

# Evaluation of FY2017 Operating Results for the National Institutes for Quantum and Radiological Science and Technology

October 2018

Minister of Education, Culture, Sports, Science and Technology  
Nuclear Regulation Authority

1. Items related to the evaluation		
Agency	National Institutes for Quantum and Radiological Science and Technology	
FY for evaluation	FY evaluation	FY2017
	Mid to long-term objective period	FY2016-FY2022 (1st term)

2. Items related to the assessor			
The Competent Minister	Minister of Education, Culture, Sports, Science and Technology		
Incorporated jurisdiction dept.	Science and Technology Policy Bureau	Dept. and person in charge	Office for Quantum Science and Technology, Research and Development Infrastructure Division, Takashi Nishiyama
Evaluation and inspection dept.	Science and Technology Policy Bureau	Dept. and person in charge	Planning and Evaluation Division, Keiji Inoue
The Competent Minister	Nuclear Regulation Authority (co-jurisdiction over the effects of radiation on human bodies, prevention of harm to human bodies from radiation, and diagnosis, treatment and medical use of radiation among agencies' operation)		
Incorporated jurisdiction dept.	Radiation Protection Department, Secretary-General's Secretariat, Nuclear Regulation Authority	Dept. and person in charge	Radiation Protection Department, Satoshi Sato
Evaluation and Inspection dept.	Secretary-General's Secretariat, Nuclear Regulation Authority	Dept. and person in charge	Policy Planning and Coordination Division, Kazuhiro Ohkuma

3. Items regarding implementation of evaluation	
<p>Opinion gathering and hearing from the National Research and Development Agency Council (hereinafter referred to as the "Council")</p> <p>According to the following procedures, a hearing about the evaluation documents related to FY2017 operating results of the National Institutes for Quantum and Radiological Science and Technology (hereinafter referred to as QST) was held and opinions were heard in the Council of the Ministry of Education, Culture, Sports, Science and Technology and the Nuclear Regulation Authority.</p> <p>On July 5, 2018, a QST sub-committee ("sub-committee") was held under the National Research and Development Agency Committee of the Ministry of Education, Culture, Sports, Science and Technology for confirming the policy of evaluating operating results and holding hearings regarding FY2017 operating results.</p> <p>On July 9, 2018, a sub-committee was held under the Nuclear Regulation Authority for confirming the policy of evaluating operating results, and hearing opinions from QST regarding the evaluation of such matters as effects of radioactivity on human bodies, radiation protection, and diagnosis and treatment of radiation hazard out of FY2017 operating results.</p> <p>On July 20, 2018, a sub-committee was held under the Nuclear Regulation Authority for hearing opinions from committee members regarding the evaluation of such matters as effects of radioactivity on human bodies, radiation protection, and diagnosis and treatment of radiation hazard out of FY2017 operating results.</p> <p>On August 1, 2018, a sub-committee was held under the Ministry of Education, Culture, Sports, Science and Technology for hearing opinions from committee members regarding the evaluation of FY2017 operating results.</p> <p>On September 25 - 28, 2018, a sub-committee was held under the Ministry of Education, Culture, Sports, Science and Technology for hearing opinions from committee members again regarding the evaluation of FY2017 operating results.</p>	

4. Important items and others relating to the evaluation	
No special matters to note	

1. Overall rating								
Rating*1 (S, A, B, C, D)	A	(Reference) Overall rating in the past fiscal years in this mid to long-term objective period						
		FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022
		A	A					
Reasons for rating	As shown in the overall evaluation of the agency as a whole, the creation of considerable achievements and anticipated creation of achievements in the future and so on were recognized as a result of comprehensive consideration based on circumstances surrounding the agency's business achievements, efforts and so on through its activities and with the national research and development agency's mid to long-term objectives taken into account.							

2. Evaluation of the whole agency	
<p>As shown in the overall evaluation of the agency as a whole, the creation of especially considerable achievements and anticipated creation of achievements were recognized in some areas. Overall, the creation of considerable achievements and anticipated creation of achievements were recognized.</p> <ul style="list-style-type: none"> <li>○ In exploratory/creative R&amp;D concerning quantum science and technology, the creation of considerable achievements and anticipated creation of achievements in the future useful for developing new research fields were recognized in the efforts for the formation of a community that can be the research base in the future by organizing a workshop for quantum life science and hosting an international symposium, and the establishment of an industry-academia-government cooperation system by promoting joint research projects for drug development with universities and companies in the study of target isotope therapy and acquisition of competitive research funds jointly by a radiopharmaceutical company.</li> <li>○ In R&amp;D into innovative medical uses of radiation, insurance coverage was made available for prostate cancer for the first time in cancer except for rare cancer cases, much earlier than initially planned. Prostate cancer is the 4th most commonly occurring cancer in men, and insurance coverage of this critical disease allows the patient to select heavy-ion cancer therapy as an ordinary therapeutic option, not as the advanced medical care requiring a high cost of healthcare. This is important in that citizens can take advantage of the heavy-ion cancer therapy. QST has played a leading role in the activities of a multicenter cooperative trial participated by other heavy particle radiotherapy facilities in Japan to promote clinical trials. Such an early achievement of insurance coverage for prostate cancer is nothing less than the result of efforts by QST, and considerable achievements to create outcomes largely contributing to public health and medical care were especially recognized.</li> <li>○ In research on the effects of radiation and radiation medicine, the creation of considerable achievements were recognized in acquiring important insights in the research of radiological consequences and cancer, including the discovery of mechanisms of the anomalous occurrence of epigenome caused by radiation exposure and implication of possibilities to prevent radioactive cancerogenesis with epigenome drug discovery, and the first-time clarification of effects of neutron rays on the induction of breast cancer and dependency on the age of exposure.</li> <li>○ In R&amp;D on the application of quantum beams, the creation of considerable achievements of great scientific significance were recognized in the theoretical study of generating attosecond pulses in a high-energy region, theoretical proposition of methodologies to verify the interaction of photons or "Delbrück scattering" with great accuracy, which was regarded as difficult for verification, and discovery of new magneto-optical effects of fluorescent X-rays, and so on.</li> <li>○ In addition to the consistent fulfillment of obligations based on international agreements in R&amp;D on nuclear fusion, the creation of considerable achievements and anticipated creation of achievements in the future were recognized in the ITER project in which superconducting center solenoid coils were produced and this led to the first successful production of a superconducting toroidal magnetic coil structure, and in-situ calibration was demonstrated in local Thomson scattering measurement with the simultaneous measurement and calibration of electron temperatures, and in BA activities in which technical possibilities of modifying ITER construction technique to a technique advantageous in terms of construction period and cost through were implicated by installing superconducting toroidal magnetic coils with a high degree of accuracy that exceeded the desired value in the JT-60SA project.</li> <li>○ In the internal exposure accident at the Oarai Research &amp; Development Center, measurements of body surface contamination and decontamination, and Japan's first treatment (to promote extracorporeal elimination of nuclear fuel materials) of the victims of the accident, as well as the prompt and appropriate response and suitable information dissemination (including 4 press conferences) are considerable achievements to meet the functions of a public research institution, and though exceeding the assumption of the fiscal plan, QST fulfilled its role as a core institution in response to nuclear emergency.</li> <li>○ It is recommended that QST review the direction of its research efforts and establish a system for adequately reflecting it in the evaluation of research while accurately understanding the position of the agency in units of department, laboratory and group through the quantitative and qualitative benchmarking of international R&amp;D trends.</li> </ul>	

- QST is expected to steadily promote research and development in the above-mentioned research fields in the future in an attempt to maximize its achievements, and efforts to contribute to the maximization of achievements in quantum science and technology in general, including those which have not been addressed by QST, as a core institution of the industry-academia-government platform that supports quantum science and technology in Japan.
- It is recommended that QST, as the leader of the state for discussing the maintenance and operation of the next-generation synchrotron radiation facility (high-brightness 3GeV class synchrotron radiation source for soft-X-rays), promote adequate coordination with local and industrial partners selected by MEXT on July 2018 for investigating and adjusting the details of maintenance and operation of the facility and get the plan underway through public-private-local partnership.

### 3. Issues to be solved and /or improved for each subject

- With regard to quantum life science, definitions of this field should be carefully discussed before new academic fields are established and promoted. QST is expected to make efforts to lead quantum life science by analyzing the significance of this field brought in society and economy as well as Japan's research potential, reviewing promotional policies based on the result of analysis and clarifying QST's roles and research themes.
- With regard to heavy-ion cancer therapy equipment, strategic efforts are expected for extensively disseminating and diffusing heavy-ion cancer therapy including exports to the U.S. and Europe where the market size is large.
- With regard to medical treatment using standard isotope therapeutic drugs, strategic R&D and dissemination are expected with the knowledge of merits and demerits compared with other drugs such as molecularly-targeted drugs.
- With regard to research on the effects of radiation and radiation medicine, efforts for recruiting outstanding human resources are expected in relation to fundamental research and development.
- Effective operation of a variety of quantum beam platforms possessed by QST, and technical development leading to the maximization of research achievements including increased use of these platforms by external researchers are the important issues. For the sake of evaluation in the coming years, QST should clearly indicate the way of expanding technical development and application in the future, together with research achievements and consequences in the past, for its various quantum beam platforms including TIARA and J-KAREN so as to make proper discussions available in evaluation.
- With regard to research on quantum beams, QST is expected to make proper discussions available for evaluation by setting up main research themes with clear targets, and presenting research achievements and consequences of these targets during evaluation.
- With regard to R&D on nuclear fusion, the construction of ITER is well underway, along with a number of major projects such as JT-60SA construction which is close to completion, and commencement of acceleration tests on the accelerator for nuclear fusion neutron sources. Sufficient consideration should be made for the assignment of personnel so that relevant projects can be carried out steadily within the limited human and physical resources and without harming the safety. QST should, therefore, further strive to reinforce industry-academia-government cooperation besides its internal work, and preferably take the initiative in managerial level as well as its efforts in fieldwork. QST is also expected to promote economic validation of the recovery of lithium from seawater and make further efforts for cooperation with academic and industrial sectors for the development of human resources capable of leading international research and development projects.
- With regard to information dissemination, it is important to keep PDCA turning by assessing or innovating results. Steady efforts are expected in the future.
- QST's approval for ventures and innovation hubs are essential efforts for implementing research achievements into society and creating open innovation, but the efforts alone cannot be recognized as the considerable achievements because a number of research and development institutes have employed similar efforts in recent years. Effective support of ventures and operation of innovation hubs as well as appropriate efforts for implementing research achievements into society are expected in the future.
- QST is desired to make clear its future planning on human resources development and procedure of incorporation in mid to long-term plans in nuclear emergency and radiological effects and protection as a core institution of this field of science.
- QST is expected to make efforts for the acquisition of research funds from private companies and self-generated incomes such as competitive research funds to reinforce its management base.
- QST is recommended to discuss the management strategy, personnel distribution and resource allocation, etc. for the future at the QST Future Strategy Investigative Committee and start actual initiatives for QST to be a core institution of quantum science and technology in Japan.

4. Other items	
Main opinions of the council on research and development	Evaluation of the agency's operating results in this evaluation document is considered adequate. (For details, see the evaluation by the competent minister in relevant itemized evaluation documents.)
Auditor's special comments	It is recognized that the agency's operation has been properly carried out according to relevant laws and regulations, and effectively and efficiently promoted for attaining mid to long-term objectives.

- \*1 S: Based on the National Research and Development Agency's aims, businesses with mid to long-term objectives due to comprehensive consideration based on some circumstances regarding the agency's business achievements, and efforts through its activities, especially the creation of considerable achievements, anticipated creation of special achievements in the future and so on toward "maximization of R&D achievements" under the conditions of appropriate, effective and efficient operations are recognized.
- A: Based on the National Research and Development Agency's aims, businesses with mid to long-term objectives due to comprehensive consideration based on some circumstances regarding the agency's business achievements, and efforts through its activities, especially the creation of considerable achievements, anticipated creation of special achievements in the future and so on toward "maximization of R&D achievements" under the conditions of appropriate, effective and efficient operations are recognized.
- B: Based on the National Research and Development Agency's aims, business with mid to long-term objectives due to comprehensive consideration based on some circumstances regarding the agency's business achievement, and efforts through its activities, a certain degree of expectation for the creation of achievement and creation of achievement in the future toward "maximization of R&D achievements" were recognized, and steady business operations have been also recognized.
- C: Based on the National Research and Development Agency's aims, businesses with mid to long-term objectives due to comprehensive consideration based on some circumstances regarding the agency's business achievements, and efforts through its activities, the creation of achievements, further drastic efforts and improvements toward "maximization of R&D achievements" or "appropriate, effective and efficient operations" are anticipated.
- D: Based on the National Research and Development Agency's aims, businesses, mid to long-term objectives and so on, as a result of comprehensive consideration based on some circumstances regarding the agency's business achievements, efforts and so on through its activities, special efforts and improvements including a fundamental drastic review, toward "maximization of R&D achievements" or "the appropriate, effective and efficient operations" are required.

Form 2-1-3 National Research and Development Agency / FY Evaluation / Summary Table for Rating by Item

Mid to long-term objectives (Mid to long-term plan)	FY evaluation							Itemized evaluation document No.	Remarks
	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022		
<b>I. Maximization of R&amp;D achievements and quality improvements of other operations</b>									
<b>1. Medical R&amp;D on quantum and radiological science and technology</b>									
(1) Exploratory/creative R&D on quantum science and technology	A	A						No.1	
(2) R&D on innovative medical uses of radiation	A	S						No.2	
(3) Research into the effects of radiation and radiation medicine	A	A						No.3	
(4) R&D on the application of quantum beams (Advanced quantum beam technology development and research on quantum beam science)	S	A						No.4	
(5) R&D concerning nuclear fusion (Dissemination and utilization of results, collaboration with external organizations, and functions to be fulfilled by a public research institution)	A	A						No.5	
2. Dissemination of R&D achievements by an intelligible method and promotion of utilization of outcomes 3. R&D promotion through international cooperation and industry-academia-government collaboration 4. Functions to be fulfilled by a public research institution (1) Functions to be fulfilled as a core institution in measures for nuclear emergency and radiation protection, etc. (2) Contribution to reconstruction in Fukushima (3) Development of human resources (4) Promotion of utilization of facilities and equipment	B	A						No.6	
<b>II. Measures to Be Taken to Achieve Objectives Concerning Operational Streamlining</b>		B						No.7	
<b>III. Budget (including an estimate of personnel expenses), an income and expenditure plan, and a funding plan</b>	A	B						No.8	
<b>IV. Important items related to business management and others</b>		B						No.9	

\* For items that are set to “high” level of importance, a “circle” shall be marked next to each comment.

For items that are set to “high” level of difficulty, each comment shall be underlined.

\* The evaluation is based on “Standards concerning the evaluation of independent administrative agencies under the jurisdiction of the Ministry of Education, Culture, Sports, Science and Technology” (as determined by the Minister of Education, Culture, Sports, Science and Technology on June 30, 2015). The details are as follows.

[Administrative and projects related to research and development (I)]

S: Based on the National Research and Development Agency’s aims, businesses, mid to long-term objectives and so on, and as a result of comprehensive consideration based on some circumstances regarding the agency’s business achievements, efforts and so on through its activities, especially the creation of considerable achievements, anticipated creation of special achievements in the future and so on toward “maximization of R&D achievements” under the conditions of appropriate, effective, and efficient operations are recognized.

A: Based on the National Research and Development Agency’s aims, businesses, mid to long-term objectives and so on, and as a result of comprehensive consideration based on some circumstances regarding the agency’s business achievements, efforts and so on through its activities, the creation of considerable achievements, anticipated creation of achievements in the future and so on toward “maximization of R&D achievements” under the conditions of appropriate, effective, and efficient operations are recognized.

B: Based on the National Research and Development Agency’s aims, businesses, mid to long-term objectives and so on, and as a result of comprehensive consideration based on some circumstances regarding the agency’s business achievement, efforts and so on through its activities, a certain degree of expectation for the creation of achievement and creation of achievement in the future toward “maximization of R&D achievements” were recognized, and steady business operations have been also recognized.

- C: Based on the National Research and Development Agency's aims, businesses, mid to long-term objectives and so on, and as a result of comprehensive consideration based on some circumstances regarding the agency's business achievements, efforts and so on through its activities, the creation of achievements, further drastic efforts and improvements toward "maximization of R&D achievements" or the "appropriate, effective, and efficient operations" are anticipated.
- D: Based on the National Research and Development Agency's aims, businesses, mid to long-term objectives and so on, and as a result of comprehensive consideration based on some circumstances regarding the agency's business achievements, efforts through its activities, special efforts and improvements including a fundamental drastic review, toward "maximization of R&D achievements" or the "appropriate, effective, and efficient operations" are required.

[Other than administrative work and projects regarding research and development (After II)]

- S: Through the activities of a corporation, remarkable performance exceeding the intended objectives is recognized quantitatively and qualitatively in the medium-term plan (in terms of quantitative indicators, 120% or more vis-à-vis planned medium-term value (or planned FY value), and remarkable performance is also recognized qualitatively)
- A: Through the activities of a corporation, remarkable performance exceeding the intended objectives is recognized in the medium-term plan (in terms of quantitative indicators, 120% or more vis-à-vis planned medium-term value (or planned FY value).
- B: Performance exceeding the intended objectives is recognized in the medium-term plan (in terms of quantitative indicators, 100% or more but less than 120% vis-à-vis planned medium-term value (or planned FY value).
- C: Performance falls below the intended objectives in the medium-term plan, requiring improved performance (in terms of quantitative indicators, 80% or more but less than 100% vis-à-vis planned medium-term value (or planned FY value).
- D: Performance falls below the intended objectives in the medium-term plan, requiring drastic improvement of business including its abolition (in terms of quantitative indicators, less than 80% vis-à-vis planned medium-term values (or planned FY value), or it is recognized that the competent Minister is required to ask for improving business operations or taking other necessary measures).