

Evaluation of FY2018 Operating Results for
National Institutes for Quantum and Radiological Science and Technology

September 2019

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	FY2018 (1st term)
	Mid to long-term objective period	FY2016-FY2022

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, Atsushi Oku
Evaluation and inspection dept.	Science and Technology Policy Bureau	Dept. and person in charge	Planning and Evaluation Division, Masao Yokoi
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, Kazuhiro Ohkuma
Evaluation and Inspection dept.	Secretary-General's Secretariat, Nuclear Regulation Authority	Dept. and person in charge	Policy Planning and Coordination Division, Yohei Kojjima

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, the Council of the Ministry of Education, Culture, Sports, Science and Technology and the Nuclear Regulation Authority was held and discussed the evaluation documents related to FY2018 operating results of the National Institutes for Quantum and Radiological Science and Technology (hereinafter referred to as QST). MEXT and Nuclear Regulation Authority received opinions from each councils. a hearing about was held and opinions were heard in.</p> <p>On July 4, 2019, a QST sub-committee ("sub-committee") under the National Research and Development Agency Council of the Ministry of Education, Culture, Sports, Science and Technology was held and confirmed the policy of evaluating operating results and holding hearings regarding FY2018 operating results.</p> <p>On July 19, 2019, 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 FY2018 operating results.</p> <p>On August 1, 2019, 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 FY2018 operating results.</p> <p>On August 6, 2019, a council was held under the Ministry of Education, Culture, Sports, Science and Technology for hearing opinions from committee members again regarding the evaluation of FY2018 operating results.</p> <p>On August 9, 2019, 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 FY2018 operating results.</p>

4. Important items and others relating to the evaluation
<p>March 1, 2019: With regard to the targets (mid to long-term objectives) on business operations that are to be achieved by a National Research and Development Agency that is National Institutes for Quantum and Radiological Science and Technology, items were added concerning businesses to which investment is needed, including research and development concerning areas such as readiness of super-luminosity 3GeV-grade radiation light source (next-generation radiation light source facility) and next-generation radiation light source facility by public, private, and community partnership.</p>

April 1, 2019: Items were added concerning businesses to which investment is needed, including research and development concerning areas such as readiness of super-luminosity 3GeV-grade radiation light source (next-generation radiation light source facility) and next-generation radiation light source facility by public, private, and community partnership, to the plan to achieve the mid to long-term objectives of a National Research and Development Agency that is National Institutes for Quantum and Radiological Science and Technology.

1. Overall rating							
Rating (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
		A	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"> ○ In germinative and creative research and development on quantum science and technology, with regard to the work to develop a community that will serve as a research platform going forwards, we recognize that we can expect the creation of achievements in our future, including the establishment of “quantum life science practice” as a proper research organization inside QST, the launch of Quantum Life Science Society as a research platform community moving forwards for all of Japan for the quantum life science field, and the experts acting as leaders to manage the suggestions on its presence going forward in the research field. ○ With regard to research and development for purposes including revolutionary medical utilization of radiation, after an analysis of prostate cancer cases on which we perform follow-ups a long-term, we learned that secondary cancer onset rate is significantly lower (by about 30%) after heavy particles radiation therapy than after x-ray therapy. This achievement has global impact on society, and we recognize that this is a particularly significant achievement by which we can expect heavy particle radiation therapy to gain more popularity. Furthermore, we were the first in the world to learn that the biological effect of a particular beam increases by 1.5 times when an external magnetic field is used in heavy particle radiation therapy, and we gained knowledge that will lead to advancements in particle beam therapy moving forwards, including upgrades to units and increases to the effect of therapy. We recognize that there are significant achievements. ○ With regard to medical research on radiation dosage impact and radiation exposure, as a significant achievement we can recognize the work we did to be the first in the world to prove that risks due to radiation dosage rate vary by age, and that there is a threshold on onset risk of breast cancer after low dosage rate radiation exposure. ○ With regard to the research and development on the application of quantum beams, we created diamonds containing a high concentration NV center by using electron beams, and validated the super-radiation of microwaves by damping the spin excitation state inside a resonator by several hundred nanoseconds. Furthermore, light ion microbeam (TIARA) and others were applied to create a single photon source inside a SiC diode, which is expected to be applied to a high-sensitivity quantum sensing device that can work under room temperature conditions, and this was able to control the luminescence intensity via voltage in the reverse-direction. This can be recognized as a significant achievement. ○ With regard to research and development on nuclear fusion, we recognize among others the creation of significant achievements and the creation of achievements for our future on schedule, including the performance of difficult duties (eg, to build a high-precision large-scale structure that can perform operations in a stable manner, while working on technical issues that cannot be anticipated, on a schedule that is agreed upon internationally), based on an international commitment to BA activities and a ITER plan, which are in the fiscal plan. ○ We can give good marks to readying a system that serves as a basic framework to make the emergency radiation exposure medicine practice function dynamically and as a single unit, as a “high-level exposure medical support center” which carries a central and leader-like role in radiation exposure medicine, as this is an achievement that far surpasses the fiscal year plan, through works including building a coordination structure with the 4 centers that are named at the high-level exposure medical support center. ○ We recognize that the founding of a “quantum life sciences practice”, the establishment of “High-Level Exposure Medical Center”, and the construction of a “Next-Generation Light Radiation Facility Readiness and Development Center”, and so on, in full coordination with concerned agencies in order to build a structure for QST version 2 are significant achievements which surpassed the fiscal year goals. We can give high marks to the adjustments that were made, resulting from a reform of the organization, including the adjustment work among all sites and the designing of a system resulting from a review of the management system that is, for example, zoned, and from the convergence of contract work and the revision to the 161 related rules and such under the control of the head office, particularly in a short period of six months from the time that a policy was decided in September 2018.

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

- While achievements are being made on schedule including the establishment of a “quantum life science practice” and the establishment of a quantum life science society, with regard to achievements in individual research, we are only at half way. Going forwards, we need to make clearer the nature of roles and research that QST shall cover, and QST shall become a leader in this field.
- With regard to the development of a “quantum scalpel”, we are in the process and on schedule with the research and development of this in coordination with industry, academia, and government, including the signing of an agreement on joint research; we however need to perform further work to secure funding from the private sector, that is, external funding from corporations.
- With regard to radiation impact research, after making clear how the obtained achievements can be applied to our society, move forwards research on areas including risks of low radiation dosage and low radiation dosage rate exposure and understanding their mechanism.
- With regard to research on radiation exposure medicine, move forwards research on a more effective discharge method and development and investigation into a more precise radiation dosage assessment methodology, and disseminate the achievements in our research as information.
- Overall, make clear how achievements from research make contributions to society and to the next research, and improve upon the nature of research.
- Moving forwards, to effectively operate the multiple varieties of quantum beam platform we have, to move forwards technology development, and to connect these to a maximization of the achievements including an expansion in external utilization. Going forward, ready a structure under which funding can be secured from the private sector and from overseas, and advance our research and development that apply the achievements into our society. Furthermore, to further move forward items including coordination with researchers overseas and human resource exchanges.
- With regard to human resource education and training, because the ratio of Japanese staff at the ITER agency is the worst among the seven, activities shall be performed in view of the work concerning research capacity improvement including improvements to human resource instability at Ministry of Education, Culture, Sports, Science and Technology.
- In view of the current situation where the dissemination of information to Japan on outsourced work from the ITER agency is not coordinated with tenders from corporations in Japan, not only shall we disseminate information but we shall do more work in view of successful use cases from elsewhere.
- To improve upon both the quantity and quality of our publications, not only will we perform research and development for the production of equipment on a schedule that is based on an international commitment, such as ITER plan and BA activities, we will also work on research and development that can create achievements that can be published, with an eye to 2020 and onwards when JT-60SA and LIPAc will start operations.
- Dissemination of information shall be performed going forwards on a schedule, while running the PDCA cycle, and being aware of the achievements and being creative with the achievements.
- It is very effective to do corporate communications tie-ups with corporation and anime. However, this must not be a unilateral dissemination of information; going forwards, a mechanism shall be built through which bilateral communication can be had.
- With regard to work that is performed mainly by the country that is moving forwards considerations on readiness and operations of a next-generation light radiation facility, work shall be moved forwards on a schedule and the coordination with concerned agencies including partners and Riken shall be reinforced further.
- With regard to work as a Strategic Innovation Creation Program (SIP) management corporation, information shall be disseminated proactively and not only at symposiums which we initially planned. Furthermore, through the work of a management corporation, gather information from fields unfamiliar to us to date, such as quantum encryption technology and optoelectronic information processing, and, moving forwards, take advantage of this information in the research at QST.
- We need to offer more guidance as the main high-level exposure medical support center, and perform human resource education and training effectively on radiation exposure medicine.
- We hear that the security audit conducted by NISC is being handled; we however need to be mindful of cyber risks and work on both information management continuously and thoroughly to prevent security incidents from occurring and on swift recovery and minimization of damages when such incidents occur. In particular, we need to make clearer who is in charge of what within the organization and each and every staff member must become more mindful of this.
- We need to perform monitoring and follow-ups across QST, with regard to the progress since the large-scale reform in our organization.
- We need to move forward work to get research funding from private sector corporations and reinforce our business platform, in order to get more revenue.
- While specific work is being done on diversity, we cannot say that the ratio of female researchers is adequate; we need to implement more specific measures, including educating and training young researchers and hiring non-Japanese researchers.

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.
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* Evaluation categories are as follows:

- 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		
I. Maximization of R&D achievements and quality improvements of other operations									
1. Medical R&D on quantum and radiological science and technology									
(1) Exploratory/creative R&D on quantum science and technology	A	A	A					No.1	
(2) R&D on innovative medical uses of radiation	A	S	S					No.2	
(3) Research into the effects of radiation and radiation medicine	A	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	A					No.4	
(5) R&D concerning nuclear fusion	A	A	A					No.5	
(Dissemination and utilization of results, collaboration with external organizations, and functions to be fulfilled by a public research institution)									
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	B					No.6	Nuclear Regulation Authority is give a mark of A with regard to 4.(1)-(3), which is under joint custody of both the Ministry of Education, Culture, Sports, Science, and Technology and the Nuclear Regulation Authority.
II. Measures to Be Taken to Achieve Objectives Concerning Operational Streamlining		B	A					No.7	
III. Budget (including an estimate of personnel expenses), an income and expenditure plan, and a funding plan	A	B	B					No.8	
IV. Important items related to business management and others		B	B					No.9	

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

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

*3 For items that were selected for reinforcement shall be marked with “Target” next to each criterion.

*4 In the “Itemized Evaluation Document No” column, the itemized document no in the itemized evaluation document for fiscal 2018 shall be entered.

*5 Evaluation categories 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 "maximizing the achievements 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: Based on the activities of a corporation, remarkable performance exceeding the intended objectives is recognized quantitatively and qualitatively in the mid- to long- objective plan (in terms of quantitative indicators, 120% or more vis-à-vis planned mid to long-term objective value (or planned FY value), and remarkable performance is also recognized qualitatively)
- A: Based on the activities of a corporation, remarkable performance exceeding the intended objectives is recognized in the mid to long- term objective plan (in terms of quantitative indicators, 120% or more vis-à-vis planned mid to long-term objective value (or planned FY value).
- B: Performance exceeding the intended objectives is recognized in the mid to long- term objective plan (in terms of quantitative indicators, 100% or more but less than 120% vis-à-vis planned mid to long- term objective value (or planned FY value).
- C: Performance falls below the intended objectives in the mid to long- term objective plan, requiring improved performance (in terms of quantitative indicators, 80% or more but less than 100% vis-à-vis planned mid to long- term objective value (or planned FY value).
- D: Performance falls below the intended objectives in the mid to long-term objectives, requiring drastic improvement of business including its abolishment (in terms of quantitative indicators, less than 80% vis-à-vis the planned mid to long-term values (or values on prior fiscal year), or it is recognized that the competent Minister is required to make an order for improving business operation or taking other necessary measures).

The following grades are to be assigned when one is forced to raise an evaluation based on qualitative indicators such as evaluation of internal controls, and when operations performance is difficult to measure such as when meeting certain conditions is set as the target.

S:—

A: The agency reached the target level, for targets whose difficulty grade were set high.

B: The agency reached the target level(This excludes items that correspond to "A").

C: The agency couldn't reach the target level(This excludes items that corresponding to "D").

D: A fundamental review of operations is needed the agency couldn't reach the target level, and this includes when the Minister in charge finds that the Minister needs to order improvements in operations management and order other necessary actions.