaea.go.jp/about_JAEA/environment/)
https://www.jaea.go.jp/about_JAEA/environment/ (in Japanese)



Status of Risk Management

JAEA implements risk management activities to reduce and prevent potential risks, including compliance risk and incidents at nuclear power facilities.

Risk Management Activities

In FY2021, our risk management activities were carried out with reflection on the accidents and issues that had occurred during the 3rd Medium-/Long-Term Objectives period, and with an awareness that the restart of the test and research reactor had further emphasized the need to ensure the safety of facilities. We used a PDCA cycle to identify and analyze operational risks and took corresponding measures to reduce them. We especially worked to strengthen governance at partner companies.

In addition, to ensure the effectiveness of the risk management activities, we carried out an exhaustive internal audit of all operations, the results of which were reported to the President and the Risk Management Committee to be reflected in operational activities so as to further improve the risk management system.

Compliance Activities

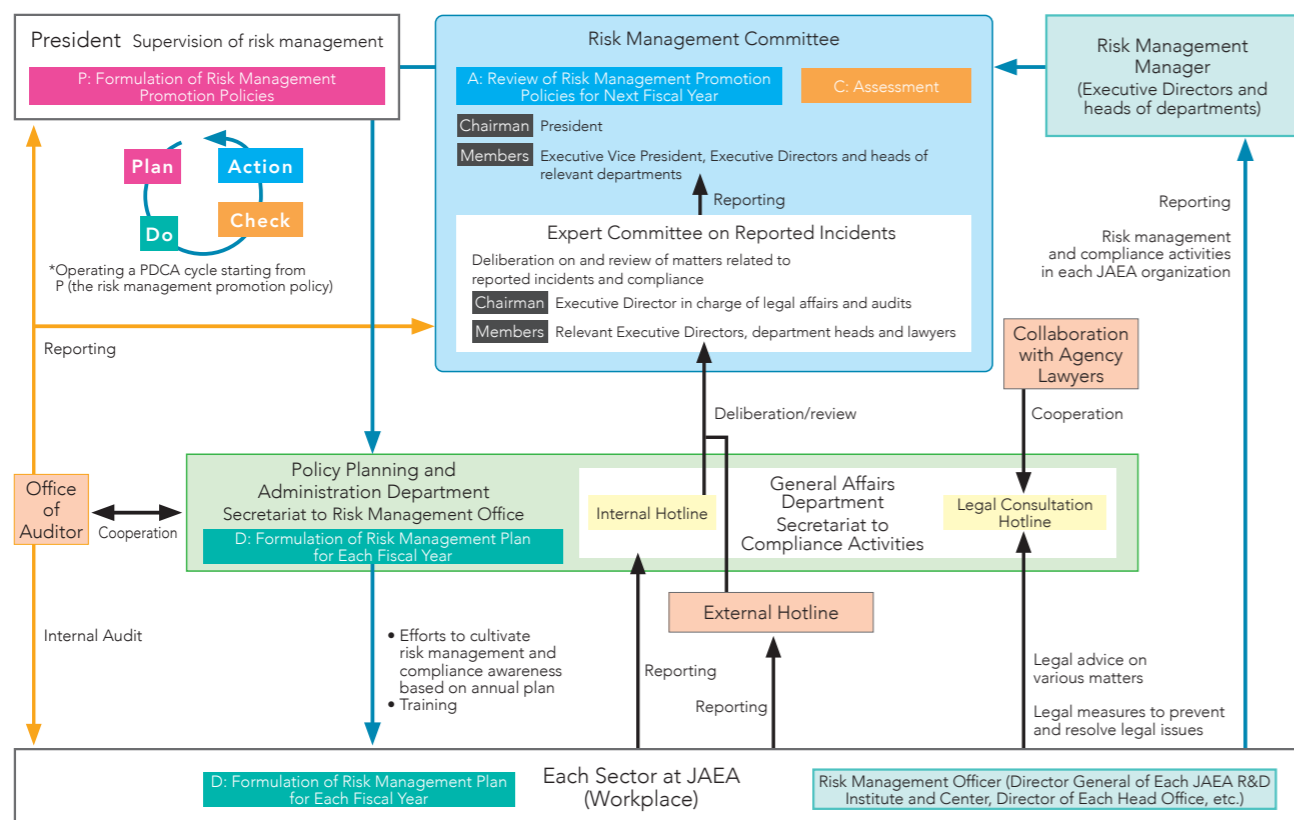
In FY2021, we introduced a system to manage conflict of interest to prevent any associated adverse impact and took steps to resolve any potential issues as necessary through self-reporting by officers and employees. Compliance training for new recruits was provided together with interdepartmental training sessions (6 times, total 652 participants) and training by external lecturers (twice, total 463 participants) as part of activities to confirm and consolidate compliance awareness.

We also worked to raise compliance awareness among officers and employees through other activities, such as participating in the National Research and Development Agency Council's compliance expert committee and the compliance promotion month organized by the committee.



Compliance awareness poster (Coordinated activity by National Research and Development Agency Council)

Organizational Chart of JAEA Risk Management Activity



Efforts to ensure fair, transparent and efficient procurement

JAEA formulates a Procurement Rationalization Plan*1 for each fiscal year. According to this plan, we implement the PDCA cycle to promote autonomous and continuous rationalization of procurement and related activities, while ensuring fairness and transparency. We promote procurement of eco-friendly products*2, such as those designated under the Act on Promoting Green Procurement, in the interest of environmental preservation. We also purchase products preferentially from organizations supporting persons with disabilities*3.

PDCA Cycle in JAEA's Contracting Process



*1 For details of the Procurement Rationalization Plan, please see the JAEA website. https://www.jaea.go.jp/for_company/supply/contract/ (in Japanese)
 *2 For performance in the procurement of eco-friendly products, please see the JAEA website. https://www.jaea.go.jp/for_company/supply/green/ (in Japanese)
 *3 For performance in the procurement of products from organizations supporting persons with disabilities, please see the JAEA website. https://www.jaea.go.jp/for_company/supply/handicapped/ (in Japanese)
 *4 For information on the Contract Monitoring Committee, please see the JAEA website. https://www.jaea.go.jp/for_company/supply/contract/committee.html (in Japanese)



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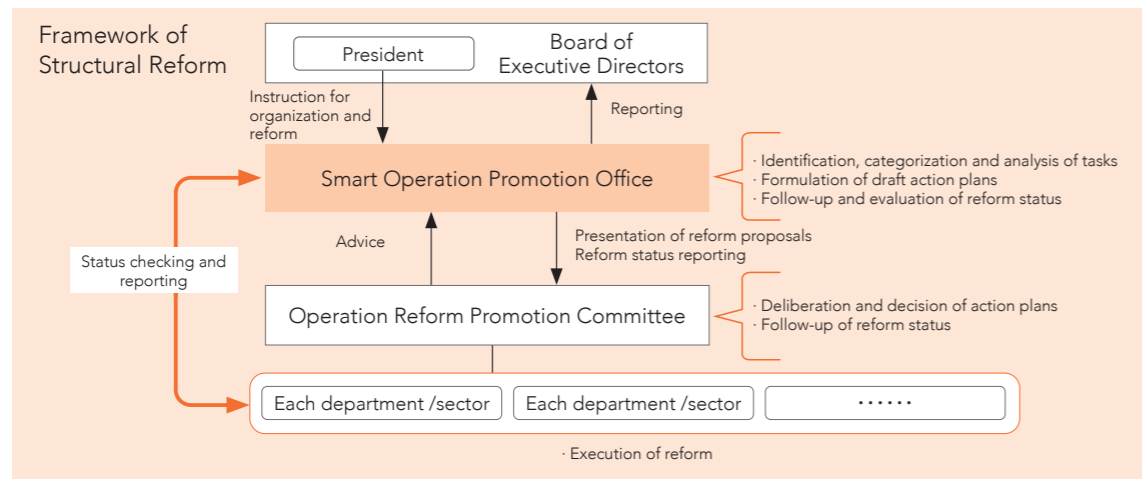
Measures against Novel Coronavirus Infection

In February 2020, JAEA established the JAEA Novel Coronavirus Response Headquarters led by the President, which makes decisions on actions to be taken based on the policy of the national government and requests by the local governments. Under this system, JAEA has continued its operations taking all necessary infection prevention measures, while adapting to new lifestyles including new ways of working such as working from home, staggered working hours, and online meetings. In particular, JAEA sites with a nuclear facility have established a business continuity plan and control measures for the event of cluster infections to ensure the safety of the facilities in emergencies and implemented site-specific measures including restriction of entry into the central control room and split use of commuting buses and communal areas such as canteens. In FY2021, JAEA encouraged its employees to be vaccinated and conducted workplace vaccinations at the Ibaraki site.

Structural Reform of JAEA Operations

Promotion of Structural Reform under Strong Leadership of President

Under the President's strong leadership, JAEA has worked on resolving its urgent management challenges through efforts led by the Smart Operation Promotion Office established in April 2019 to promote structural reform of operations.

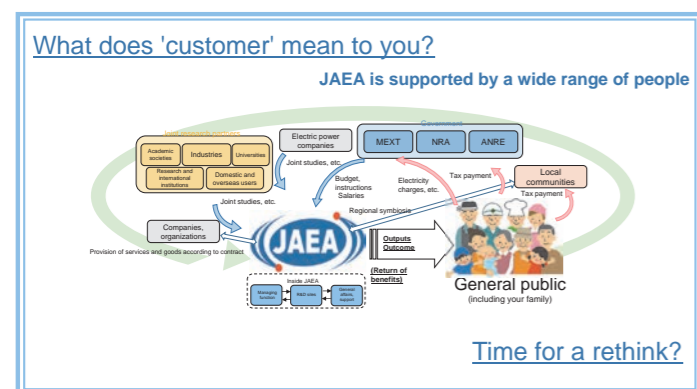


JAEA's management challenges include aging facilities and equipment, increasing workload in waste management and decommissioning, and a decrease in the R&D budget and staff numbers. To address these issues, we need to accelerate relevant initiatives including elimination of inefficient or wasteful activities, efficiency improvement and consolidation of operations, and introduction of IT.

Execution of Reform Action Plans

With the Smart Operation Promotion Office playing the core role, in FY2019, we formulated Reform Action Plans clarifying "who" does "what" "by when" to resolve issues. In FY2021, based on the outcome of activities performed in the previous fiscal year, we organized reform challenges to be addressed, summarizing issues pointed out by the management and requests identified in opinion exchanges with employees.

We are promoting the reform of JAEA as a whole while quantifying the outcome of activities where possible and adjusting Action Plans as appropriate based on progress checks by the Operation Reform Promotion Committee and opinions gathered from staff.



Customer awareness-raising poster



Motivation-raising campaign

Evaluation of Activities in FY2021 and Future Activities

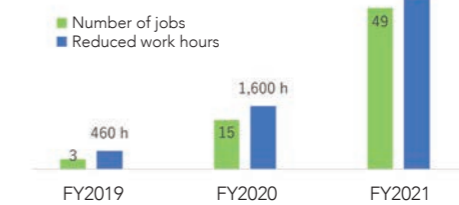
In FY2021, through discussion by the Operation Reform Promotion Committee of the outcomes of reform activities and their dissemination to all employees, JAEA made a unified effort to improve awareness of reforms and developed reform activities targeting all its operations. We will continue with the structural reform of operations including operational rationalization and efficiency improvement.

List of Status and Achievements of Major Reform Tasks in FY2021

Category of task	Main activity subjects	Main achievement
Reform of employee awareness	• Motivation raising	• As part of the Motivation Raising Campaign, facility tours, inter-organization opinion exchange sessions, lecture sessions, etc. were held (approx. 2,100 participants in total) to raise employee motivation.
	• Business operations with customer and economy in mind	• Rollout of awareness-raising activities including display of a poster underlining that JAEA's customers are the general public and holding of lecture sessions on cost- and customer-conscious operations.
Rationalization and efficiency improvement of operations	• Initiatives for job streamlining and introduction of information technology	• Continuous improvement of management operations (e.g. streamlining contracting procedures by introducing online ordering systems, streamlining goods management using QR codes).
	• Electronization of internal procedures	• Of over 20,000 paper-based procedures at JAEA, some 8,500 are about to be electronized.
	• Introduction and spreading of RPA	• Robotic Process Automation (RPA) was implemented for 49 items, saving approximately 4,500 hours of labor.
	• Cost reduction through hearings	• Guidance on cost optimization, etc. was provided in contract hearings, which led to a cost reduction of approximately 140 million yen across 10 items.
	• Rationalization of administrative expenses	• A total cost reduction of approximately 22 million yen was realized through reduction of the number of JAEA-owned vehicles, photocopiers, and fax machines and other measures.
	• Promotion of cross-divisional sharing of operations	• Cross-divisional liaison meetings were held on 17 items to realize technical and operational coordination across organizations.
Organization system	• Needs-seeds matching	• A search system for linking the issues employees have (needs) to the technologies they have (seeds) and a bulletin board system for exchanging opinions and sharing information were newly established.
	• Appropriate personnel procurement	• To improve new graduate recruitment activities, coordination of student acceptance systems and employment activities was enhanced.
Personnel system	• Establishment of specialized career path system	• The JAEA Fellowship was established as a career development system for staff with outstanding expertise and abundant achievements.
Management enhancement	• Introduction of project system	• Regarding cross-divisional operations, a system for the President to appoint a project manager with responsibility and authority for supervising the project was introduced and seven projects launched.



Site tour and opinion exchange session in motivation-raising campaign



Number of jobs replaced by introduction of RPA

Public Consultation, Public Relations and Information Disclosure



JAEA fosters mutual understanding with local communities and society through various dialog activities and works to earn their trust. In FY2021, we formulated the JAEA PR Strategy to develop integrated public relations activities with a story aspect and started initiatives to visualize “JAEA to the future” by actively adopting a designed catchphrase.

Prompt and Proactive Provision and Disclosure of Information and Transparency

JAEA actively provides and discloses information. In doing so, we try to make information accurate, neutral, and easy to understand by incorporating risk communication techniques. When disseminating R&D results and information at exhibition events, we use both paper media such as public relations magazines and electronic media such as social networking services (SNS) and utilize video clips and effective photographs where possible to help people understand the content of research that may otherwise appear distant from daily life. Meanwhile, in the event of an accident or a trouble, JAEA distributes information focusing on promptness and accuracy.

Official Twitter account:
https://twitter.com/jaea_en



Tweets presenting R&D results in short video clips

Science Cafés and Open Facility Days

JAEA promotes direct dialog with all interested parties through exhibitions to disseminate its research outcomes and web-based participation in educational events such as science experiment classes and science cafés. JAEA also conducts facility tours through online video clips and virtual reality systems to provide the public with the opportunity to learn about its operations.



Web-based exhibition Science AGORA 2021



JRR-3 virtual tour

Timely and Appropriate Press Releases, Accurate and Easy-to-Understand Information Dissemination

In addition to holding press study sessions suitable for the needs of the time, JAEA periodically holds lecture sessions for its staff on how to write press release documents and encourages creative expression to convey the writer's intent, aiming to improve the rate of documentation in newspapers and other media. We have also opened a page on social networking sites to promptly deliver information on our achievements and topics of high social interest.



Press study session

Introducing JAEA's R&D outcomes in an easy-to-understand manner:
https://www.jaea.go.jp/study_results/representative/ (in Japanese)

Information Disclosure

JAEA responds promptly and appropriately to disclosure requests as provided for in the Act on Access to Governmental Information. JAEA also works to ensure the objectivity and transparency of its operations through, for example, the operation of a Public Information Committee composed of external experts to verify the proper operation of its information disclosure framework.

Information Disclosure:
https://www.jaea.go.jp/about_JAEA/information_disclosure/ (in Japanese)



JAEA Annual Symposium

For FY2021, we held the JAEA Annual Symposium in a hybrid format, both inviting attendees to the venue and providing an online streaming service. Under the main theme “To the Future – Shaping a Sustainable Future with New Era Nuclear Science and Technology,” we reported the basic approach to and the directionality of our future activities. During the “Talk Session,” well-informed members of the public expressed the expectation that the technologies related to nuclear energy that are part of our daily life can be focused to improve the quality of life as part of the social infrastructure.



JAEA Annual Symposium

Initiatives for Industry-Academia-Government Collaboration

JAEA has been focusing on creating innovation and giving back its R&D results to society. In FY2021, we carried out 219 new joint research projects and 125 contract research projects with various bodies such as government, universities and private companies. In addition, 469 shared use programs were conducted on JAEA-owned facilities.

Since 2018, we have hosted the JAEA Technology Salon to accelerate R&D activity and the application of its results through interdisciplinary research. As a result of advances in technology presented at the JAEA Technology Salon, a startup company originating from JAEA, Emulsion Flow Technologies Ltd., was established. Furthermore, technical consultations on social implementation and joint research were received from private companies with which we did not have previous connections.

JAEA also operated the R&D Collaboration Frame to promote the practical implementation of our intellectual property, and a local company in Fukui Prefecture took advantage of this framework to develop a decommissioning and disaster response robot that gathers information on the 3D distribution of radiation contamination.

To strengthen structures for the creation of innovation, the JAEA Innovation Hub was established in October 2021, for which a director and senior advisors with considerable knowledge of industry-academia-government collaboration were engaged through external recruitment. Additionally, the Open Facility Platform (OFF) was launched in April 2021 with the aim of promoting the industrial utilization not only of the large JAEA research facilities already used for industrial purposes, but also of other facilities and analytical equipment. Furthermore, we have been implementing open innovation and open science activities, such as initiating plan-based management of research data.

* The JAEA's R&D results (approximately 110,000 items in total), including academic papers and patents released by JAEA, can be accessed on the JAEA Originated Papers Searching System (JOPSS). For more details of industry-academia-government collaboration, please access the JAEA Innovation Hub's website.

JOPSS:
<https://jopss.jaea.go.jp/search/servlet/interSearch?language=1>
JAEA Innovation Hub: <http://tenkai.jaea.go.jp> (in Japanese)



A Co-Creation Space has been set up for mutual access to facilities and equipment. Consultants will propose the appropriate facilities and equipment in response to inquiries on research and utilization of resources.



JAEA Facilities and Analytical Instruments throughout Japan, which can be used for industrial purposes through a single point of contact at OFF.

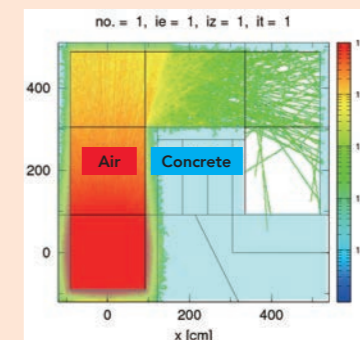
TOPICS

JAEA technologies introduced at the JAEA Technology Salon FY2021

- Development of in-situ visualization technology for large-scale simulation
- Rapid and quantitative analysis method for alpha-emitting radiopharmaceuticals
- Low-cost, transportable nuclear material detection device for nuclear security
- Radiation-resistant straight tube LED lighting
- Visualization of radioactive contamination at decommissioning sites with 3D mapping
- Early detection technology for glass lining damage to prevent leakage of materials such as high-temperature concentrated sulfuric acid
- Three-dimensional seismic isolation system
- Further promotion of the use of the radiation transport code system PHITS
- Small hand-held dust collector with HEPA filter head used at plutonium handling facilities



Radiation-resistant straight tube LED lighting



Sample of PHITS calculation results



iRIS for visualization of radioactive contamination at decommissioning sites through 3D mapping

Redefining the Organizational Concept and Securing/ Training Human Resources

With a view to maximizing R&D outcomes and carrying out efficient operations, JAEA has formulated a Human Resources Policy, a plan that sets out the ideal employee profile and includes related career path policies. By increasing employee motivation and improving their qualifications and capabilities in this way, JAEA is promoting human resource development in a systematic and organized manner.

Ideal JAEA Employee Profile

- (1) Persons who understand management philosophy and can implement it in a steadfast and voluntary manner
- (2) Persons who play an active role in the international community while demonstrating originality and an innovative mindset in their respective areas of specialty
- (3) Persons who understand their respective roles within their organizational structure and demonstrate a high level of expertise while collaborating with others

Career Path Policies

JAEA formulates organizational training plans that reflect the actual circumstances of individual organizations. Based on the organizational training plans, JAEA formulates a personal training plan for each staff member and holds annual training interviews to provide follow-up and career path adjustment as necessary. In this way, JAEA endeavors to assist employees in developing a unique career that fits individual skills and aptitude and works to improve the capabilities of each employee and translate the outcomes into improved performance for the entire organization.

Further, in order to promote and vitalize R&D, in April 2022, we established the JAEA Fellowship, a system for recognizing employees with outstanding expertise and abundant R&D achievements as specialists in their field.



<p>Research positions</p> <p>Conduct original and innovative R&D to carve out the future of nuclear energy Example activities: Support for acquisition of doctoral degree; basic training for research positions; seminars on methodology for drafting research papers; support for presentations at academic conferences; dispatch to overseas research and other organizations and overseas nuclear study programs; utilization of cross-appointment system.</p>	<p>Administrative positions</p> <p>Contribute to smooth execution of JAEA operations and serve as bridge between specialists and society Example activities: Experience of different administrative operations through job rotation system; transfer to international organizations or overseas offices and temporary assignment to central government ministries and agencies; improvement of expertise through participation in external seminars.</p>
<p>Engineering positions</p> <p>Play active role as engineer, engaging in latest technology development and operating cutting-edge facilities Example activities: On-the-job training by senior colleagues at nuclear facilities; encouragement of acquisition of government-sanctioned qualifications and nurturing of legally required chief engineers; dispatch to overseas research and other organizations and overseas nuclear study programs.</p>	<p>Various training programs</p> <p>Activities to develop capabilities as a group of specialists trusted by society Example activities: Training for new employees; training for mid-career employees; training for employees promoted to managerial positions; basic and applied courses in nuclear energy; practical business language training.</p>

Enhancement of Employee Development Framework

Our efforts to promote human resource development in a well-planned and systematic manner comprise on-the-job training, which provides guidance in each workplace on carrying out duties, and off-the-job training to complement on-the-job training.

Furtherance of Diverse and Highly Productive Ways of Working Tailored to Each Employee

Promotion of Work-Life Balance

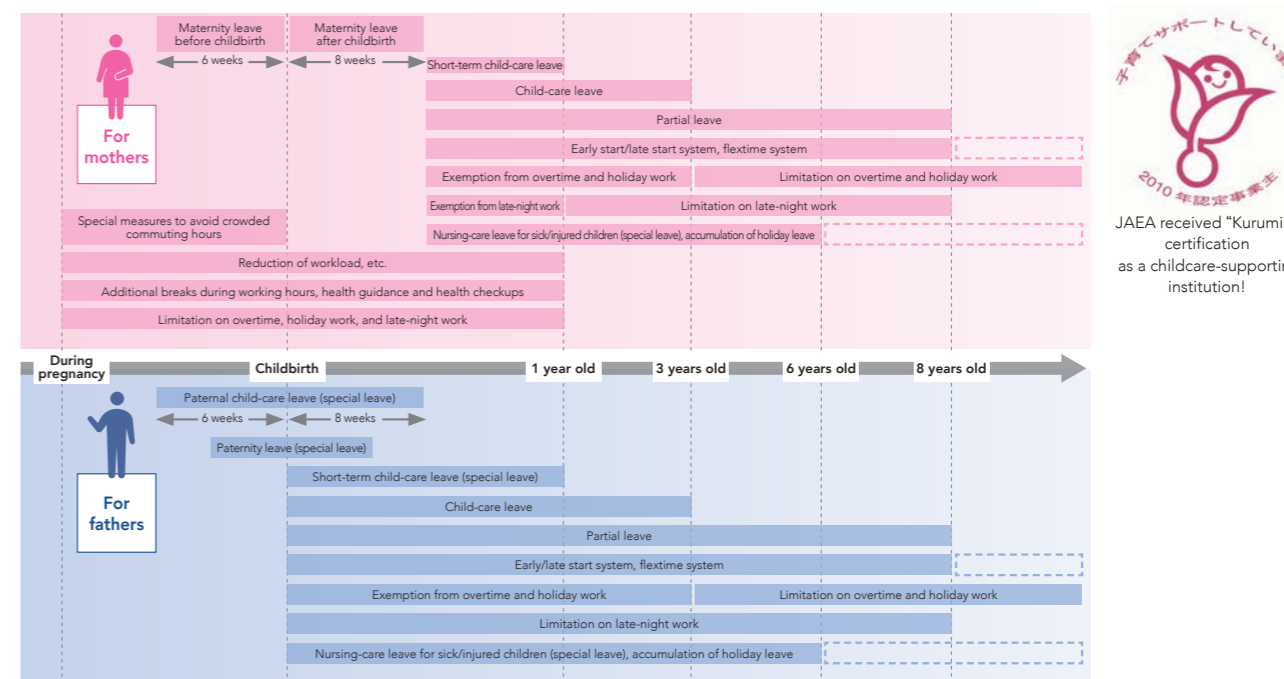
JAEA engages in a variety of activities to facilitate all its employees to fully exert their abilities by creating an environment where employees can balance work and personal life.

To encourage employees to continue working during challenging life stages such as child rearing and nursing care, we introduced a telecommuting system in FY2019. In order to further develop it as part of our new ways of working, we have formulated and tried a teleworking optimization program, which we plan to officially implement in the future.

In addition, we implemented initiatives to balance work and child rearing, such as financial aid for childminding fees using the system indicated by the national government and conclusion of corporate contracts.

“Genki! Ikukatsu Menu” for balancing work and child care

JAEA has in place a wide range of short-/long-term leave systems collectively called “Genki! Ikukatsu Menu” for both female and male employees to balance work and child care.



Development of Systems for Balancing Work and Family Care

We offer the following extensive working, holiday, and leave systems to help balance work and family care: flexible time system; nursing-care leave; short-term nursing-care leave; partial leave; exemption from and limitation on working extra hours; early/late start system; accumulation of accumulated leave.

Promotion of Gender Equality

JAEA engages in a variety of activities to promote gender equality from the viewpoint of securing and utilizing a wide spectrum of human resources (diversity).

- Ratio of female employees newly employed in FY2021 19.4%
- Ratio of female employees to all employees (as of April 1, 2022) 12.0%

- (1) Increase female recruitment: We implement initiatives to help potential female employees to envisage their career paths after joining us, including use as recruiters of successful female employees practicing various work styles and appealing to female students in recruitment activities and on our websites.
- (2) Career development of female employees: Through mentoring and other systems, we offer role models to our female employees in a bid to assist autonomous career development from a long-term perspective.
- (3) Facilitating understanding of gender equality: We hold opinion exchange sessions throughout our sites and publish Diversity Newsletters to disseminate information on our initiatives and actual cases to increase employee understanding of our activities and to raise their awareness through means such as rank-based training.

International Cooperation and Contribution

Implementation of the Strategy for International Cooperation

For JAEA to execute its mission, various forms of cooperation and partnership with the relevant nuclear organizations in other countries and international organizations are essential. These include, among others, undertaking international joint research to maximize R&D outcomes, expanding human networks through international contribution via such means as support for human resource development efforts in other countries, and increasing the visibility of JAEA in the global nuclear community through dissemination and international outreach of JAEA R&D outcomes.

European Commission (EC)
Nuclear Non-Proliferation/
Nuclear Security

Finland
Nuclear Safety

Poland
HTGR, and Material
Testing Reactor

Russia
Minor Actinoid (MA)
Transmutation

Sweden
R&D on the Disposal of High-
Level Radioactive Waste

United Kingdom
Decommissioning, Radioactive
Waste Management, and
High-Temperature Gas-Cooled
Reactor (HTGR)

Switzerland
R&D on the Disposal of
High-Level Radioactive Waste

France
Fast Reactor, Nuclear Safety and Radiation Protection,
Nuclear Science, Decommissioning, and Issues related
to the Fukushima Daiichi NPS Accident, etc.
• Expansion of the scope of R&D cooperation with
the French Alternative Energies and Atomic Energy
Commission (CEA) was agreed in December 2021.

China
Nuclear Non-Proliferation/
Nuclear Security, and Nuclear
Spallation, etc.

United States
R&D on the Next Generation
Reactor, R&D on the Nuclear Fuel
Cycle and Radioactive Waste
Management, Nuclear Non-
Proliferation/Nuclear Security, and
Nuclear Science
• Project agreements on
technical development
cooperation in the field of
nuclear non-proliferation and
nuclear security were signed
(May 2021-September 2021).
• A Cooperative Research and
Development Agreement
with the Idaho National
Laboratory (INL) on irradiating
chrome-coated zirconium alloy
cladding in the Advanced
Test Reactor was signed in
July 2021.

South Korea
Nuclear R&D, Nuclear
Non-Proliferation/Nuclear
Security, and Radioactive
Waste Management

Australia
Research Reactor
Utilization and
Neutron Science

**Emerging Nuclear Countries
in Asia and the Middle East
(Personnel Training Support for Nuclear Safety and Security)**

GEN IV International Forum
Expertise | Collaboration | Excellence
The Generation IV International Forum (GIF)
Participation in R&D project on Generation IV
reactor systems

International Atomic Energy Agency (IAEA)
Advanced Reactor
Nuclear Safety
Safeguards and Nuclear Security
Decommissioning and Radioactive
Waste Management, etc.

**Organisation for Economic
Co-operation and Development/
Nuclear Energy Agency (OECD/NEA)**
Advanced Reactor
Nuclear Safety
Nuclear Science
Decommissioning
Radioactive Waste Management
Personnel Training
The Agreement on the QUENCH-ATF Project (Development of Accident
Tolerant Fuel at QUENCH, Germany) was signed in September 2021.

**Preparatory Commission
for the Comprehensive
Nuclear-Test-Ban Treaty
Organization (CTBTO)**
Contribution to the
international monitoring
system to detect nuclear
test explosions

**International Science and
Technology Center (ISTC)**
Participation in cooperative
research projects

IAEA Collaborating Centre
JAEA was designated
as IAEA Collaborating
Centre in the two fields
of nuclear security and
decommissioning/radioactive
waste management in
October 2021.

**(*) Due to the changing international
environment, bilateral and
multilateral cooperation involving
Russia may be suspended or
otherwise affected in the future.**

Event organized by JAEA overseas office (Introduction of the new meeting style utilizing on-line platform)

The Fifth Symposium on U.S.-Japan Nuclear Energy Research Cooperation (November 2021)

Key figures representing the nuclear community in the U.S. participated in the Symposium and confirmed and promoted the nuclear R&D partnership between Japan and the U.S. in the introduction of advanced reactors, safety research, etc.

Other Event

Receipt of the Order of Merit of the Republic of France in April 2021

In recognition of his extensive contribution to nuclear cooperation between Japan and France, the then President Toshiro Kodama was awarded L'ordre national du Mérite, Officier Classe.

Strategy for International Cooperation:
https://www.jaea.go.jp/about_JAEA/international_strategy/ (in Japanese)



Contribution to Regional Development

JAEA sites actively contribute to regional development throughout Japan by holding science classes at junior high schools, participating in local events, and conducting other activities. JAEA also opens its facilities to the public and holds various events to deepen mutual understanding with local residents.

* The activities shown below are implemented with all necessary measures taken to prevent novel coronavirus infection.

Examples of Regional Contributions in FY2021

[Horonobe] Site tour for elementary school students

[Aomori] Science class at junior high school

[Fukushima] Staffing of a booth at a science event

[Tokai] Workplace experience for junior high school students

[Tokai] Participation in a cleaning event "Autumn Clean Campaign"

[Tsuruga] Decommissioning training session for local companies

[Ningyo-toge] Summer vacation crafting class for elementary school students

[Tono] Crafting class at a science event

[Oarai] Science class at junior high school

About the New Test and Research Reactor at the Monju Site

Together with Kyoto University and the University of Fukui, JAEA was adopted by MEXT in November 2020 as a core institution of the project "Examination of the conceptual design and operation scheme of the new research reactor to be installed at the Monju site". Within the project, JAEA focuses on the "design, installation, and operation of the research reactor".

In FY2021, JAEA simulated various core-configurations for the research reactor and continued with its geological survey of the candidate construction site. Activities continue with periodic review of the results by a consortium consisting of academia, industry, and related local organizations.

Measures to Be Taken for Attaining Targets Concerning Business Operations with Placing Top Priority on Safety

This item includes content realized by implementation of other matters, and the amounts recorded as administrative costs are as recorded for those other matters.

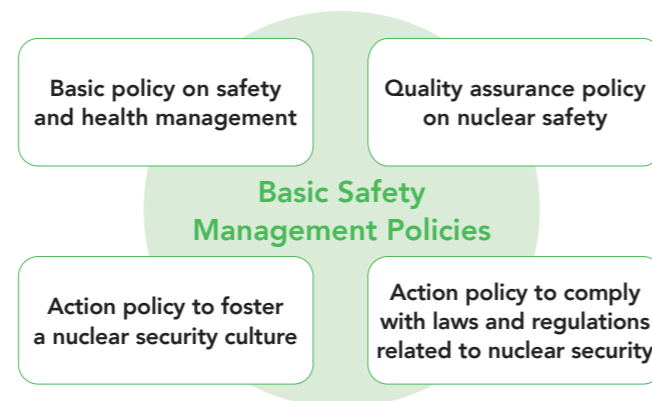
Basic Safety Management Policies

In its Basic Policy, JAEA specifies ensuring safety as the utmost priority for its management and operations. In addition, based on the Basic Safety Management Policies, JAEA thoroughly ensures the safety of its facilities and operations and the proper control of its nuclear materials, and ceaselessly works on the development and maintenance of a safety culture*1 and a nuclear security culture*1.

[Safety assurance activities page:
https://www.jaea.go.jp/about_JAEA/safety/
\(in Japanese\)](https://www.jaea.go.jp/about_JAEA/safety/)



*1 Safety culture and nuclear security culture refer, respectively, to prioritizing safety and to fulfilling the required roles and responsibility in nuclear security, as reflected in an organizational culture and awareness at both the organization and individual staff level.



Ensuring Safety Above All Else

As a comprehensive R&D institute in the field of nuclear energy, JAEA handles radioactive materials and is therefore required to demonstrate exceptionally high levels of safety and reliability. To that end, JAEA has formulated basic policies on safety, quality, and nuclear security and conducts its operations placing safety above all else.

Each JAEA site undertakes activities in accordance with

the basic policy on safety and health management and the quality assurance policy on nuclear safety. Each site also seeks continuous operational improvement by repeating the plan-do-check-act (PDCA) cycle. In addition, by instilling recognition of the importance of basic behavior at each individual workplace, we promote pre-work activities such as risk assessments and hazard prediction.

Activities to Develop and Maintain a Safety Culture

As part of activities to develop and maintain a safety culture, JAEA officials undertook safety patrols and exchanged opinions with staff on-site to promote information sharing and mutual understanding between management and staff. Each JAEA site held a safety gathering with participation of operating partners, a safety and health patrol by the director

general, sensory-based safety training to enhance staff sensitivity to risk, and other related activities as ongoing efforts to improve the safety consciousness of personnel involved in JAEA operations.

We will continue these activities to develop and maintain a safety culture and thereby prevent accidents and technical issues.



Virtual Reality (VR) experience training to enhance sensitivity to safety

Activities to Prevent Recurrence of Similar Events (Agency-wide Sharing of Lessons Learned from Incidents)

Following an accident or technical issue, JAEA undertakes activities to share the lessons learned agency-wide. In FY2021, continuing from the previous fiscal year, in addition to its pre-existing agency-wide sharing of information, JAEA worked to promote understanding among staff by creating short educational videos with subtitles giving a visual demonstration of inappropriate responses to an accident or emergency and shared them on the JAEA intranet.

In April 2019, JAEA received instructions from the Minister of Education, Culture, Sports, Science and Technology titled "Future measures to prevent accident or problem recurrence following the contamination accident in the controlled area of the Nuclear Fuel Cycle Engineering Laboratories." In FY2021, JAEA evaluated the effectiveness of measures taken in accordance with the instructions and confirmed that the initially expected results had been achieved. We will continue with related action.

Efforts to Organize and Prioritize Aging Facilities for Utilization

As JAEA started its R&D operations in the 1960s, many of its facilities and equipment items have aged. These older facilities and equipment items pose a safety risk that needs to be prioritized. Our response plan is to group these facilities into those we will continue to use and those we will no longer use and have to decommission. The necessary measures are

implemented based on risk assessment.

In FY2021, continuing from the previous fiscal year, we promoted relevant activities for these facilities by incorporating the plans to address aging into the Medium-/Long-Term Management Plan for JAEA Facilities (see page 14), thus reducing risk.

Implementation of Training and Drills at Nuclear Facilities

To be prepared for crises such as nuclear facility accidents/failures and natural disasters, we periodically implement necessary training and drills.

In FY2021, we conducted a total of 15 drills assuming a JAEA facility being the source of the emergency. In comprehensive emergency preparedness drills held at the research institutes subject to the Act on Special Measures Concerning Nuclear Emergency Preparedness, we conducted exercises on sharing information via the Integrated Nuclear Emergency Preparedness Network that links JAEA and the Secretariat of the Nuclear Regulation Authority, with the aim of refining the system to share and send out information. In addition, during the comprehensive emergency preparedness drills at the Fugen and Oarai R&D facilities, we conducted drills that incorporated support from other JAEA sites and confirmed the support system of the entire organization.

Comprehensive Emergency Preparedness Drills in FY2021 (Participant figures do not include participants of evacuation drills only or drill evaluators)

September 7, 2021	November 9, 2021	February 22, 2022
Ningyo-toge Environmental Engineering Center	Oarai Research and Development Institute	Nuclear Fuel Cycle Engineering Laboratories
ca. 230	ca. 380	ca. 260
October 15, 2021	December 14, 2021	March 8, 2022
Fugen Decommissioning Engineering Center	Prototype Fast Breeder Reactor Monju	Nuclear Science Research Institute
ca. 130	ca. 160	ca. 250

Maintenance of Equipment for Emergency Response

We operate and maintain equipment for emergency response including a teleconferencing system to enable us to unflinchingly share information within JAEA and send out information to external parties.

Focusing specifically on the Integrated Nuclear Emergency Preparedness Network, which is important in sharing information with the Japanese government, we conducted

periodic connection testing to ensure the availability of services in the case of a nuclear emergency. Also in FY2021, continuing from the previous fiscal year, we took steps to bypass any communication failure and ensure information sharing during emergency response by upgrading our teleconferencing system, which uses a dedicated network, and reflecting the upgrade at all our sites.

Occurrence of Accidents and Problems

The number of accidents and technical issues JAEA reported in FY2021 was 25 (29 in FY2020 and 29 in FY2019), which represents a decreasing trend.

None of them required reporting pursuant to the Act on Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors. JAEA had no violation of safety regulations based on nuclear regulatory inspections, no corrective recommendation from the Labor Standards Inspection Office, and three injury incidents requiring lost workdays.

JAEA ensures to reduce occupational accidents and false fire alarms.

○ Accidents and problems

<https://www.jaea.go.jp/news/incident/> (in Japanese)



Activities Based on Quality Assurance Policy on Nuclear Safety

JAEA ensures proper operation and continuous improvement of safety-related activities under a quality assurance policy on nuclear safety set forth in accordance with the operational safety program for reactors and other facilities.

In FY2021, JAEA ascertained issues at each site for the purpose of developing and establishing quality management activities (e.g. periodic nuclear operator inspections, independent inspections, initiatives pertaining to the development and maintenance of a safety culture) based on

the quality management plan and other quality management documents that were revised pursuant to the revision of relevant laws and regulations in April 2020. We have been making continuous improvements including revision of the JAEA standard guidelines to maintain and improve quality control pertaining to nuclear facilities.

Nuclear regulatory inspections in FY2021 found no violation of safety regulations or recommendations, indicating proper operation of the quality management system.

Agency-Wide Safety Review and Quality Assurance Committee

JAEA operates an Agency-wide Safety Review and Quality Assurance Committee to consider applications for licensing of nuclear facilities and matters related to quality management activities across JAEA. We took measures to improve the efficiency of the Committee's deliberations, including preparation of a summary sheet to check the completeness of the required items in technological standards and regulations and of the entries in licensing application forms, which promoted appropriate licensing applications.

The committee met eleven times in FY2021 to discuss a total of nine matters, including applications to change the operating license of nuclear facilities and applications for approval of decommissioning plans. In addition, causal analysis was performed on the accidents and technical issues that occurred in the calendar year of 2021, and recommendations to prevent occurrence and recurrence of accidents, and issues were made for each site. Based on the recommendations, each site will plan activities to promote a safety culture.

Management Review by the President

The President himself periodically receives and reviews activity reports from each facility (i.e. subjects them to Management Review by the President) to ensure the effectiveness of safety-related activities at our nuclear facilities and to improve our quality management system and security operations. In FY2021, two management reviews were held with the participation of senior advisors (external specialists). Based on improvement instructions from the President, decisions were made on the items necessary to deepen and enhance the thorough practice of basic procedures for safe operation, taking into account the accidents and issues that occurred in FY2021. In response to the improvement instructions from the President, each site will plan improvement activities to be carried out in the next fiscal year.



Management Review by the President at the end of FY2021

Compliance with Regulatory Standards and Response to Changes in Inspection Program

In inspections to verify compliance with the new regulatory standards triggered by the accident at TEPCO's Fukushima Daiichi Nuclear Power Station, the High Temperature Engineering Test Reactor (HTTR) passed the pre-use and periodic nuclear operator inspections and resumed operation in July 2021.

To enhance agency-wide compliance with common safety regulations, we periodically held safety review and response liaison meetings to share information about the state of review by the Secretariat of the Nuclear Regulation Authority and

recommendations. In addition, we promoted resolution of issues by holding periodic meetings with the safety regulation managers of the Secretariat of the Nuclear Regulation Authority.

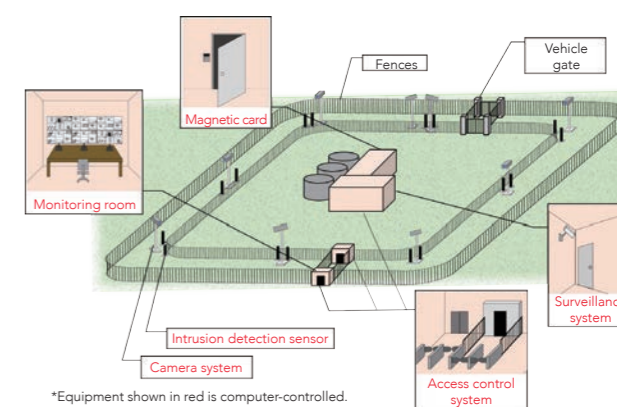
In response to the Inspection Program that was changed in April 2020, in FY2020 we made the appropriate licensing applications and applications to change operational safety programs and decommissioning plans based on the revised regulations and had obtained approval for all applications by June 2021.

Initiatives for Ensuring Nuclear Security

JAEA steadily promotes "nuclear security (physical protection and specified radioisotope security)," which is designed to prevent the unauthorized removal of nuclear materials and/or radioactive materials and the sabotage against nuclear facilities by terrorism or other suspicious activities, in accordance with relevant laws, regulations, and standards. Lately, since the threat is growing due to changes in external conditions, JAEA is promoting risk mitigation against outsiders and insiders*2 by strengthening physical protection, inspections and monitoring, and effective operation of the trustworthiness determination program*3.

In addition, the Physical Protection Corrective Action Program (PPCAP) operation and assessments to relevant facilities were conducted to evaluate and improve voluntary nuclear security efforts.

Specifically, JAEA strives to maintain a high level of staff awareness of nuclear security through e-learning, messages from the President, patrols and opinions exchanges by management, the designation of "nuclear security strengthen month", and case studies. Those activities are conducted based on the action policy to ensure compliance with laws and regulations at nuclear facilities, and the action policy to foster a nuclear security culture.



*Equipment shown in red is computer-controlled.

Schematic illustration of physical protection (example)

*2 Outsiders and Insiders: A person who enters a nuclear facility from the outside and attempts to sabotage or steal nuclear materials is called an outsider. On the other hand, a person such as a staff member attempting to do this is called an insider. In the case of an insider they are difficult to detect because they have access rights.

*3 The trustworthiness determination program: As one of the measures against threats from staff and other insiders, this program investigates the identity, career, possible terrorist connections and other background details of individuals who have access to the designated inner areas of nuclear facilities and handle confidential information on physical protection so as to exclude the risk of sabotage.

Activities for SSAC *4 and Safeguards *5

From the viewpoint of peaceful use of nuclear materials, and to demonstrate the transparency of its use of nuclear materials, JAEA provides the Japanese government and the IAEA with information on the state of its nuclear material management and facilities in a timely and appropriate manner. For these activities, the Japanese government and IAEA conduct safeguards inspections to check that nuclear materials are properly managed. In addition, JAEA strives to further advance the nuclear material accountancy and safeguards related knowledge of the staff involved through e-learning, safeguarding lectures, rank-based training, and patrols and opinions exchanges by management.



Safeguards lecture session

*4 Nuclear material accountancy: This work involves measuring and recording the inventory and movement of nuclear materials and supplies which is internationally regulated under the law and reporting this information to the government on a regular basis.

*5 Safeguards: It is a system led by IAEA and the Japanese government that conducts inspections of nuclear facilities to verify that no diversion to nuclear weapons has taken place.

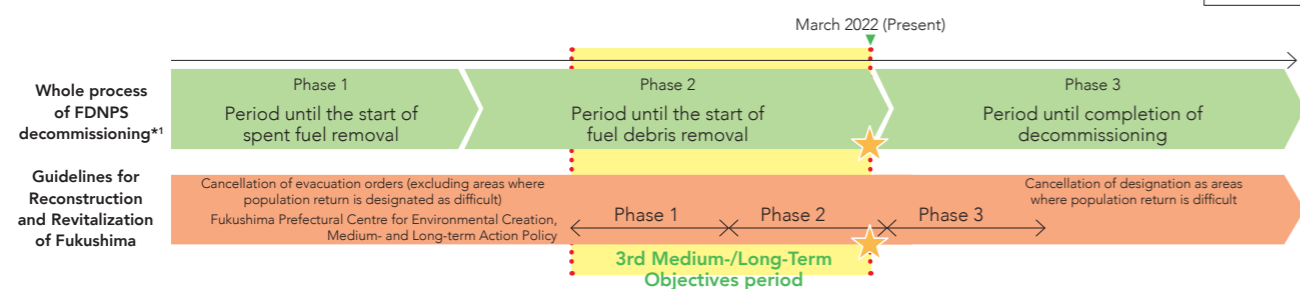
R&D Pertaining to the Response to the Accident at TEPCO's Fukushima Daiichi Nuclear Power Station

The cost of this R&D was 17,303 million yen (operations expenses 16,413 million yen and entrusted expenses 807 million yen). The income recorded as funding for the R&D included income from government funding for operational grant (10,315 million yen) and income from subsidies, etc. (3,365 million yen). The administrative cost, calculated by adding extraordinary loss (90 million yen) and other administrative costs (986 million yen) to this cost, was 18,386 million yen.

Objectives: Contribute to decommissioning and environmental recovery for the reconstruction of Fukushima ~Efforts to decommission TEPCO's Fukushima Daiichi Nuclear Power Station (FDNPS) and restore the environment of Fukushima~

With the Sector of Fukushima Research and Development at its center, we have established a research base in Fukushima and are conducting research and development related to the decommissioning of FDNPS and the environmental restoration of Fukushima in accordance with the Mid-and-Long-Term Roadmap towards the Decommissioning and the Basic Guidelines for the Reconstruction and Revitalization of Fukushima. By applying newly obtained knowledge and results to the decommissioning of JAEA facilities, we aim to bring the knowledge and results into circulation.

Sector of Fukushima Research and Development:
<https://fukushima.jaea.go.jp/en/>



* 1 Based on "An important story about decommissioning 2021" (presented by METI).

Summary of results during the 3rd Medium-/Long-Term Objectives period

During the 3rd Medium-/Long-Term Objectives period, JAEA contributed to the future progress of the decommissioning process, such as removal and analysis of fuel debris, through the following R&D activities.

R&D for decommissioning

Research on comprehending the situation inside the furnace and the properties of fuel debris

- Estimating fuel debris characteristics through international projects, etc.
- Providing information that contributes to the examination of fuel debris removal methods

Understanding the properties of radioactive waste, treatment/disposal research

- Continuous analysis of samples taken at FDNPS
- Aggregate as a database

Analysis of samples taken at FDNPS

Fukushima Daiichi Radwaste Analytical Data Library (FRANDLI)

R&D related to environmental restoration of Fukushima

- R&D on environmental dynamics and monitoring
- Operation of a website that explains research results in an easy-to-understand manner for citizens

Fukushima Comprehensive Environmental Information Site (FaCEIS)

Development of R&D infrastructure (facilities and human resources)

- Development of Collaborative Laboratories for Advanced Decommissioning Science (CLADS), Naraha Center for Remote Control technology development (NARREC) and Okuma Analysis and Research Center
- Holding of training programs for students and decommissioning companies

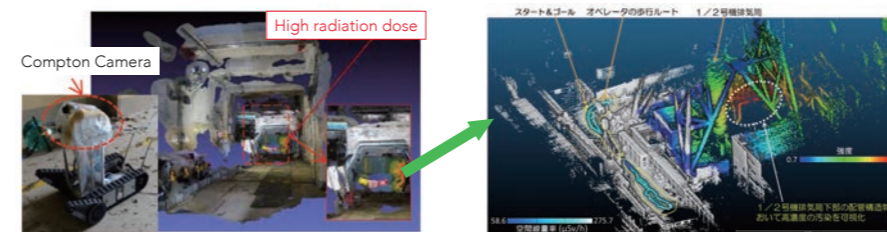
New facility under construction

Training program for students

Major achievements 2021

R&D for reducing radiation exposure of workers

Equipment and rubble contaminated with radioactive materials remain at FDNPS, and it is necessary to specify the distribution of radioactive contamination three-dimensionally in order to reduce the radiation exposure of workers. As it was difficult to assess the detailed radioactive contamination distribution three-dimensionally with the existing method using a survey meter or a gamma camera*2, CLADS has developed iRIS, a system that combines a Compton camera*2 that visualizes the distribution of radioactive contamination with 3D space recognition devices. In 2021, this system succeeded in tests at the reactor building to measure outdoor radiation distribution three-dimensionally.



Visualization results of high-concentration contaminated areas inside FDNPS Unit 1 (2018)

Visualization results for air dose rate and high-concentration contaminated areas around the exhaust stack of FDNPS Unit 1/2 (2021)

*2 Gamma camera and Compton camera: Both are devices for measuring gamma rays. A Compton camera is a type of gamma camera and has a structure that is advantageous for miniaturization and weight reduction.

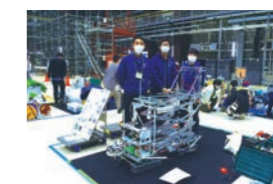
<https://www.jaea.go.jp/02/press2021/p21051403/> (in Japanese)



Outcome The full-scale introduction of iRIS at FDNPS is expected to contribute to reducing workers' radiation exposure.

Efforts to secure continuous human resources

As future-oriented training activities for the younger generation related to the decommissioning of FDNPS, we held a robot operation training program using a virtual reality system and a remote-controlled robot, organized the "Robocon" contest to create a decommissioning technology robot and thereby encourage young people to tackle issues related to decommissioning works, and gave a science class for local junior high school and high school students. In addition, we conduct "decommissioning human resources development training" for companies that are interested in decommissioning.



Robocon (13 teams from 12 schools from all over Japan participated)



Decommissioning human resources training

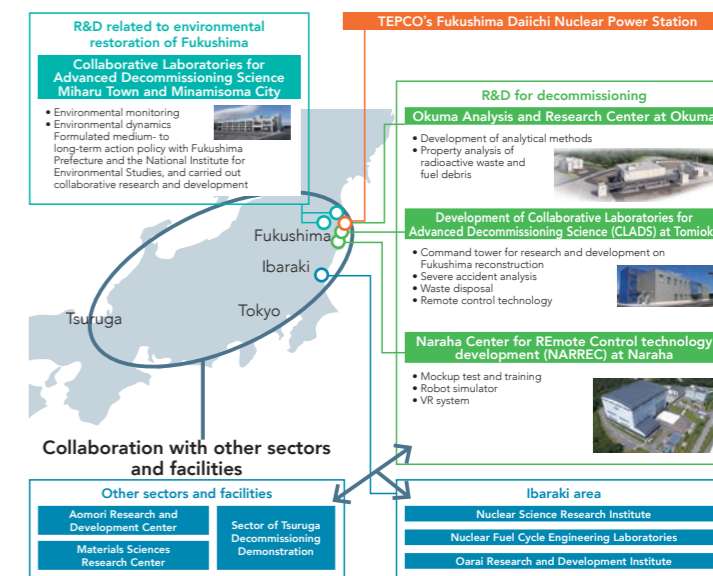
Outcome We will develop a wide range of human resources with knowledge of decommissioning and continuously secure human resources.

Development of R&D infrastructure

NARREC has contributed to research and development related to decommissioning by supporting mockup tests for the removal of fuel debris, preparing data that can simulate the reactor building in 3D, and establishing a system that can be provided to companies and research institutes. The Okuma Analysis and Research Center is preparing Laboratory 1 for analysis of radioactive waste, etc. toward the start of operation in June 2022. We have also been preparing Laboratory 2 for analysis of fuel debris.

In addition, we have established a collaborative system with other sectors, such as sharing R&D knowledge and developing human resources through R&D projects.

Outcome We proceeded with the development of R&D facilities in line with the progress of decommissioning.



Development of R&D infrastructure in Fukushima Prefecture and cooperation with other sectors

Technical Supports for Nuclear Safety Regulation and Safety Research for Their Purposes

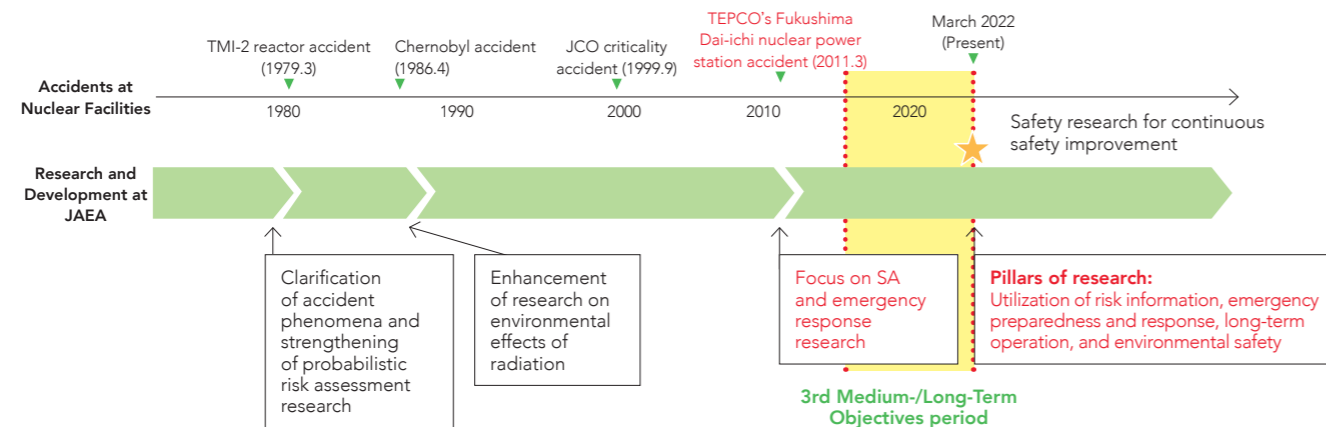
The cost of this R&D was 7,759 million yen (operations expenses 3,745 million yen and entrusted expenses 3,972 million yen). The income recorded as funding for the R&D included income from government funding for operational grant (3,241 million yen) and income from research consigned from the government (3,977 million yen). The administrative cost, calculated by adding extraordinary loss (35 million yen) and other administrative costs (166 million yen) to this cost, was 7,960 million yen.

Objectives: Contribute to improving nuclear safety and strengthening nuclear emergency preparedness and response ~Creation of valuable scientific and technical knowledge as a technical support organization (TSO) for nuclear safety regulation~

JAEA's Sector of Nuclear Safety Research and Emergency Preparedness conducts multifaceted research on the safety of a wide range of nuclear facilities, including not only light water reactors but also reprocessing and radioactive waste management facilities, on the effects of severe accidents*1 (SA) on the public and the environment, and on emergency responses to such accidents. Its research results are used to develop scientific and effective regulation standards, to investigate the cause of accidents and failures, and to enhance the safety of nuclear facilities.

*1 Severe accident: A serious accident involving significant damage to the reactor core.

[Sector of Nuclear Safety Research and Emergency Preparedness: https://www.jaea.go.jp/04/nsrc_neat/ \(in Japanese\)](https://www.jaea.go.jp/04/nsrc_neat/)



Summary of results during the 3rd Medium-/Long-Term Objectives period

During the period, JAEA focused on research and development activities based on the lessons learned from the 1F accident, including research on prevention and mitigation of SA, nuclear emergency preparedness and response, external events (earthquake, projectile impact), and detailed technical investigation and analysis of the 1F accident. Main results are as follows:

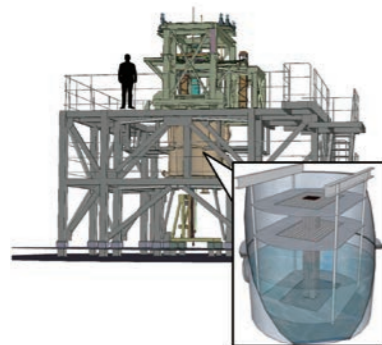
We installed a high-pressure thermal-hydraulic loop (HIDRA) and a containment integral measurement apparatus (CIGMA) in the framework of a project entrusted by the Nuclear Regulation Authority (NRA), and used the former to conduct experiments to simulate the thermal hydraulics of a reactor core during an accident and the latter to investigate the behavior of hot gases in a containment vessel during an SA.

In addition, in order to obtain data that will contribute to the validation of criticality management methods for the fuel debris to be removed from 1F, we are modifying the static critical experiment facility (STACY) under a project entrusted by the NRA, and plan to achieve criticality in FY2022 and start experiments in FY2023.

Installation of distinctive large-scale experimental equipment



Containment Integral Measurement Apparatus (CIGMA)

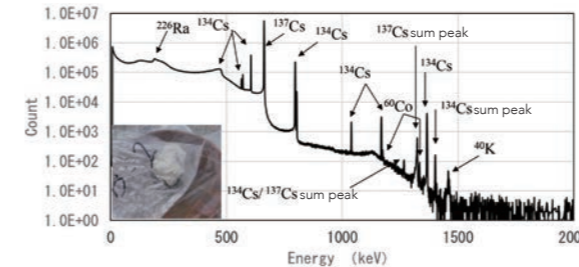


Ongoing modification of Static Experiment Critical Facility (STACY)

Nuclear Regulation Authority's Study Group on Analysis of the 1F Accident

JAEA researchers participated in the discussions as members of the study group and cooperated in the accident analysis through measurement of samples collected from 1F. The information provided was reflected in the interim report.

<https://www.nsr.go.jp/data/000345595.pdf>



Example of analysis of concrete rubble presumed to be from the Unit 3 reactor building wall

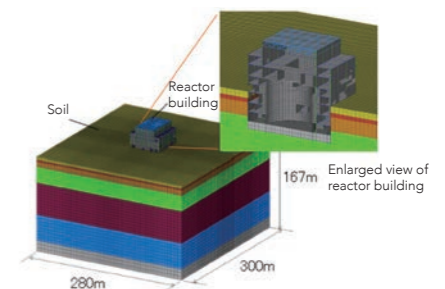
International joint project of the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA)

The project "Analysis of Information from Reactor Buildings and Containment Vessels of Fukushima Daiichi Nuclear Power Station (ARC-F)," operated by the Nuclear Safety Research Center of the Sector of Nuclear Safety Research and Emergency Preparedness, examined 1F accident scenarios and nuclide transport behavior at the 1F, collected and compiled information obtained from investigations in the reactor building, and contributed to international activities related to the analysis of the 1F accident. In addition, a new "1F accident information collection and evaluation (FACE) project" is planned to launch to continue accident analysis in a constructive manner.

Major achievements 2021

Further improvement of the reliability of seismic safety assessment of nuclear facilities using detailed three-dimensional models

In order to evaluate the seismic safety of nuclear facilities with higher reliability, a detailed three-dimensional model that accurately represents the entire nuclear facility is an effective tool. It is however reported that there are large differences in the results of different analysis teams even when using similar methods. JAEA initially investigated and identified important factors affecting the seismic response to earthquakes, for example non-linear behavior at the boundary between the soil and the building. We then clarified the modeling method for each critical factor so as to enable accurate and detailed seismic analysis using the detailed three-dimensional model. Following confirmation by external experts, the findings and insights were compiled and made publicly available as the first standard guideline for the seismic analytical method based on detailed 3D models.



Example of a detailed three-dimensional model of a reactor building

Outcome Our study is expected to make great contributions to further risk-informed activities relating to the seismic safety of nuclear facilities.

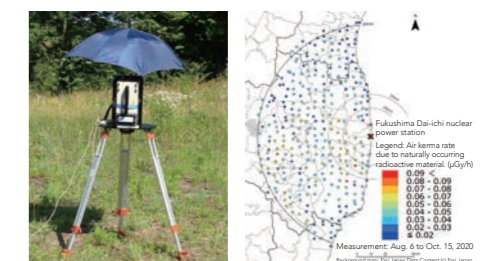
[https://www.jaea.go.jp/02/press2021/p22032502/ \(in Japanese\)](https://www.jaea.go.jp/02/press2021/p22032502/)



Improving monitoring accuracy for radiation doses from radionuclides accidentally released into the environment

For more accurate evaluation of air dose rates due to accidental environmental release of anthropogenic radionuclides, it is necessary to know the background dose rate levels due to naturally occurring radioactive materials. As one related initiative, we have created a background dose rate map, based on in-situ gamma-ray spectrometry using portable germanium detectors conducted at 370 locations within an 80-km radius of TEPCO's Fukushima Dai-ichi nuclear power station. (This is part of the results of the NRA-commissioned project.)

Outcome Improving the accuracy of radiation monitoring enhances the reliability of monitoring results in areas lightly contaminated by an accident, and the associated data is expected to be useful in the evaluation of additional exposure doses from the accident.



Dose rate map (right) created using a portable germanium detector (left)

[https://www.jstage.jst.go.jp/article/taes/advpub/0/advpub_J20.010/_pdf \(in Japanese\)](https://www.jstage.jst.go.jp/article/taes/advpub/0/advpub_J20.010/_pdf (in Japanese))



R&D for Improving Nuclear Safety and Activities that Contribute to Nuclear Non-Proliferation and Nuclear Security

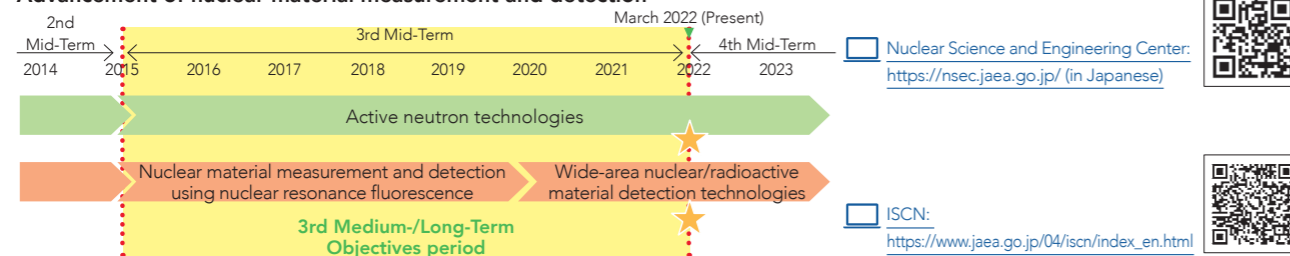
The cost of this R&D was 2,423 million yen (operations expenses 1,916 million yen and entrusted expenses 496 million yen). The income recorded as funding for the R&D included income from government funding for operational grant (1,232 million yen) and income from research consigned from the government (345 million yen). The administrative cost, calculated by adding extraordinary loss (10 million yen) and other administrative costs (30 million yen) to this cost, was 2,463 million yen.

Objectives: Contribute to the Enhancement of Nuclear Safety
Support peaceful use of nuclear energy as a non-nuclear weapon state

Within JAEA, the Nuclear Science and Engineering Center (NSEC) conducts research to enhance the safety of nuclear systems using its technical potential and in line with related policies such as the Japanese Strategic Energy Plan. The NSEC also actively supports projects on the enhancement of nuclear safety by related authorities and companies and works on the application of its research outcomes to JAEA's own nuclear systems.

The Integrated Support Center for Nuclear Non-proliferation and Nuclear Security (ISCN) aims to realize a world without nuclear weapons and nuclear terrorism by further strengthening nuclear non-proliferation and nuclear security and by supporting denuclearization efforts through JAEA's technologies and experience.

Advancement of nuclear material measurement and detection



Nuclear Science and Engineering Center:
<https://nsec.jaea.go.jp/> (in Japanese)

ISCN:
https://www.jaea.go.jp/04/iscn/index_en.html



Summary of results during the 3rd Medium-/Long-Term Objectives period

Research and Development to Enhance Nuclear Safety

- In cooperation with fuel and plant manufacturers and universities, an assessment was carried out of the effect of introducing Accident Tolerant Fuels (ATFs) into existing nuclear light water reactors (LWRs) in terms of reducing accident risk.
- Various codes for enhancing the safety of LWRs were developed and improved: a two-phase CFD numerical simulation code (TPFIT) and a three-dimensional thermal-hydraulics analysis code (JUPITER) were developed and released, as well as ECUME, a database for the analysis of the fission product chemistry necessary for source term evaluation during a severe accident; the performance of a filtered containment venting system was evaluated using a developed numerical simulation method based on TPFIT; and ECUME was incorporated into a severe accident analysis code (SAMPSON).
- Within a knowledge-base program advocated by the Japanese Atomic Energy Commission, a set of technical documents, known as "SA archives," in which severe accident-related knowledge is compiled systematically, was edited in cooperation with the Federation of Electric Power Companies of Japan, the Japan Electrical Manufacturers' Association, and private research organizations.

Activities to Contribute to Nuclear Non-Proliferation and Nuclear Security

- Advanced nuclear material measurement, detection and forensics, adoption of newly developed code as a tool in Geant-4, a tool-kit to simulate the path of radiation and particles.
- Improved nuclear test detection capability through stable operation of the Takasaki and Okinawa monitoring stations, and the xenon laboratories installed at Horonobe and Mutsu by JAEA, based on the Comprehensive Nuclear-Test-Ban Treaty (CTBT), all of which providing high-quality monitoring data.
- Development of world-first online training courses for nuclear non-proliferation and nuclear security and training provision in Japan and overseas, which has received high evaluation.



Online Training Tool using Virtual Tour

Major achievements 2021

~Research and Development to Enhance Nuclear Safety~ ○ Holding of "Accident Tolerant Fuel Workshop"

At the Fukushima Dai-ichi NPP, melting of the fuels led to a severe accident (SA). Subsequently, the development of Accident Tolerant Fuels (ATFs), which are expected to reduce SA risk by increasing the coping time and reducing the rate of hydrogen production under SA conditions, has been actively pursued worldwide.

Effective utilization of existing light water reactors (LWRs) is necessary in order for nuclear energy to contribute to the achievement of carbon neutrality. The introduction of ATFs will have a great impact in this respect. In the United States, for example, the introduction of ATFs is planned in the 2020s. In March 2022, an information exchange workshop to gather all the parties related to the development of ATFs was held for the first time in order to enhance nuclear safety through ATF development in Japan. The status and technical issues of ATF development were presented and necessary work for the development was discussed.

Outcome The introduction of ATFs is expected to enhance the safety of LWRs.

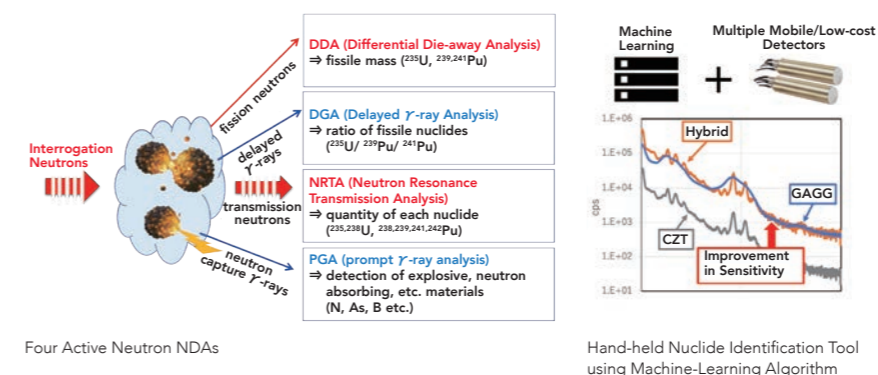
<https://nsec.jaea.go.jp/ATFWS/index.html> (in Japanese)



Information sheet for ATF workshop in March 2022

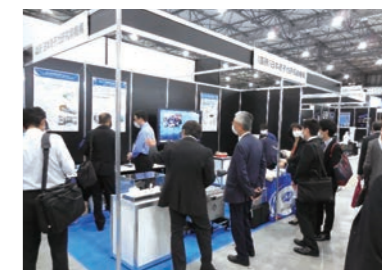
~Activities to Contribute to Nuclear Non-Proliferation and Nuclear Security~ ○ Contribution to advancement of nuclear material measurement and detection technologies through international cooperation

JAEA's ISCN and Nuclear Science and Engineering Center have developed four different active neutron non-destructive assay (NDA) technologies and contributed to their advancement. These technologies allow measurement of highly radioactive nuclear material and detection of concealed illicit nuclear material, both of which are difficult using the conventional passive NDA techniques. ISCN has also developed a hand-held nuclide identification tool using a machine-learning algorithm to support preliminary nuclear forensic investigation. The results of the studies have been widely disclosed and shared with personnel in the nuclear non-proliferation and security fields.



Four Active Neutron NDAs

Hand-held Nuclide Identification Tool using Machine-Learning Algorithm



Exhibition of R&D Products at the Special Equipment Exhibition & Conference for Anti-Terrorism (SEECAT) (October 2021)



Participants of the Workshop on Active Neutron NDA Technology (March 2022)

Outcome Advancement of nuclear material measurement and detection technologies will further strengthen nuclear non-proliferation and nuclear security.

https://www.jaea.go.jp/04/iscn/nnp_news/attached/0298.pdf#page=37 (in Japanese)



Basic and Fundamental Research and Human Resources Development in the Nuclear Field

The cost of this R&D was 29,660 million yen (operations expenses 29,224 million yen and entrusted expenses 328 million yen). The income recorded as funding for the R&D included income from government funding for operational grant (15,679 million yen) and income from subsidies, etc. (7,479 million yen). The administrative cost, calculated by adding extraordinary loss (84 million yen) and other administrative costs (1,496 million yen) to this cost, was 31,241 million yen.

Objectives: Advance the latest science and technology supporting the use of radiation and atomic energy and to develop human resources in the nuclear field
 ~To advance the safe use of radiation and atomic energy, to work on the creation of innovative science & technology and new industries, and to develop human resources in the nuclear field within and outside Japan~

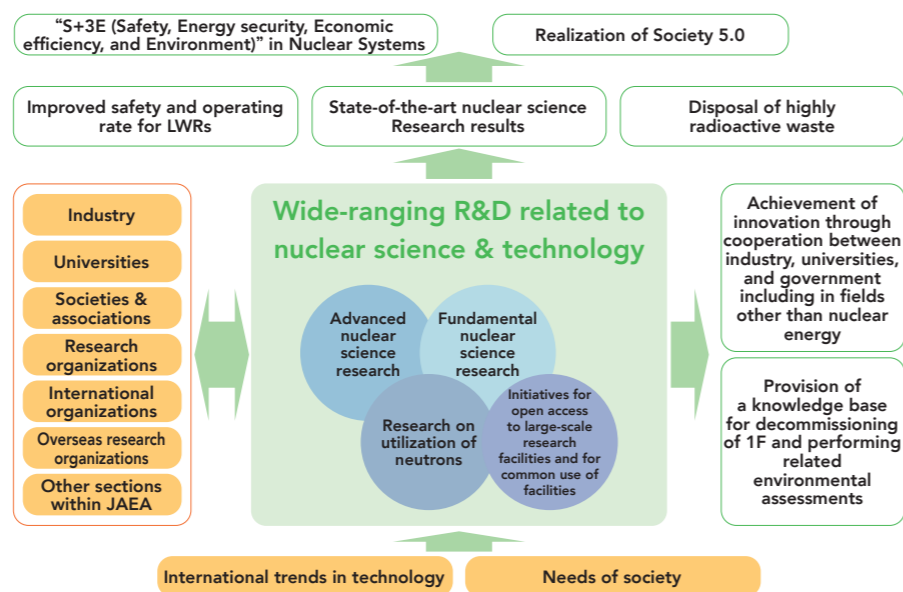
A wide range of research and development to advance the safe use of radiation and atomic energy and to provide fundamental support to atomic energy development is conducted, mainly by the Sector of Nuclear Science Research (SNSR).

A broad range of human resources development in the nuclear field is undertaken, mainly by the Nuclear Human Resource Development Center (NuHRDeC).

[Sector of Nuclear Science Research \(SNSR\)](https://snsr.jaea.go.jp/)
<https://snsr.jaea.go.jp/>
 (in Japanese)



[Human Resources Development in the Nuclear Field](https://nutec.jaea.go.jp/)
<https://nutec.jaea.go.jp/>
 (in Japanese)



Summary of results during the 3rd Medium-/Long-Term Objectives period

In order to open new horizons for the use of radiation and atomic energy, a broad range of R&D such as basic and fundamental nuclear research, advanced nuclear science research, and science research using neutrons and synchrotron radiation was advanced within the SNSR.

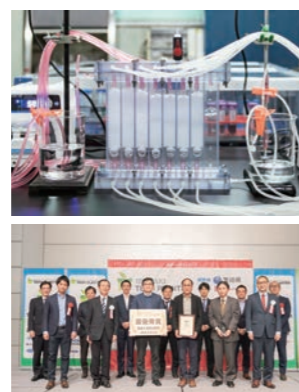
- Many scientifically important research outcomes were achieved, such as findings in the chemistry of superheavy elements that were covered in an issue of the journal *Nature*.
- Research on resolving social problems and meeting various needs within and outside JAEA was conducted. For example, a technology for the partitioning and transmutation of radioactive waste led to the foundation of a start-up company for resource recycling.
- The research reactor JRR-3 has resumed operation and use by external users, and J-PARC established the prospect of stable beam operation with a power of 1 MW.

Scientifically important research outcomes



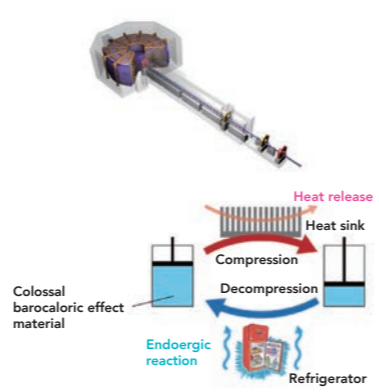
Frontline discovery in the science of superheavy elements

Activities to achieve innovation



Foundation of a start-up company based on emulsion flow technology

Scientific research using neutrons and synchrotron radiation



Report on "colossal barocaloric effects" (published in the journal *Nature*)

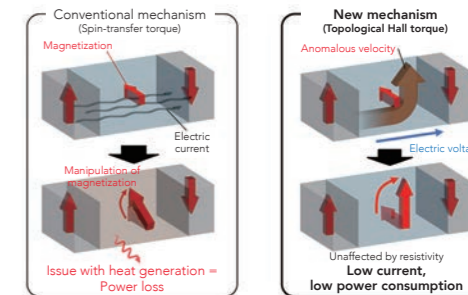
Major achievements 2021 ~Basic and Fundamental Research in the Nuclear Field~

○ New principle for significant reduction of power consumption in spintronics — Approach to material development for "electric manipulation of magnetism"

Whereas the conventional method uses an electric current and suffers from power loss due to electric resistivity, the new principle enables manipulation of magnetism through electric voltage, which relies on the "topology" structure of electrons and is insensitive to electric resistivity. This principle of "topology" will accelerate material development for spintronics.

Outcome Contribution to further reduction of power consumption in the "electric manipulation of magnetism" toward application in magnetic memories.

* Topology: The way the parts of something are organized or connected, especially in shape. Electrons can be "twisted" or "spiral" in shape.



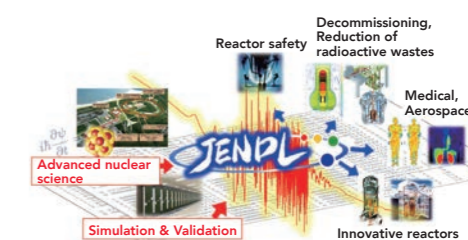
Electric manipulation of magnetism

<https://www.jaea.go.jp/02/press2021/p21122402/>
 (in Japanese)

○ Release of JENDL-5, the latest version of JENDL

JENDL-5, the latest version of JENDL (Japanese Evaluated Nuclear Data Library), was released in December 2021. Nuclear data are necessary for the numerical simulation of nuclear reactors and various uses of radiation. As a large amount of nuclear data on light to heavy nuclides in various forms of radiation (protons, alpha-rays and so on in addition to neutrons) have been revised and added, JENDL-5 has become one of the most reliable libraries in the world.

Outcome Various contributions are expected to the enhancement of nuclear safety, as well as to R&D on radiation-related issues in emerging areas including medical and aerospace applications.



The Japanese Evaluated Nuclear Data Library, JENDL

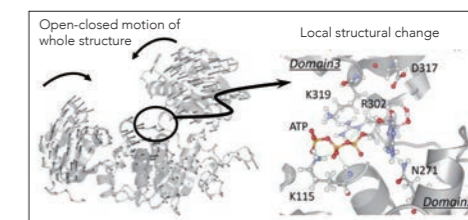
<https://www.jaea.go.jp/02/press2021/p21122701/>
 (in Japanese)



○ Elucidation of hierarchical and dynamical structure of proteins revealed by neutron scattering and computational science

It has been discovered that fluctuations in the higher-order structure of proteins, called domain structure, control the local molecular structure that serves as the reaction field for catalysts. This achievement shows that the hierarchical structure of protein molecules and its fluctuations provide an important perspective in the molecular design of functional catalysts.

Outcome Expected contributions to the field of chemical engineering, including the development of functional foods and pharmaceuticals.



Fluctuation of protein domain structure and its local structural change

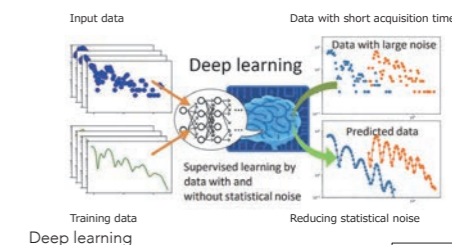
<https://msrc.jaea.go.jp/jp/> (in Japanese)



○ Significant reduction of measurement time by noise-reducing method based on deep learning

We have developed a method to remove the large statistical noise from the neutron reflectometry data obtained in a short acquisition time. With a deep learning method based on one million data items on reflection profiles, the true signal behind the large noise can be accurately extracted. As a result, the acquisition time is reduced to 1/10 or less without compromising the accuracy of the analysis.

Outcome Expected contribution through improved time resolution to the research and development of new thin-film devices and adhesive technologies that change structure in a short time.

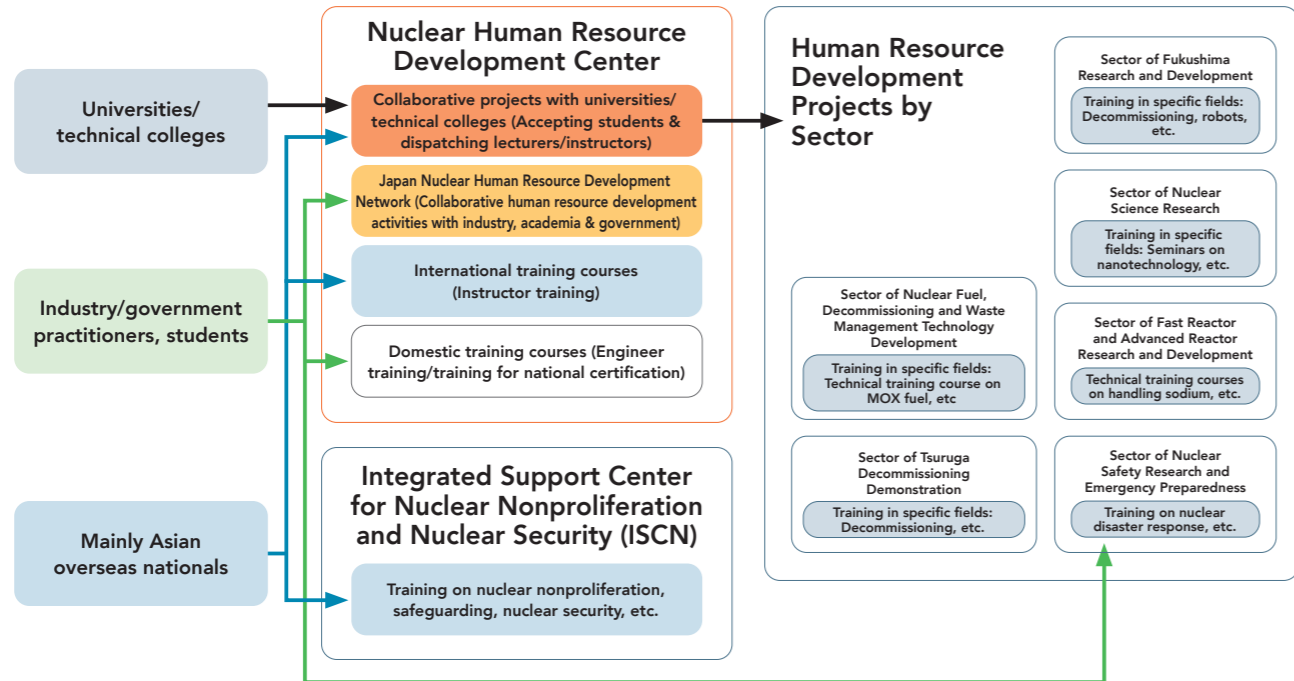


<https://www.jaea.go.jp/02/press2021/p21120801/>
 (in Japanese)



~Human Resources Development in the Field of Nuclear Energy~ Major achievements 2021

In order to develop nuclear human resources in Japan and abroad, the Japan Atomic Energy Agency (JAEA) conducts collaborative projects with universities and technical colleges, pursues activities through the Japan Nuclear Human Resource Development Network, and offers international training, in which activities the Nuclear Human Resource Development Center plays a central role. Although continuously affected by the COVID-19 pandemic in FY2021, we progressed with training programs by utilizing the experience we had gained in the previous fiscal year, taking advantage of online lecture formats, and taking measures to prevent the spread of infection.



Domestic Human Resources Development Activities

Collaboration with Universities

JAEA promotes cooperation with universities and technical colleges to develop future nuclear human resources. Together with seven national universities^{*1}, JAEA forms the Japan Nuclear Education Network, which conducts a Nuclear Engineering Basic Course through distance education. In addition, JAEA accepts students and dispatches lecturers under various schemes.

*1 Tokyo Institute of Technology, Kanazawa University, University of Fukui, Okayama University, Ibaraki University, Osaka University, Nagoya University

<Achievements>

- Nuclear Engineering Basic Course of the Japan Nuclear Education Network ... **241** students
- Cooperation under agreement of the Collaborative Graduate School System ... **1** student accepted, **51** lecturers dispatched
- Cooperation with the Nuclear Professional School of the University of Tokyo ... **13** students accepted, **159** lecturers/instructors dispatched
- Student Acceptance System ... **44** special research students, **60** student trainees, **213** summer intern trainees



Students in practical training exercise

Initiatives targeting practitioners in industry and government and students in higher education

JAEA serves as the secretariat of the Nuclear Human Resource Development Network (84 participating institutions), which promotes human resource development activities through collaboration among Japan's industry, academia and government.

<Achievements>

- Japan-IAEA Nuclear Energy Management School in cooperation with the IAEA ... A school for young experts from Japan and other countries to discuss and learn about nuclear issues. Held virtually, 20 participants from Japan and 9 overseas countries.
- Capacity Building Course for Young Nuclear Professionals ... A course for young Japanese nuclear professionals focusing on improving English proficiency. Held virtually, 14 participants.
- Webinars to support international success ... A webinar to encourage young people to engage in international participation through exposure to the experiences and messages of Japanese citizens who have worked in international organizations or are internationally active. Held 4 times.

Cooperation for Human Resources Development Activities Overseas

International Training Courses (Instructor Training Course)

JAEA enrolled trainees from Asian countries and held online Instructor Training Courses and seminars which incorporated practical exercises and facility tours. A questionnaire survey of the trainees showed excellent results illustrated for instance by the comment that "the online practical exercise was very good." In addition, lecture support for training courses in Asian countries was conducted online from Japan.

• Training course for engineers in Asian countries ... **10** courses (**133** participants from **10** countries)

Launching a New Program -Advanced Instructor Training Course

JAEA has worked routinely on training instructors in the field of nuclear energy in Asian countries, but in order to develop instructors with an even higher level of expertise, the Advanced Instructor Training Course was launched in FY2021. This course covers more advanced and specialized content than the above-mentioned Instructor Training Course. Through this program, we aim to further contribute to the development of nuclear science and technology and the improvement of nuclear safety in Asian countries.

TOPICS

An institute and centers for basic and fundamental nuclear research of the Sector of Nuclear Science Research

Nuclear Science Research Institute

The Nuclear Science Research Institute has research reactors and facilities for safe handling of radioactive substances and is a base for conducting research and development that makes effective use of these facilities.

Nuclear Science and Engineering Center

In order to respond scientifically to various social demands and to create innovative technology for better use of nuclear energy, the Nuclear Science and Engineering Center conducts basic and fundamental R&D on nuclear science and reactor engineering, fuels and materials engineering, nuclear chemistry, and environment and radiation sciences.

Advanced Science Research Center

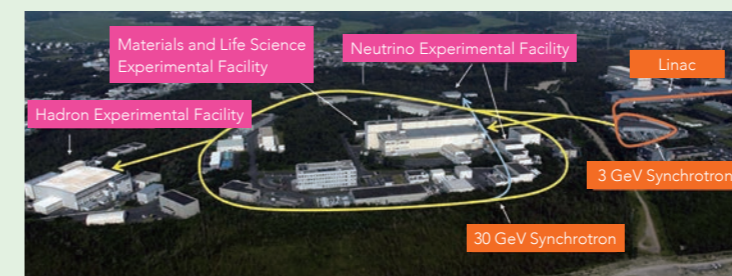
The Advanced Science Research Center promotes leading-edge nuclear science research on advanced actinide nuclear science and advanced nuclear materials science, which has the greatest academic and technological impact, aiming to discover novel principles and phenomena, create new materials, and generate innovative technologies.

Materials Sciences Research Center

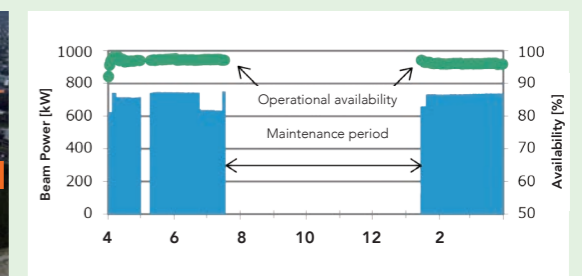
The Materials Science Research Center promotes research and development on materials science and nuclear science, which have high scientific significance and relevance to social needs, by utilizing state-of-the-art structural and functional analysis tools based on neutrons (J-PARC, JRR-3, etc.) and synchrotron radiation (SPring-8, etc.).

J-PARC Center

The Japan Proton Accelerator Research Complex (J-PARC) consists of a series of world-class proton accelerators and experimental facilities that produce a variety of secondary-particle beams which are put to use in a wide range of fields from basic science to industrial application in partnership with many research institutes and companies. While conducting research and development for the upgrading of the facility, in fiscal year 2021 we provided users with a stable supply of the world's highest-intensity pulsed neutron beams generated by proton beams with a power of 700 kW for 151 days.



High-Intensity Proton Accelerator Facility Project, J-PARC



Operational history of neutron source in FY2021

R&D on Fast Reactors and Advanced Reactors

The cost of this R&D was 17,535 million yen (operations expenses 13,074 million yen and entrusted expenses 4,458 million yen). The income recorded as funding for the R&D included income from government funding for operational grant (10,219 million yen) and income from research consigned from the government (4,399 million yen). The administrative cost, calculated by adding extraordinary loss (39 million yen) and other administrative costs (660 million yen) to this cost, was 18,239 million yen.

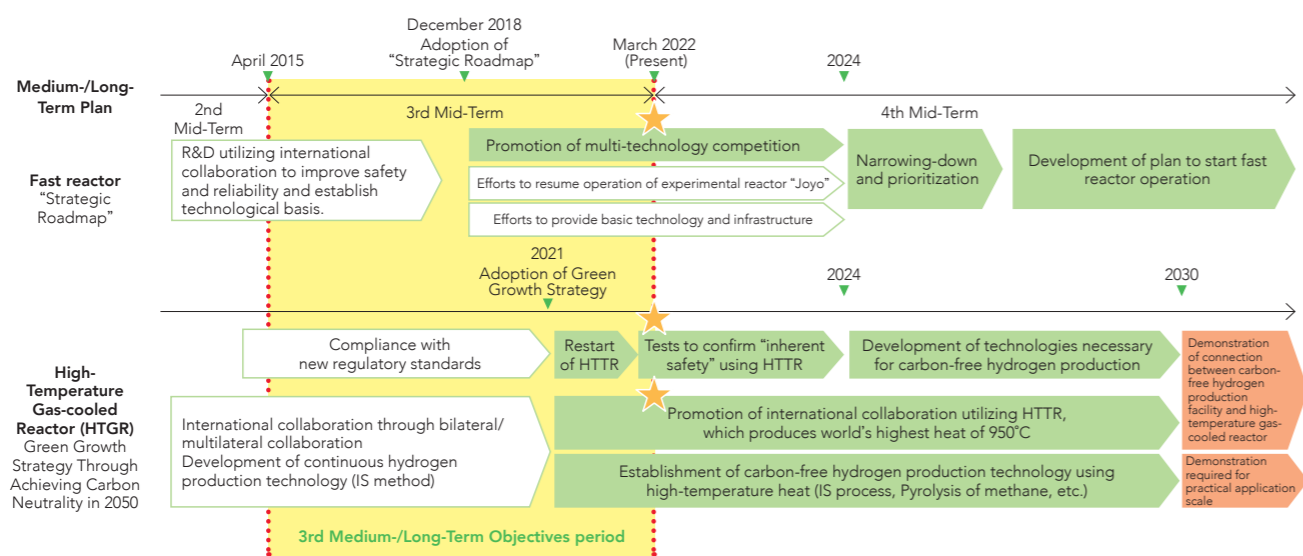
Objectives: Realize environment-friendly reactors with high levels of safety ~R&D on advanced reactors, including fast reactors and high-temperature gas-cooled reactors, and nuclear fuel cycle technologies~

In order to establish a sustainable energy system, JAEA engages in research and development on advanced reactors, including fast reactors and high-temperature gas-cooled reactors, as well as on the nuclear fuel cycle, with the aim of improving safety and reliability, economic efficiency, and the proliferation resistance*1 of nuclear energy systems.

JAEA aims to pave the way for the commercialization of safe and innovative reactor systems, including nuclear fuel cycle technologies and heat utilization systems, which will enable the achievement of greenhouse gas emission reduction targets, secure stable energy supply, and reduce environmental impact. In addition, we promote research and development based on 'seeds and needs' within and outside of JAEA, including the decommissioning of nuclear facilities and the treatment and disposal of radioactive waste.

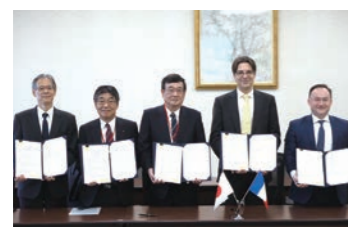
*1 Nuclear proliferation resistance refers to the ability to prevent the diversion of nuclear materials to military purposes and ensure the peaceful use of nuclear energy. Specifically, in reprocessing, plutonium is extracted in a form (mixture) that is difficult to divert to nuclear weapons.

Sector of Fast Reactor and Advanced Reactor Research and Development
<https://www.jaea.go.jp/04/sefard/> (in Japanese)



Summary of results during the 3rd Medium-/Long-Term Objectives period

In order to achieve technology demonstration of a fast reactor, JAEA progressed with R&D in line with the "National Strategic Roadmap", advancing technological basis development, including an advanced evaluation approach called ARKADIA, and codes and standards. JAEA also promoted R&D on high-temperature gas-cooled reactors and heat utilization technology and achieved the following results:



A new Implementing Arrangement was signed between Japan and France.

- A conceptual design was built for a pool-type sodium-cooled fast reactor with enhanced anti-seismic features and 3D seismic isolation technology was developed.
- Japan-France collaboration on the sodium-cooled fast reactor development began under a new Implementing Arrangement (December 2019).
- JAEA promoted Japan-U.S. collaboration on sodium-cooled fast reactors which contribute to the achievement of carbon neutrality.



HTTR

- Restart of HTTR (July 2021)
- First success of 150 hours of continuous hydrogen production in the world using IS process facility composed of practical industrial materials (January 2019)
- Launch of cooperation through conclusion of agreements between Japan and Poland and between Japan and the United Kingdom.

Major achievements 2021

Restart of High-Temperature Engineering Test Reactor (HTTR) and conduct of LOFC test

The High-Temperature Engineering Test Reactor (HTTR) at the Oarai Research and Development Institute, which had been shut down for periodic inspections since January 2011, passed the new regulatory requirements established after the accident at the Fukushima Daiichi Nuclear Power Plant and was licensed on June 3, 2020. The HTTR restarted on July 30, 2021, after completing the necessary safety measures. In January 2022, the world's first test simulating the loss of cooling performance due to an all-station blackout was conducted under the international joint research project "Loss Of Forced Cooling (LOFC) test" at the OECD/NEA and confirmed the inherent high safety features of HTGR*2.



Control room at time of restart

Outcome This project is expected to demonstrate the inherent safety features of HTGRs. It is also expected to contribute to the international standardization of safety standards that reflect the particular safety features of HTGRs and to strengthen the international competitiveness of Japan's HTGR technology, both of which are necessary for commercialization.

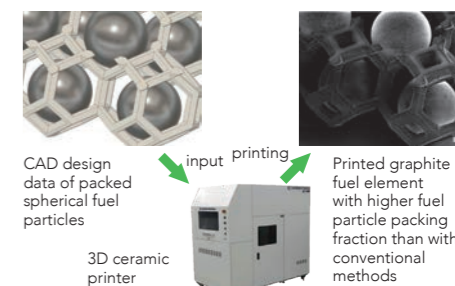
<https://www.jaea.go.jp/04/o-arai/nhc/jp/index.html> (in Japanese)



*2 High-Temperature Gas-cooled Reactor: Advanced reactor with excellent safety features, such as the high heat resistance of the fuel particles, which are coated with four layers of silicon carbide and other materials; the use of graphite as the core inner structural material; and the chemical inertness of the helium gas used as coolant.

Innovative Fuel Manufacturing Technology Based on 3D Additive Manufacturing (3D Printing)

Targeting an innovative common fuel manufacturing technology for the various fuel specifications of advanced reactors, we have developed a fuel manufacturing technology based on 3D printing. In addition to manufacturing MOX-simulated fuel with the aim of downsizing the fuel manufacturing facility for sodium-cooled fast reactors (SFR), we have established good technical prospects both for the fabrication of functionally graded silicon carbide and graphite materials that improve the oxidation resistance of the fuel used in high-temperature gas-cooled reactors (HTGR), and for an integrated manufacturing technology able to pack TRISO fuel particles*3 at high density into the reactor's fuel element.



Outline of innovative fuel fabrication by 3D additive manufacturing

Outcome The project is expected to contribute to improving the flexibility and reducing the cost of SFR and HTGR fuel manufacture and to achieving qualitative improvement of fuel safety features in the event of an accident.

*3 TRISO fuel particles are spherical fuel particles approximately 1 mm in diameter consisting of an innermost uranium kernel coated with three sequential layers of silicon carbide and graphite. TRISO fuel integrity is maintained even at high temperatures of up to 1,600°C.

Activities of GIF chairman and his group for generation IV reactor development

As the chairing country of the Generation IV International Forum (GIF), a framework for international cooperation involving members such as Japan, the U.S., and European countries that develops Generation IV reactors (fast reactors and advanced reactors), JAEA promoted R&D cooperation and dissemination of GIF results, including international standardization of safety design, market attractiveness enhancement, and advanced manufacturing technologies. Furthermore, JAEA joined with GIF participating countries to promote the demonstration and deployment of Generation IV reactor technologies by emphasizing their contribution to the realization of carbon neutrality through collaboration with CEM NICE Future*4 and proposals to COP26.



GIF site (JAEA's summary)

Outcome JAEA contributed to strengthening international collaboration and promoting the importance of new reactor development to the world.

https://gif.jaea.go.jp/material/kit/index_eng.html



*4 CEM NICE Future is an initiative to promote international cross-sectoral dialogue on the role of nuclear energy as a clean energy source (Clean Energy Ministerial Nuclear Innovation Clean Energy Future).

R&D Related to the Nuclear Fuel Cycle, such as Reprocessing, Fuel Manufacturing and Treatment and Disposal of Radioactive Waste

The cost of this R&D was 49,506 million yen (operations expenses 46,490 million yen and entrusted expenses 2,686 million yen). The income recorded as funding for the R&D included income from government funding for operational grant (34,792 million yen) and income from contribution for treatment and disposal of waste (6,151 million yen). The administrative cost, calculated by adding extraordinary loss (797 million yen) and other administrative costs (742 million yen) to this cost, was 51,060 million yen.

Objectives: Contribute to the deepening of reprocessing and MOX fuel technologies and the development of technical infrastructure for final disposal

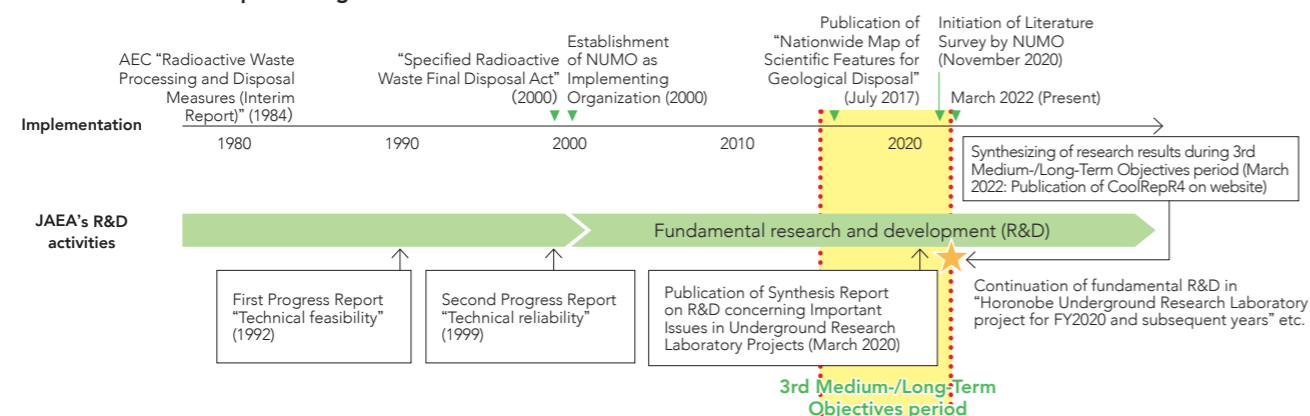
Japan's basic policy is to promote the nuclear fuel cycle, in which spent fuel is reprocessed and the recovered plutonium and other materials are used effectively in order to promote the effective utilization of resources and reduce the volume and radiotoxicity of high-level radioactive waste. To support this policy, JAEA is developing technologies for spent fuel reprocessing and fuel fabrication and conducting research on reducing the volume and radiotoxicity of radioactive waste.

Furthermore, JAEA is conducting basic research and development of geological disposal technology for high-level radioactive waste in order to promote measures for the treatment and disposal of radioactive waste generated from the use of nuclear energy.

[Sector of Nuclear Fuel, Decommissioning and Waste Management Technology Development: <https://www.jaea.go.jp/04/backend/> \(in Japanese\)](https://www.jaea.go.jp/04/backend/)



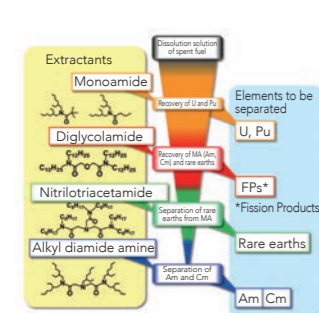
Milestones in HLW Disposal Program



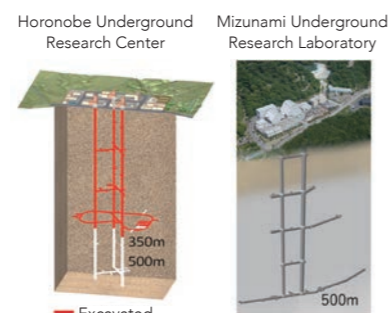
Summary of results during the 3rd Medium-/Long-Term Objectives period

The Nuclear Fuel Cycle Engineering Laboratories has conducted technological development related to spent fuel reprocessing and fuel fabrication during the 3rd Medium-/Long-Term Objectives period. In addition, the decommissioning plan for the Tokai Reprocessing Plant was formulated and approved by the government and the steady implementation of decommissioning and development of related technologies was promoted.

Regarding the studies on reducing the radiotoxicity and volume of high-level radioactive waste, we developed a separation process called SELECT and contributed significantly toward its practical application. In terms of the research and development of geological disposal technology, we have demonstrated that it is possible to construct and operate underground facilities at depths greater than the 300 m required by law for final disposal facilities (see figure below right). Our advanced scientific achievements will provide the technical basis for the implementation of geological disposal by the government and the implementing organization (NUMO).



A conceptual image of SELECT process



An image diagram of Mizunami Underground Research Laboratory* and Horonobe Underground Research Center

* At Mizunami Underground Research Laboratory, the underground facilities had been backfilled and surface facilities removed by January 16, 2022.

Major achievements 2021

Development of "SELECT" separation process

To reduce the radiotoxicity and volume of waste, we have been engaged in the development of partitioning and transmutation technology. In the separation process for minor actinides (MAs), MAs with long half-life and high radiotoxicity are separated from high-level liquid waste. The separated MAs are then transmuted into short-lived or stable nuclides by fast reactors and/or accelerator-driven systems. At the Nuclear Science and Engineering Center, we synthesized novel extractants to reduce the volume of waste generated by the separation. By using the novel extractants, we developed a process called SELECT that realizes reprocessing and the separation of MAs, which were successfully recovered from genuine high-level liquid waste.



Handling of an experimental apparatus installed in a concrete cell

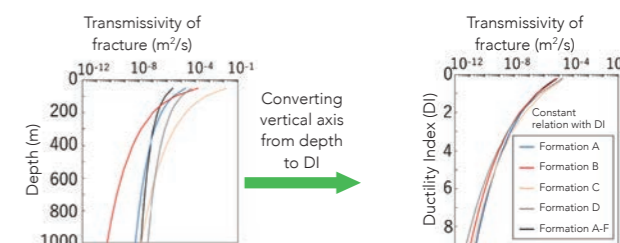
Outcome The obtained results are expected to contribute to the rationalization of final disposal by reducing the radiotoxicity and volume of high-level waste.

<https://www.jaea.go.jp/02/press2019/p19042401/> (in Japanese)



Discovery of the principles determining the transmissivity of deep underground fractures

We analyzed borehole data from six different geological formations in Japan and overseas to determine the causes of depth-dependent differences in the ease of water flow in fractures, and found that a combination of three factors — the force applied to the rock, its hardness, and the degree of interlocking of the fractures — universally determines the upper limit of the ease of water flow in fractures.



*1 Ductility Index (DI): Force applied to rock divided by tensile strength of rock.
*2 Transmissivity: Ease of water flow.

Relationship between Ductility Index (DI) and transmissivity of fracture

Outcome The discovery of the principles is expected to allow more efficient understanding of the transmissivity of subsurface fractures with fewer borehole investigations.

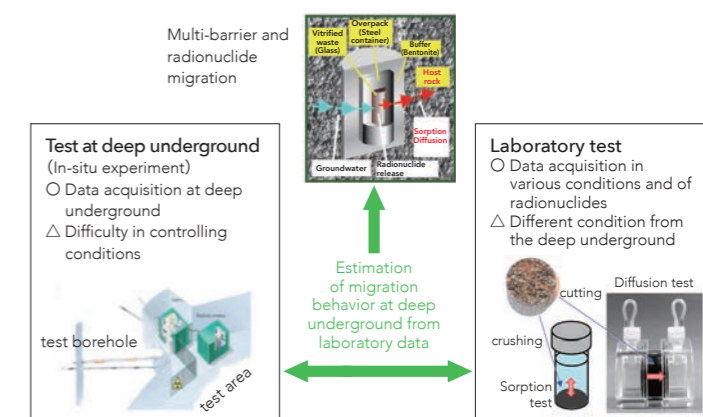
<https://www.jaea.go.jp/02/press2021/p21120601/> (in Japanese)



Development of estimation method of radionuclide migration behavior in rocks deep underground

Estimation of radionuclide migration behavior is required for the safety assessment of geological disposal. JAEA developed a new estimation method for radionuclide migration behavior in deep underground rock based on comparison between in-situ and laboratory experiments in an international collaboration project with Sweden.

Outcome The estimation method is expected to contribute to reliable safety assessment.



Roles of in-situ and laboratory experiments in model development and data acquisition for radionuclide migration in host rocks

<https://www.jaea.go.jp/02/press2021/p21121501/> (in Japanese)



Activities for Sector of Tsuruga Decommissioning Demonstration

The cost of this R&D was 28,594 million yen (operations expenses 28,528 million yen), and the income recorded as funding for the R&D included income from government funding for operational grant (26,464 million yen). The administrative cost, calculated by adding extraordinary loss (33,251 million yen) and other administrative costs (846 million yen) to this cost, was 62,696 million yen.

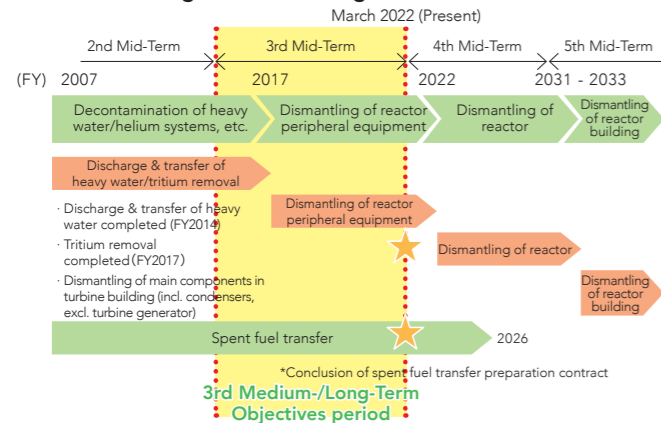
Objectives: Completion of Decommissioning of Fugen and Monju
 ~Promotion of development of decommissioning technology by gathering domestic and international expertise and promotion of safe and efficient operations~

With utmost priority given to safety assurance, the Japan Atomic Energy Agency has worked on the decommissioning of “Fugen” and “Monju” mainly conducted through the Sector of Tsuruga Decommissioning Demonstration in line with the decommissioning plans. We are now steadily moving forward with the decommissioning: full-scale dismantling of the reactor peripheral equipment is in progress at Fugen while the fuel unloading operation is proceeding on schedule at Monju.

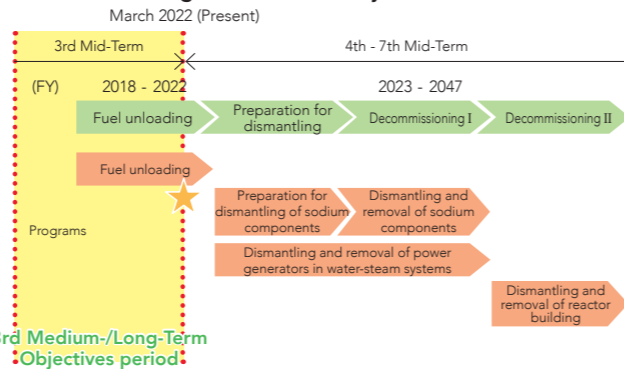
Sector of Tsuruga Decommissioning Demonstration:
<https://www.jaea.go.jp/04/haishisochi/> (in Japanese)



Decommissioning Schedule of Fugen



Decommissioning Schedule of Monju



Summary of results during the 3rd Medium-/Long-Term Objectives period

At Fugen, dismantling of the A loop piping was completed in FY2020 and subsequent work on the B loop is in progress. We are also preparing for spent fuel (SF) transfer by manufacturing transport casks.

In addition, we developed the laser cutting technology necessary for the underwater dismantling of the nuclear reactor, despite the lack of an operational precedent, and made steady progress in other efforts, such as starting the operation of a clearance system* for dismantled materials. Furthermore, after confirming that the SF was sufficiently cooled, we obtained approval, for the first time in Japan, to cease operation of the heat removal system from the pool where the SF is stored.

Monju was the first sodium-cooled fast reactor in Japan to receive approval for its decommissioning plan.

* The clearance system is a system that enables materials with extremely low levels of radioactivity and negligible health effects, which “do not need to be treated as radioactive waste”, to be reused or disposed of as industrial waste.



Development of remote laser cutting technology at Fugen



Fuel unloading operation at Monju

Major achievements 2021

Promotion of reuse of clearance material to establish a clearance system

At Fugen, we are going forward with radioactivity measurement and evaluation for clearance of the very low-radioactivity metal generated by the dismantling and demolition. These materials have undergone the radioactivity measurement and evaluation method approval required for the classification of clearance material.

As part of a national project to establish a clearance system we are also working with local companies in Fukui Pref., metal fabricators, and electric power companies. In January 2022, approximately 4.6 tons of clearance materials were for the first time shipped out for reuse to metal fabricators in Fukui Pref. and are being processed into metal materials (ingots).



Radioactivity measurement for clearance | Storage of materials after measurement | Processed metal materials (ingots)

Outcome We are currently carrying out verification and studies to establish a process for the transport of clearance material from nuclear facilities and its safe reuse. These activities are expected to contribute to the establishment of a publicly recognized clearance system.

Safe progress of fuel unloading operation at Monju

At Monju, the fuel unloading operation commenced in FY2018 with a completion target of FY2022. In FY2021, we safely completed the treatment of 146 fuel assemblies previously removed from the reactor vessel and transferred to the ex-vessel storage tank, and 406 of the 530 spent fuel assemblies have been transferred to the spent fuel pool. We are also compiling our findings and results to contribute to the design of operation and maintenance technologies in the future development of fast breeder reactors.

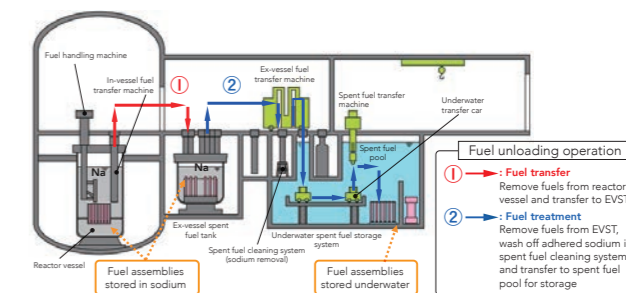
Progress of fuel unloading operation at Monju

	FY2018 (start of decommissioning)	July 2021	FY2022 (scheduled completion of fuel unloading work)
Reactor vessel	370	124	0
Ex-vessel storage tank	160	0	0
Spent fuel pool	0	406	530

Apart from those in the table, there are two further assemblies transferred in the past and currently stored in the spent fuel pool.

Outcome It is expected that the accumulation of technologies related to the fuel unloading operation will enhance operational safety, promote decommissioning as planned, and be reflected in the development of future fast breeder reactors.

Fuel unloading operation



https://www.jaea.go.jp/04/monju/fuel_removal/ (in Japanese)



Monju sodium to be exported to the United Kingdom from FY2028

It is scheduled that the treatment and disposal of the approximately 1,665 metric tons of sodium maintained at Monju will be included in the Decommissioning Plans and be approved prior to the commencement of the 2nd phase (Preparation for dismantling of sodium components).

To this end, we have assessed a number of domestic and international options from points of view such as technical and regulatory feasibility and economic viability. As a result, we have selected the option of having the sodium processed into sodium hydroxide in the United Kingdom and reused for industrial purposes. Based on this option, JAEA and a U.K.-based company signed a memorandum of understanding describing basic agreements between the parties on sodium treatment in December 2021.

We will make arrangements with the U.K. company for the implementation of the project and prepare for future sodium transport.

Outcome Our progress will contribute to the reduction of the risks related to sodium storage on site and the realization of an early start on the dismantling of relevant facilities.

JAEA's Budget Structure and Research Facilities

The outcome of operations in FY2021 and the resources required are presented on P.30 to P.45. Here, we would like to additionally explain the characteristic features of the composition of JAEA's operations and the resources required.

JAEA has large-scale nuclear facilities and works to create the unique research results that only JAEA can produce using these facilities. JAEA has sites all over Japan, among which the main nuclear facilities are HTTR, which was successfully restarted in FY2021, JRR-3, the Nuclear Safety Research Reactor (NSRR), and "Joyo." Operating and maintaining these facilities with top priority on safety requires operating and maintenance costs and safety measure costs. Examples of operating and maintenance costs are presented below.

Examples of operating and maintenance costs

- Maintenance and inspection costs • Utility costs • Fuel production costs • Operation to manage negative-pressure
- Installation and maintenance of nuclear material protection systems

Many safety measures to meet the new standard have been introduced since the Great East Japan Earthquake of March 11, 2011. Measures to deal with aging facilities have also been pursued to prevent a nuclear disaster.

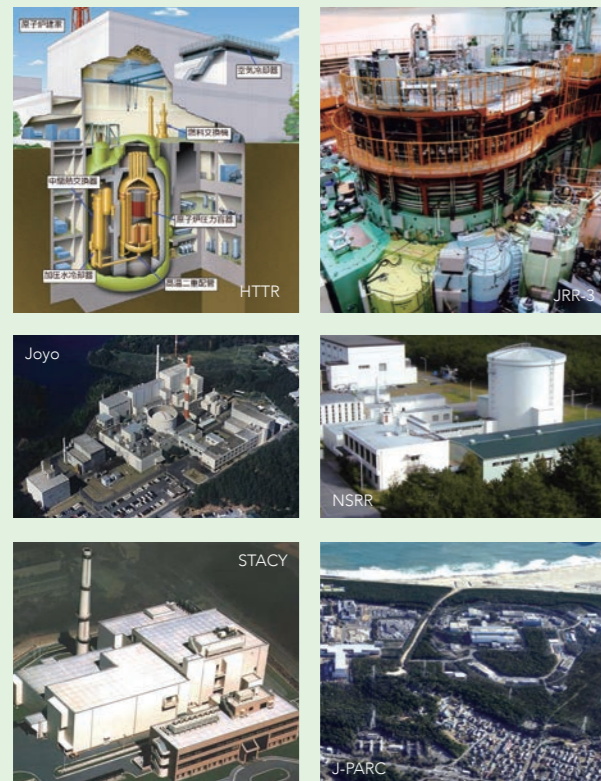
Examples of safety measure costs

- Construction costs for tsunami countermeasures • Costs of seismic strengthening work
- Installation of water supply and power feeding system • Updating of aged piping equipment

In addition, various nuclear facilities are moving to the decommissioning stage. Therefore, we are progressing with decommissioning based on the Medium-/Long-Term Management Plan for JAEA Facilities formulated in 2017 (P.14). The decommissioning of large-scale nuclear facilities such as Monju, Fugen and the Tokai Reprocessing Plant can reduce overall costs, but the decommissioning process itself requires a large expenditure. The decommissioning budget has increased under the 3rd Medium-/Long-Term Plan. Decommissioning is an urgent issue and one of JAEA's main operational tasks.

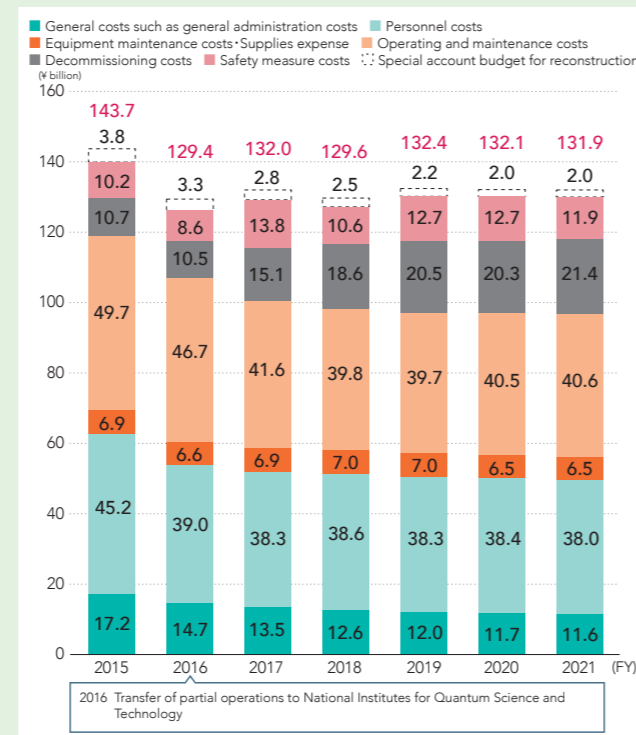
Examples of decommissioning costs

- Treatment costs of spent fuel • Dismantling costs of reactor peripheral facilities • Retained earnings for waste disposal costs



Examples of large-scale research facilities

3rd Medium-/Long-Term Plan



Government funding for operational grant

Results of Self-Assessment and Administrative Cost by Segment in FY2021

Results of Ministerial Evaluation for Past Years

(1) Self-Assessment and Administrative Cost in FY2021

Keeping in mind that the objective of national research and development agencies is achievement of both "maximization of R&D results" and "appropriate, effective, and efficient operating," JAEA conducted self-assessment of its performance in FY2021. This rating was based on the Guidelines for Evaluation of Incorporated Administrative Agencies (decided by the Minister of Internal Affairs and Communications on September 2, 2014, last revised on March 12, 2019).

[Operational Results Report: https://www.jaea.go.jp/about_JAEA/business_plan.html](https://www.jaea.go.jp/about_JAEA/business_plan.html) (in Japanese)



Item	Rating	Amount (million yen)
1. Safety assurance and nuclear security	A	— 1)
1) This item includes content realized by implementation of other items and amounts recorded as administrative costs as recorded for those other items.		
2. R&D pertaining to the response to the accident at TEPCO's Fukushima Daiichi Nuclear Power Station	A	18,386
3. Technical supports for nuclear safety regulation and safety research for their purposes	A	7,960
4. R&D for improving nuclear safety and activities that contribute to nuclear non-proliferation and nuclear security	S	2,463
5. Basic and fundamental research and human resources development in the nuclear field	S	31,241
6. R&D on fast reactors and advanced reactors	A	18,239
7. R&D related to the nuclear fuel cycle, such as reprocessing, fuel manufacturing and treatment and disposal of radioactive waste	A	51,060
8. Activities for sector of Tsuruga decommissioning demonstration	A	62,696
9. Activities to strengthen industry-academia-government collaboration and secure the trust of society	A	4,009
10. Promotion of rationalization and efficiency of operations	B	— 2)
11. Budget (including estimate of personnel expenses), revenues and expenditure plan, financing plan	B	— 2)
12. Establishment of effective and efficient management system	A	— 2)
2) The administrative costs recorded for this item consist of costs for other items and costs common to the corporation (4,738 million yen).		
Total		200,791

(2) Overall Ratings of Past Fiscal Years by Competent Ministers within the present Medium-/Long-Term Objectives Periods

Fiscal year	2015	2016	2017	2018	2019	2020	2021
Rating	B	B	B	B	A	A	
Reasons for rating	As shown in the evaluation of the entire corporation, the results and initiatives arising from the corporation's activities were comprehensively considered in light of the objectives and operations of the Japanese National Research and Development Agencies, the Medium-/Long-Term Objectives, etc. As a result, JAEA was recognized as having attained marked achievements and the expectation of future results in its efforts for maximization of research and development outcomes under adequate, effective and efficient management*.						

* Extract from the Evaluation of FY2020 Operating Results of Japan Atomic Energy Agency (2021, Minister of Education, Culture, Sports, Science and Technology, Minister of Economy, Trade and Industry, Nuclear Regulation Authority)

Summary of Financial Statements

Balance Sheet [Balance Sheet: https://www.jaea.go.jp/about_JAEA/financial/](https://www.jaea.go.jp/about_JAEA/financial/) (in Japanese)

(¥ million)

Item	FY2021	FY2020	Item	FY2021	FY2020
Current assets	225,148	229,067	Current liabilities	57,205	68,458
Cash and deposits ^(*)	139,246	178,101	Debt from government funding for operational grant	—	16,321
Securities	30,608	—	Reserves	13,281	9,852
Nuclear materials	5,907	5,947	Others	43,924	42,285
Others	49,387	45,019	Fixed liabilities	336,460	303,613
Fixed assets	585,704	552,839	Asset-offsetting liabilities	134,572	125,797
Tangible fixed assets	450,897	441,756	Reserves	164,570	143,101
Buildings	82,952	85,506	Others	37,319	34,715
Machinery and equipment	31,455	30,640	Total liabilities	393,665	372,070
Land	57,178	57,216	Capital stock	819,958	817,797
Construction in progress	198,186	186,310	Government investment	803,672	801,505
Others	81,127	82,085	Private investment	16,286	16,292
Intangible fixed assets	2,688	2,652	Capital surplus	-61,024	-456,870
Patent rights	62	59	Capital surplus	105,709	104,554
Others	2,626	2,593	Cumulative total of other administrative costs	-566,733	-561,424
Investments and other assets	132,118	108,432	Retained earnings	58,253	48,910
			Total net assets ^(*)	417,187	409,836
Total assets	810,852	781,906	Total liabilities and net assets	810,852	781,906

Administrative Cost Statement

[Administrative Cost Statement: https://www.jaea.go.jp/about_JAEA/financial/](https://www.jaea.go.jp/about_JAEA/financial/) (in Japanese)

(¥ million)

	FY2021	FY2020
Expenses on profit and loss statement	195,483	169,857
Ordinary expenses ^(*)	161,112	161,251
Extraordinary loss ^(*)	34,320	8,558
Income taxes	50	48
Other administrative costs	5,308	8,135
Administrative cost total	200,791	177,992

In order to show the flow of information within the system of financial statements, items that are linked across statements are indicated by an asterisk (*), and the same number is assigned for the linked items.

Profit and Loss Statement

[Profit and Loss Statement: https://www.jaea.go.jp/about_JAEA/financial/](https://www.jaea.go.jp/about_JAEA/financial/) (in Japanese)

(¥ million)

Item	FY2021	FY2020
Ordinary expenses ^{(A) (*)}	161,112	161,251
Operations expenses	143,180	145,591
Entrusted expenses	12,899	11,263
General and administrative expenses	4,401	4,217
Financial expenses	561	145
Others	71	34
Ordinary revenues (B)	161,045	161,541
Revenues from government funding for operational grant	109,563	109,649
Income from entrusted research	13,101	11,215
Revenues from facilities expenses	65	269
Revenues from subsidies	11,372	10,907
Reversal of asset-offsetting liabilities	12,210	11,763
Others	14,734	17,738
Extraordinary loss ^{(C) (*)}	34,320	8,558
Extraordinary income (D)	43,781	10,392
Income taxes (E)	50	48
Reversal of reserves carried over from previous Medium-/Long-Term Objectives period (F)	75	87
Gross profit for fiscal year (B - A - C + D - E + F)	9,418	2,163

Statement of Changes in Net Assets [Statement of Changes in Net Assets: https://www.jaea.go.jp/about_JAEA/financial/](https://www.jaea.go.jp/about_JAEA/financial/) (in Japanese)

(¥ million)

	FY2021	FY2020
Starting balance of fiscal year	409,836	411,212
I. Change of capital stock in fiscal year	2,161	-727
Receipt of investments	2,260	—
Reduction due to payment to national treasury pertaining to unnecessary assets, etc.	-99	-727
II. Change of capital surplus in fiscal year	-4,153	-2,725
Acquisition of fixed assets	1,078	4,847
Disposition/sale of fixed assets	-343	-972
Depreciation	-6,062	-6,630
Impairment of fixed assets	-142	-229
Others	1,315	259
III. Change of retained earnings in fiscal year	9,343	2,076
Change in fiscal year	7,351	-1,376
Ending balance of fiscal year ^(*)	417,187	409,836

Cash Flow Statement [Cash Flow Statement: https://www.jaea.go.jp/about_JAEA/financial/](https://www.jaea.go.jp/about_JAEA/financial/) (in Japanese)

(¥ million)

Items	FY2021	FY2020
I. Cash flow from business activities (A)	18,186	16,572
Personnel expenses	-41,809	-42,115
Proceeds from subsidies	15,388	16,038
Other proceeds	156,929	156,820
Other payments	-112,323	-114,172
II. Cash flow from investment activities (B)	-58,263	36,979
III. Cash flow from financial activities (C)	1,223	-896
IV. Fund increase (or decrease) (D = A + B + C)	-38,855	52,654
V. Starting balance of fund (E)	178,101	125,447
VI. Ending balance of fund (F = E + D) ^(*)	139,246	178,101

(Reference) Relation between Ending Balance of Fund and Cash and Deposits

(¥ million)

	FY2021	FY2020
Ending balance of fund ^(*)	139,246	178,101
Time deposits	—	—
Cash and deposits ^(*)	139,246	178,101

Outline of Budget and Settlement

Explanations of Items in Summary of Financial Statements

(1) Balance Sheet	
Cash and deposits	: Cash and deposits
Securities	: Trading securities, government bonds that mature within one year, government-guaranteed bonds
Nuclear materials	: Nuclear source materials and nuclear fuel materials stipulated by relevant laws and regulations
Buildings	: Buildings and ancillary equipment
Machinery and equipment	: Machinery and equipment
Land	: Land
Construction in progress	: Amount expended and materials appropriated for construction or production in progress
Intangible fixed assets	: Patent rights, trademark rights, software, etc.
Investments and other assets	: Investment securities, long-term prepaid expenses, security deposits, security money, etc.
Debt from government funding for operational grant	: Account that shows the liability generated when receiving government funding for operational grant
Others (current liabilities)	: Accounts payable, accrued expenses, deposits received, etc.
Reserves	: Specific future expenses or losses accrued as expenses or losses for the fiscal year, including reserve for bonus, reserve for retirement benefits, reserve for radioactive waste, reserve for environmental measures, and reserve for overseas refining
Asset-offsetting liabilities	: Liabilities appropriated when depreciable assets are obtained in accordance with the purpose of use predetermined by the Agency and within the scope envisaged by the Medium-/Long-Term Plan by means of government funding for operational grant or subsidies, etc. from national or local government
Others (fixed assets)	: Long-term donations deposited, asset retirement obligations, etc.
Capital stock	: Paid-in capital sourced from investment in the Agency
Capital surplus	: Capital other than capital stock and retained earnings (in the case of appropriation of fixed assets, those appropriated assets deemed to constitute part of the Agency's financial basis in consideration of the nature of the acquired asset)
Cumulative total of other administrative costs	: Cumulative total that shows the practical reduction in the financial basis of the Incorporated Administrative Agency corresponding to the reduction in the assets acquired using government investment, facilities expenses granted by the government, etc. as the source of funds
Retained earnings	: Cumulative total of surplus generated in connection with the Agency's operations
(2) Administrative Cost Statement	
Expenses on profit and loss statement	: Ordinary expenses, extraordinary loss, and income taxes on the profit and loss statement
Other administrative costs	: Account that shows the level of the practical reduction in the financial basis of the Incorporated Administrative Agency corresponding to the reduction in the assets acquired using government investment, facilities expenses granted by the government, etc. as the source of funds
Administrative cost	: Account that has the character of the full cost used for generating the output of the Incorporated Administrative Agency and the character of an indicator showing the basis for calculating costs related to the operations of the Incorporated Administrative Agency that are attributable to the nation
(3) Profit and Loss Statement	
Operations expenses	: Expenses required for R&D operations of the Agency
Entrusted expenses	: Expenses required for entrusted operations of the Agency
General and administrative expenses	: Expenses required for the headquarters management sectors of the Agency
Financial expenses	: Expenses for financing and leasing, such as interest payments
Others (ordinary expenses)	: Miscellaneous losses, etc.
Revenues from government funding for operational grant	: Revenues originating from government funding for operational grant which is recognized as revenues for the financial year
Income from entrusted research	: Income arising from entrusted research
Revenues from facilities expenses	: Revenues originating from facility expenses from the government which is recognized as revenues for the financial year
Revenues from subsidies	: Revenues originating from subsidies, etc. from national and local government which is recognized as revenues for the financial year
Reversal of asset-offsetting liabilities	: Asset-offsetting liabilities converted to revenues in response to depreciation, etc.
Others (ordinary revenues)	: Miscellaneous income, etc.
Extraordinary loss	: Loss on retirement or sale of fixed assets, casualty loss, etc.
Extraordinary income	: Income corresponding to the cost of retirement of fixed assets, etc.
Income taxes	: Paid amount of corporate, resident, and enterprise taxes
Reversal of reserves carried over from previous Medium-/Long-Term Objectives period	: Reversal arising from cost generated for the fiscal year for the retained earnings carried over from the previous Medium-/Long-Term Objectives period in accordance with Article 21, paragraph (1), of the Act on the Japan Atomic Energy Agency
(4) Statement of Changes in Net Assets	
Ending balance of fiscal year	: Balance shown in the net assets section of the balance sheet
(5) Cash Flow Statement	
Cash flow from business activities	: Cash flow originating from activities other than investment or financial activities, such as income from provision of services and payments for purchase of raw materials, commodities, or services (shows the state of funds for the execution of the Agency's normal operations)
Cash flow from investment activities	: Cash flow originating from acquisition, sale, etc. of fixed assets (shows the state of funds for investment activities to secure the business base for the future)
Cash flow from financial activities	: Cash flow originating from procurement and repayment of funds, such as incomings and outgoings of funds and incomings and outgoings due to issuance and redemption of bonds and borrowings and repayments

Comparison of Budget and Settlement

(¥ million)

Items	Budget amount	Settlement amount
Incomings		
Government funding for operational grant	131,903	131,903
Government subsidies	23,675	15,069
Government investment	2,260	2,260
Other subsidies	—	1,646
Income from entrustment, etc.	3,115	12,534
Other income	1,579	3,637
Contribution for treatment and disposal of waste	9,400	9,403
Amount carried over from previous fiscal year	138,199	146,039
Total	310,131	322,491
Outgoings		
General and administrative expenses	4,592	4,563
Business expenses	192,974	152,710
Expenses related to government subsidies	23,675	14,943
Expenses related to other subsidies	—	1,642
Expenses related to entrustment, etc.	3,112	12,386
Amount carried over to next fiscal year	85,778	145,277
Total	310,131	331,522

For details, please see JAEA's financial statements.

https://www.jaea.go.jp/about_JAEA/financial/ (in Japanese)

Explanations on Financial Situation and Operation Status

(1) Balance Sheet

(Assets)

The total of assets as of the end of FY2021 was 810,852 million yen, an increase of 28,945 million yen (4%) compared with the end of the previous fiscal year. The main causes of this were an increase in new acquisitions necessary for business operation and a decrease in depreciation due to the elapse of time.

(Liabilities)

The total of liabilities as of the end of FY2021 was 393,665 million yen, an increase of 21,594 million yen (6%) compared with the end of the previous fiscal year. The main causes of this, as in the case of assets, were an increase in new acquisitions necessary for business operation and a decrease in depreciation due to the elapse of time.

(2) Administrative Cost Statement

Administrative cost in FY2021 was 200,791 million yen, an increase of 22,799 million yen (13%) compared with the previous fiscal year. The main cause of this was an increase of 25,762 million yen in extraordinary loss.

(3) Profit and Loss Statement

(Ordinary expenses)

Ordinary expenses in FY2021 were 161,112 million yen, a decrease of 139 million yen (less than 1%) compared with the previous fiscal year. The main cause of this was a decrease in the transferred reserve for radioactive waste.

(Ordinary revenues)

Ordinary revenues in FY2021 were 161,045 million yen, a decrease of 496 million yen (less than 1%) compared with the previous fiscal year. The main cause of this, as in the case of ordinary expenses, was a decrease in income pertaining to the offsetting of the reserve for radioactive waste associated with the new inclusion of this reserve.

(Gross profit for the fiscal year)

The gross profit for FY2021 was 9,418 million yen, an increase of 7,255 million yen (335%) compared with the previous fiscal year. The main cause of this was the inclusion of 9,487 million yen of profits from settling the debt from government funding for operational grant in the last fiscal year of the Medium-/Long-Term Plan in accordance with the Accounting Standards for Incorporated Administrative Agencies.

(4) Statement of Changes in Net Assets

The total amount of assets as of the end of FY2021 was 417,187 million yen, an increase of 7,351 million yen (2%) compared with the end of the previous fiscal year. The main cause of this, as in the case of gross profit for the fiscal year, was the inclusion of 9,487 million yen of profits from settling the debt from government funding for operational grant in the last fiscal year of the Medium-/Long-Term Plan in accordance with the Accounting Standards for Incorporated Administrative Agencies.

(5) Cash Flow Statement

(Cash flow from business activities)

The cash flow from business activities in FY2021 was 18,186 million yen, an increase of 1,614 million yen (10%) compared with the previous fiscal year. The main cause of this was a decrease of 1,686 million yen (2%) in expenditure associated with R&D activities.

(Cash flow from investment activities)

The cash flow from investment activities in FY2021 was a deficit figure of 58,263 million yen, a decrease of 95,242 million yen (258%) compared with the previous fiscal year. The main cause of this was an increase of 34,375 million yen in expenses for the acquisition of securities.

(Cash flow from financial activities)

The cash flow from financial activities in FY2021 was 1,223 million yen, an increase of 2,119 million yen (236%) compared with the previous fiscal year. The main cause of this was an increase of 2,260 million yen in income from receipt of monetary investments.

(6) Financial Data Year-on-Year Comparison and Budget, Revenues and Expenditure Plan, and Financing Plan for Next Fiscal Year

1. Year-on-Year Comparison of Primary Financial Data

(¥ million)

Items	3rd Medium-/Long-Term Objectives period						
	FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021
Assets	948,147	753,495	696,898	695,391	787,137	781,906	810,852
Liabilities	394,226	266,329	265,770	271,451	375,924	372,070	393,665
Net assets	553,921	487,166	431,128	423,941	411,212	409,836	417,187
Administrative cost	—	—	—	—	371,325	177,992	200,791
Ordinary revenues	182,875	160,309	161,542	175,020	156,358	161,541	161,045
Ordinary expenses	182,277	158,696	158,920	173,063	155,000	161,251	161,112
Gross profit [or loss (indicated by negative sign)] for fiscal year	961	427	-2,182	2,002	21,725	2,163	9,418
Cash flow from business activities	32,460	15,897	25,380	18,114	13,028	16,572	18,186
Cash flow from investment activities	-38,737	9,874	-24,718	-9,006	-9,571	36,979	-58,263
Cash flow from financial activities	-2,397	-3,181	-2,478	-2,570	-1,523	-896	1,223
Ending balance of fund	99,242	118,791	116,975	123,513	125,447	178,101	139,246

2. Budget, Revenues and Expenditure Plan, and Financing Plan for Next Fiscal Year

(1) Budget

(¥ million)

Category	Total
Incomings	
Government funding for operating expenses	131,717
Subsidy for facility maintenance expenses	285
Subsidy for expenses to manage specific large advanced research facilities	10,183
Subsidy for business expenses to promote nuclear security improvement, etc.	493
Subsidy for nuclear transmutation R&D expenses	61
Subsidy for business expenses to promote decommissioning research, etc.	1,322
Revenues from contract, etc.	3,312
Other revenues	2,672
Amount carried over from previous fiscal year (carried-over waste treatment business expenses, etc.)	145,118
Total	295,161
Outgoings	
General and administrative expenses	5,674
Business expenses	153,194
Expenses related to subsidy for facility maintenance expenses	285
Expenses related to subsidy for expenses to manage specific large advanced research facilities	10,183
Expenses related to subsidy for business expenses to promote nuclear security improvement, etc.	493
Expenses related to subsidy for nuclear transmutation R&D expenses	61
Expenses related to subsidy for business expenses to promote decommissioning research, etc.	1,322
Expenses related to contract, etc.	3,309
Amount carried over to next fiscal year (carried-over waste treatment business expenses, etc.)	120,641
Total	295,161

(2) Revenues and Expenditure Plan

(¥ million)

Category	Total
Expenses	147,145
Ordinary expenses	147,145
Business expenses	126,842
General and administrative expenses	5,237
Expenses related to contract, etc.	3,309
Depreciation expenses	11,758
Revenues	148,826
Revenues from government funding for operational grant	110,667
Revenues from subsidies	12,058
Income from waste disposal for research facilities, etc.	3
Income from contract, etc.	3,309
Revenues from contribution for treatment and disposal of waste	2,172
Other income	2,872
Reversal of asset-offsetting liabilities	11,758
Revenues from reserve offsets	5,986
Net profit	1,681
Gross profit	1,681

(3) Financing Plan

(¥ million)

Category	Total
Outgoing funds	295,161
Expenditure for business activities	143,052
Expenditure for investment activities	31,468
Amount carried over to next fiscal year	120,641
Incoming funds	295,161
Revenues from business activities	149,759
Revenues from government funding for operational grant	131,717
Revenues from subsidies	12,058
Revenues from waste disposal for research facilities, etc.	3
Revenues from contract, etc.	3,309
Other income	2,672
Revenues from investment activities	285
Revenues from facility maintenance expenses	285
Amount carried over from previous fiscal year	145,118

For details, please see the Annual Plan.

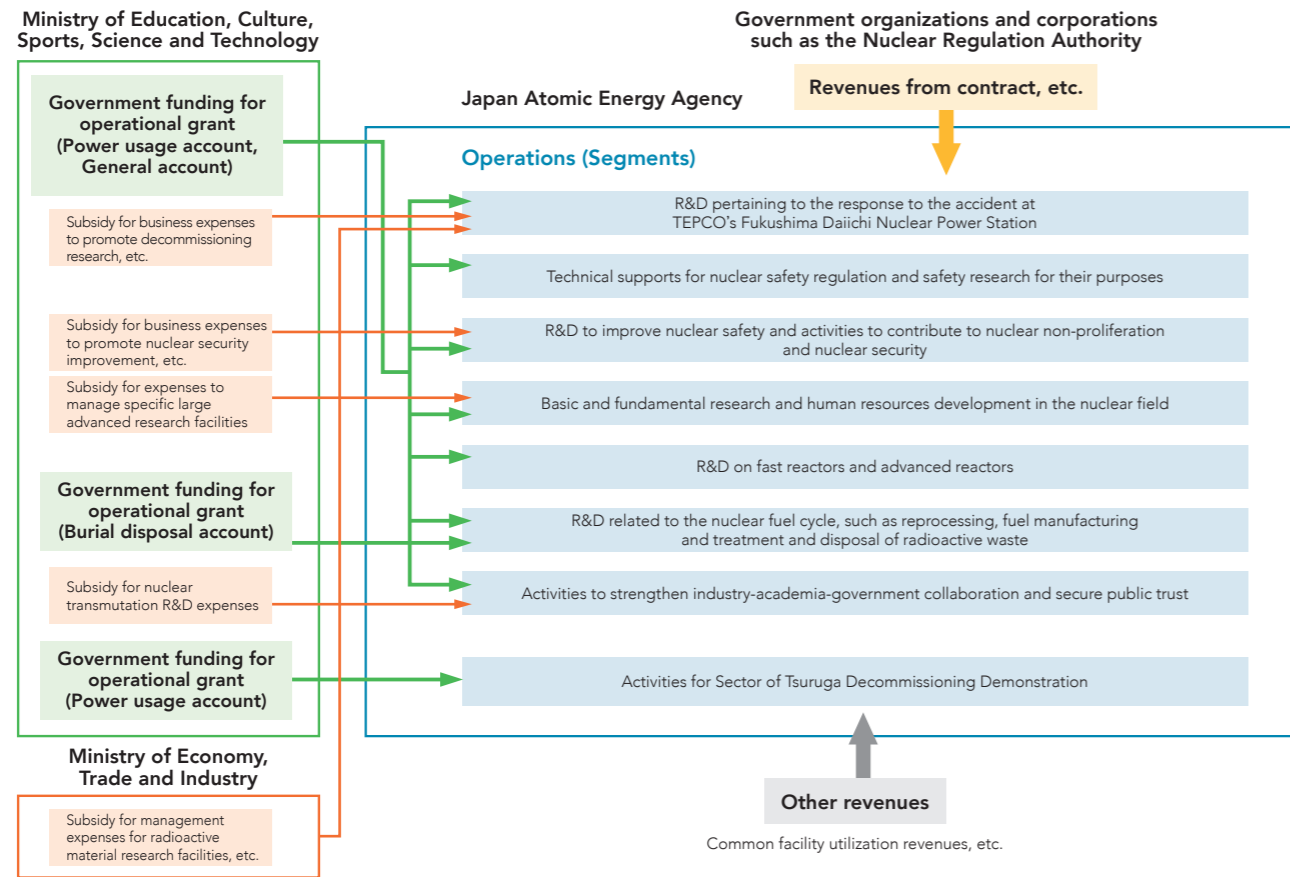
[Annual Plan:](https://www.jaea.go.jp/about_JAEA/business_plan.html)
https://www.jaea.go.jp/about_JAEA/business_plan.html
 (in Japanese)

Premise Information for Proper Assessment of Operations

Information on Operation of Internal Control

(1) Premise Information for Proper Assessment of Operations

To assist with understanding and evaluation of JAEA's operations in FY2021, the operating scheme (revenue source and individual operations) is shown below.



(2) Information on Operation of Internal Control

JAEA has formulated a statement of operation procedures which sets out the system for ensuring that the performance of duties by corporate officers (excluding auditors) conforms with the Act on General Rules for Incorporated Administrative Agencies and the Act on the Japan Atomic Energy Agency, National Research and Development Agency, etc. The main items relating to the operation of internal control and their implementation status are shown below.

Internal audit (Article 32 of the statement of operation procedures)

In addition to the existing audit subjects (such as the implementation status of personal information protection), we have started an audit of all JAEA organizations to prevent the emergence of risk. This has resulted in the strengthening of the monitoring function for JAEA's internal control system. In addition, the Office of Auditor is engaged in establishing a system for centralized internal auditing of all JAEA activities in coordination with the regulation audits conducted by other departments.

Bidding and Contract (Article 34 of the statement of operation procedures)

In September 2021 and February 2022, the Contract Monitoring Committee inspected contracts with a high ratio of bid price to asking price, such as multi-bidder contracts with a 100% ratio; contracts with a single bidder company for two consecutive years; contracts for which a low bid price survey was conducted; contracts with affiliated corporations; and the appropriateness of reasons given for choosing no-bid contracts (negotiated contracts).

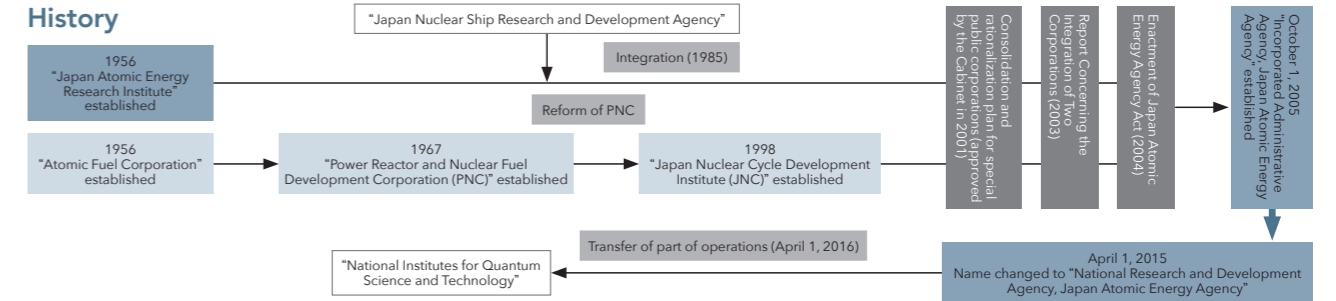
Appropriate budget allocation (Article 35 of the statement of operation procedures)

The 2021 implementation plan budget guideline and implementation plan were decided at a board meeting. We strived to allocate the budget appropriately based on an analysis of budget use during the period.

Basic Information on JAEA

Profile of Organization

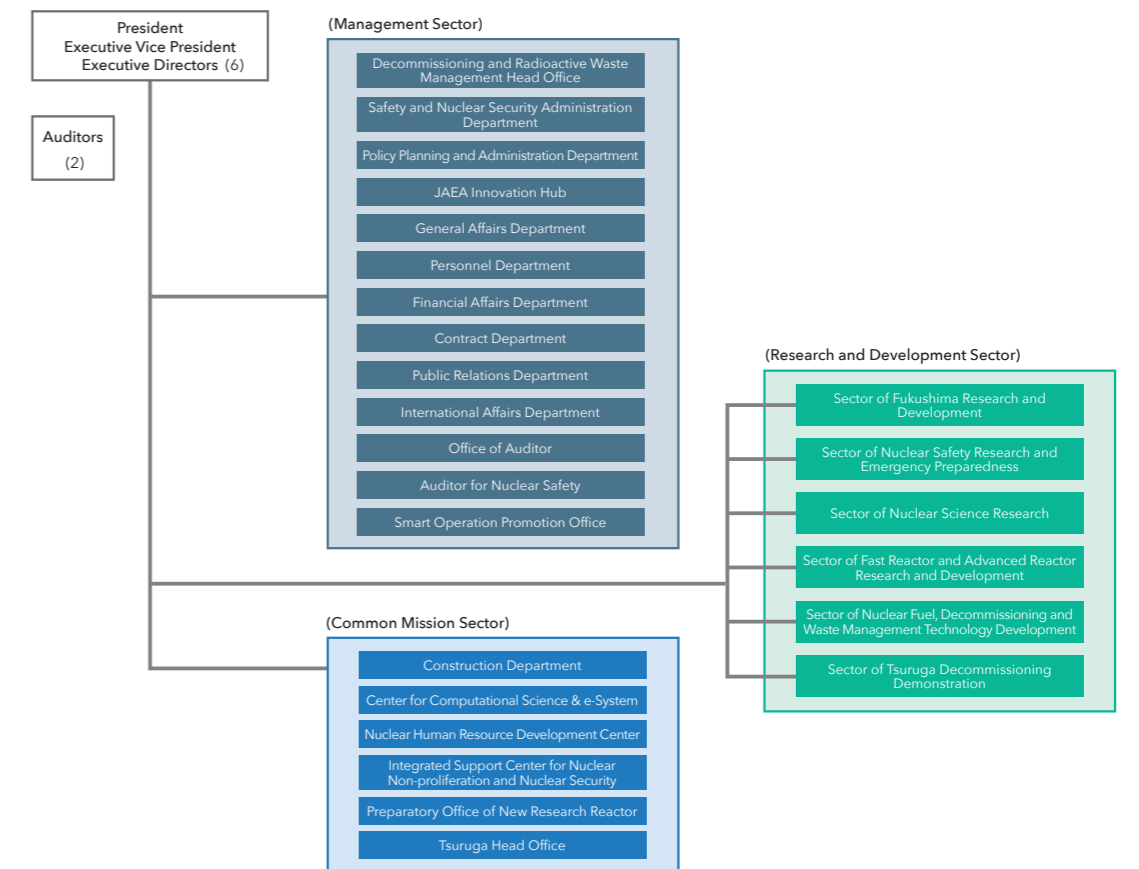
History



Law Underlying Establishment of JAEA

Act on the Japan Atomic Energy Agency, National Research and Development Agency (Act No.155 of 2004)

Organization*



* The Management Sector and Common Mission Sector were unified as Headquarters on April 1, 2022. The Safety and Nuclear Security Administration Department was reorganized into the Safety and Nuclear Security Administration Head Office to strengthen its function. The Smart Operation Promotion Office, which was a time-limited organization, was closed and its operations transferred mainly to the General Affairs Department and the Policy Planning and Administration Department.

Employees

The number of full-time employees under the age-limit system as of the end of FY2021 was 3,109 (a decrease of 7 compared with the end of the previous fiscal year) and the average age was 42.6 years (42.8 years as of the end of the previous fiscal year). The number of full-time employees under the age-limit system does not include persons seconded from the national government or private companies. The number of employees retiring on March 31, 2022, was 93.

Profile of Organization

Major Specified Affiliated Companies, Affiliated Companies and Related Public Interest Corporations

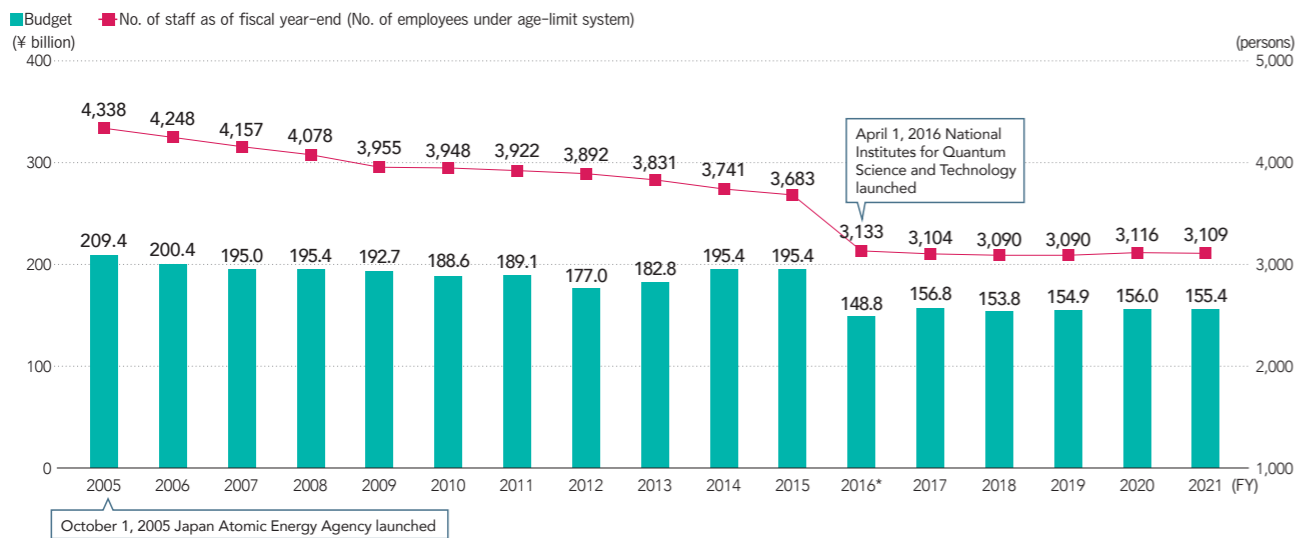
Corporation	Outline of operations	Relation to JAEA
Mutual Aid Association for Japan Atomic Energy Agency	Promotes the benefit and welfare of executive directors, staff and other employees of the Japan Atomic Energy Agency (JAEA) and its full-time officers and employees and conducts activities to contribute to and achieve the advancement of JAEA's operations.	Related public interest corporation
Institute of Radiation Measurements	Conducts activities necessary to improve the reliability of radiation measurement and uses the results of these activities and training and education on radiation measurement to contribute to and achieve the healthy advancement of the development and use of nuclear energy and radiation and the realization of a safe and secure society.	Related public interest corporation
Japan Chemical Analysis Center	Conducts activities such as analysis and measurement of radioactive materials contained in environmental materials, analysis and measurement of various other substances, related investigation and research to contribute to the improvement of the health and safety of Japanese people, and activities to contribute to the promotion of academia and science and technology.	Related public interest corporation
Radiation Application Development Association	Promotes the application of radiation and conducts activities to contribute to and achieve the improvement of the lives of Japanese people and the establishment of a sustainable society by promoting dissemination of knowledge and technology related to the use of nuclear energy.	Related public interest corporation
Research Organization for Information Science and Technology (RIST)	Comprehensively propels investigation and collection of information on studies and technology development pertaining to information science and technology and information in the science and technology field, and activities to contribute to and achieve the development of academia and science and technology.	Related public interest corporation

Detailed statements supplementary to JAEA's financial statements: https://www.jaea.go.jp/about_JAEA/financial/ (in Japanese)

Accounting Auditor

KPMG AZSA LLC

Transition in Number of Staff and Budget

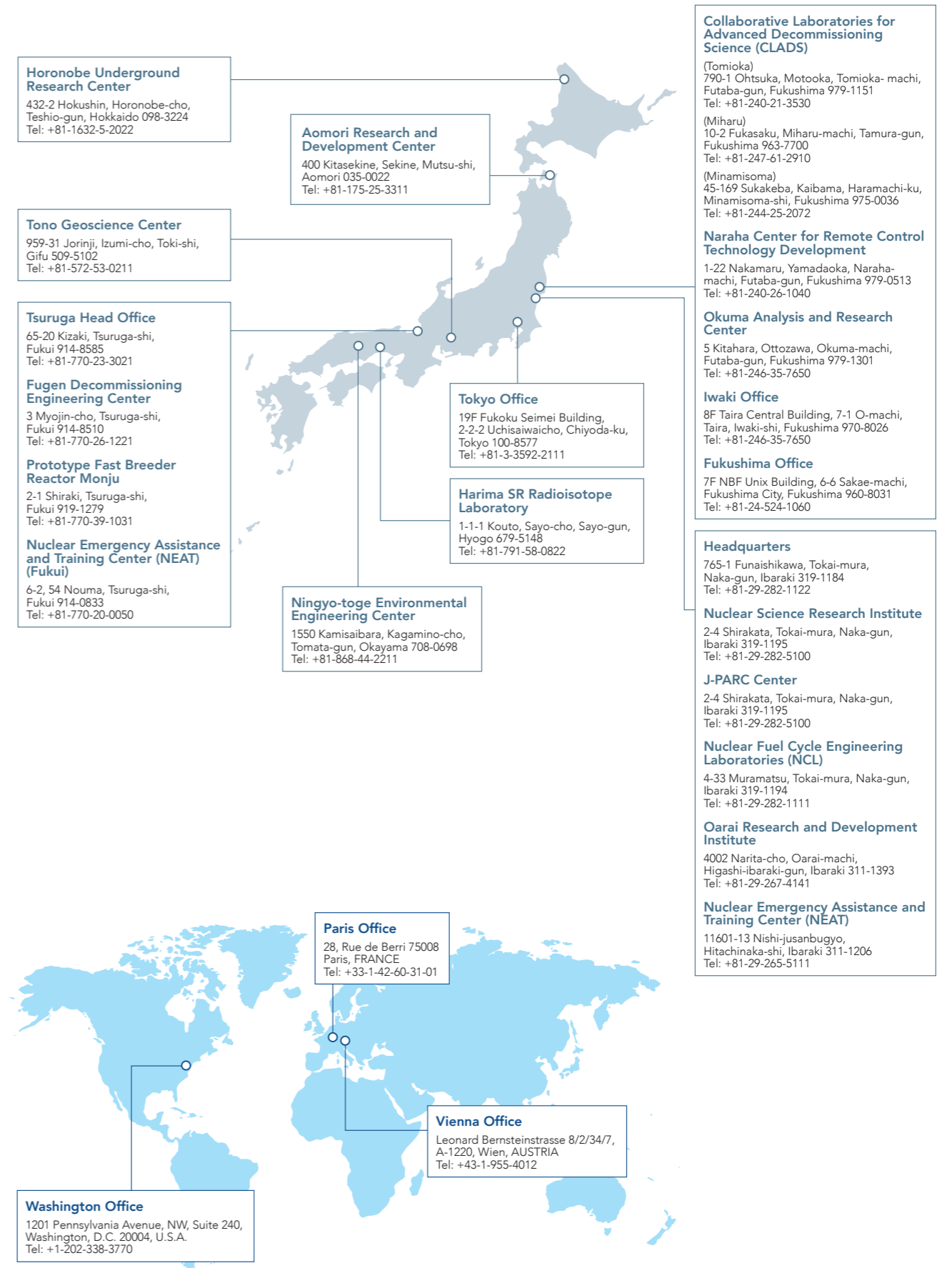


* Decrease in staff and budget with launch of National Institutes for Quantum Science and Technology

State of Establishment of Important Facilities

- Major facilities, etc. completed this fiscal year
 - None
- New construction or expansion of major facilities, etc. in progress this fiscal year
 - Safety measures of nuclear facilities, etc.
 - Establishment of research base facilities toward decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station
- Major facilities, etc. disposed of this fiscal year
 - Sale of eastern Oarai site (land; Oarai Base) (acquisition cost 37 million yen; accumulated impairment loss 25 million yen)
 - Disposition of shafts and drifts of Mizunami Underground Research Laboratory (Tono Base) (acquisition cost 14,944 million yen; accumulated depreciation 562 million yen; accumulated impairment loss 14,381 million yen)

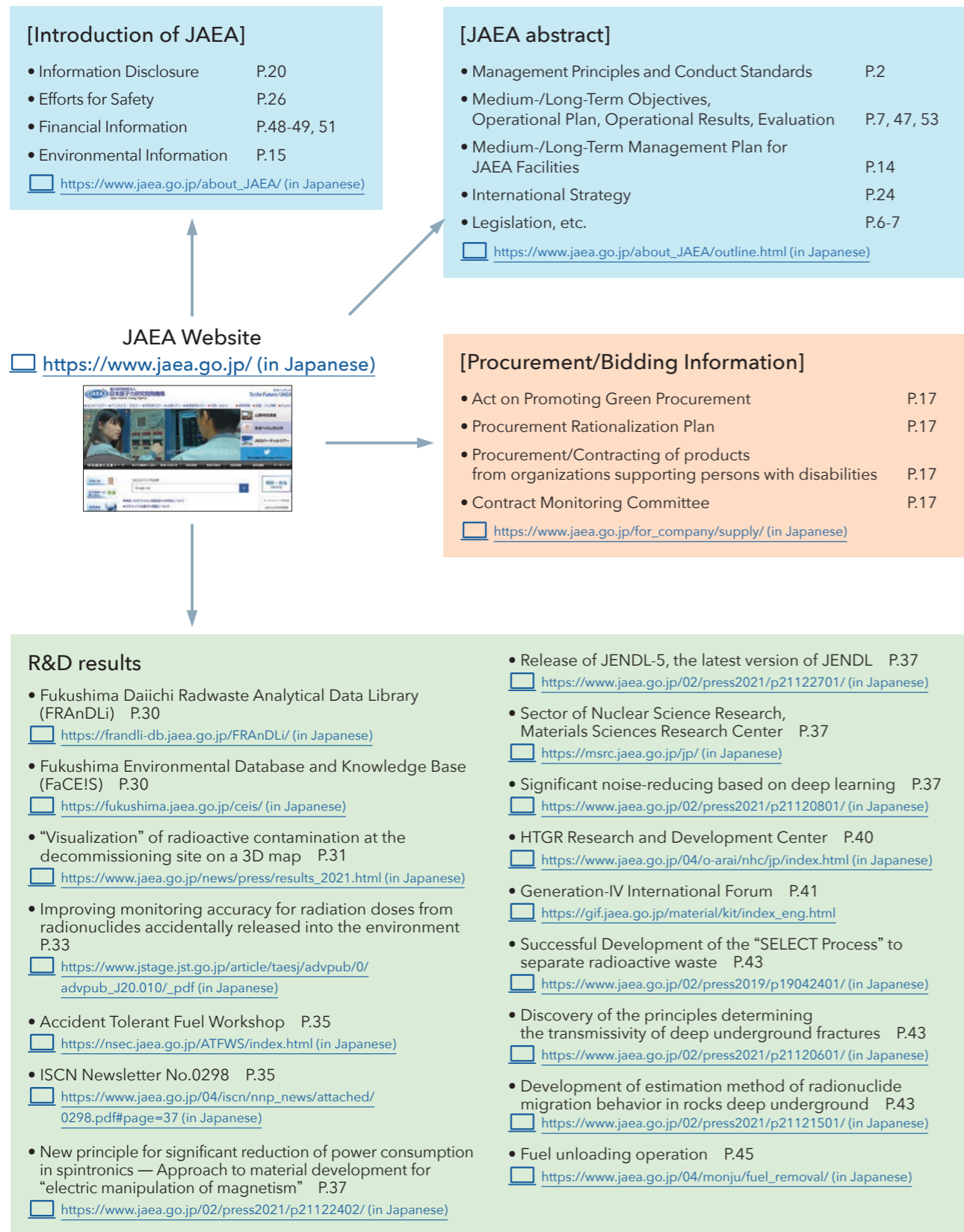
Location of R&D Sites (as of June 2022)



Other Information for Publication

Reference sources of 2021 annual report

The relationship between the items contained in this report and the JAEA website are as indicated in the following.



Other Information for Publication

◆ JAEA publicizes its activities through various media.

JAEA Website

<https://www.jaea.go.jp/english/>

Information on the activities of JAEA such as R&D status.

Social Network Services

(Twitter official account @JAEA_en)

https://www.jaea.go.jp/english/jaea_channel/

Introducing JAEA activities through video streaming services.

JAEA Channel

https://www.jaea.go.jp/english/jaea_channel/

Introducing JAEA activities through video streaming services.

— Publicity Brochures —



— Dissemination of Scientific Achievements —



Inquiries

An Inquiry Page is available on our website <https://www.jaea.go.jp/english/query/>
 If you cannot find the inquiry page, please use the following Inquiry Form:
<https://www.jaea.go.jp/query/form.html> (in Japanese)



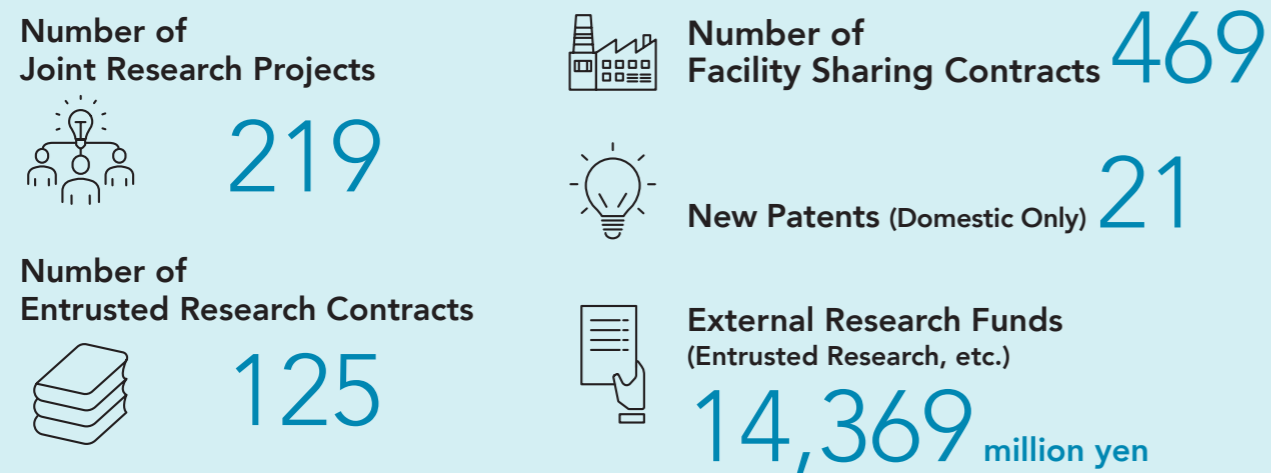


Quantitative Analysis of the JAEA Achievements

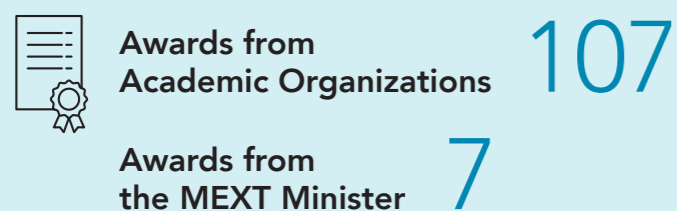
Dissemination of R&D Achievements



Indicators of R&D Activities



Awards



Performance Information

Cooperation/Collaboration with Other Organizations

Cooperation Arrangements with Other Organizations



International Training Courses



Domestic Training Courses



Number of Cross-Appointment Researchers



Public Hearings and Public Relations Activities

Public Hearings and Public Relations Activities

