

The Status of Nuclear Safety Reform Initiatives

February 13, 2024

Tokyo Electric Power Company Holdings, Inc.



Contents of this report

- On December 27, 2023, it was decided that the nuclear regulatory review category will be changed from category 4 to category 1. TEPCO is aware that this decision represents merely a starting line, and our ceaseless perseverance to continually improve, such as by improving weaknesses in our ability to take action and communicate, which were identified through additional inspections, shall carry on.
- At this meeting, we shall report on initiatives to improve our ability to take action (human resource cultivation) and communication, as well as major preparations taking place from the perspective of the "3P's"* as the Kashiwazaki-Kariwa Nuclear Power Station transitions from "renovation mode" to "operation mode," all of which is part of nuclear safety reforms.

* 3P's: People, Plant, Procedure

1. People (Collaboration/Ability)

- 1-1. Performance improvement initiatives
- 1-2. Individual operator training/assessment
- 1-3. Emergency response training implementation
- 1-4. Training at thermal power stations/PWR
- 1-5. Pair MO (dialogue-based MO for auxiliary operators)

2. Plant (Power station facilities)

- 2-1. Primary safety equipment at the Kashiwazaki-Kariwa NPS Unit 6/7
- 2-2. Pre-use operator inspections

3. Procedure (Mechanisms)

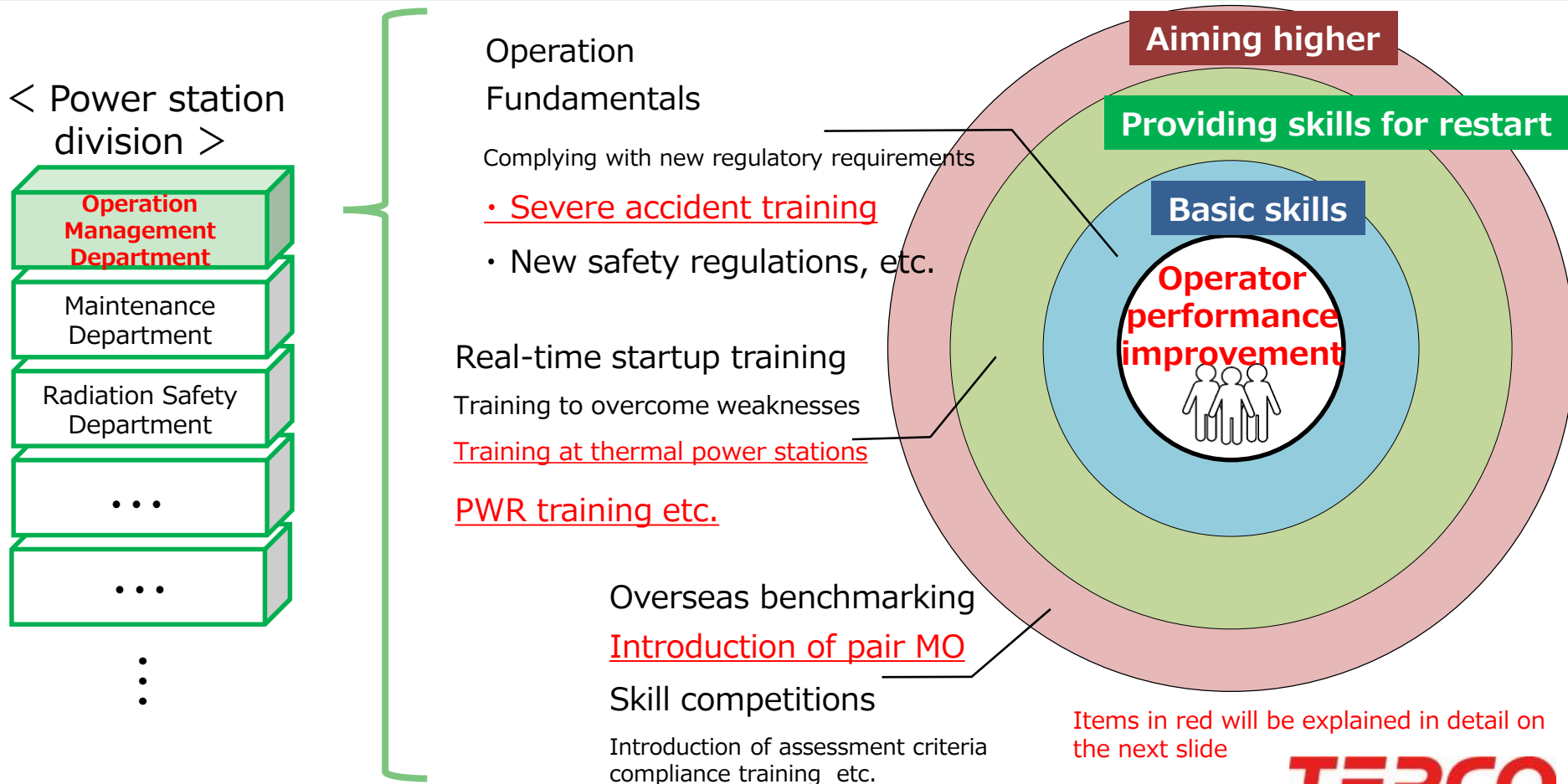
- 3-1. Developing/newly creating procedures
- 3-2. Strengthening risk management
- 3-3. Corrective action programs (CAP)

4. Ability to take action/communicate

- 4-1. Human resource training initiatives (hierarchy-based training)
- 4-2. Communication activities improvements

1-1. Performance improvement initiatives

- As we transition to "operation mode," we are engaging in initiatives to provide/manage the skills required in each field.
- We are providing various training and experience to operators that have little or no experience with actual operation due to long-term plan shutdown
- We have created organizations for improving the skill of operators, which is a key issue, and in 2020 we received a special award from JANSI for operator performance



1-2. Individual operator training/assessment

- Approximately 40% of the 243 operators at the Kashiwazaki-Kariwa Nuclear Power Station have no experience with actual operation (approximately 50% of Unit 6/7 operators) (as of January 1, 2024)
- Training provided to all shift teams (unit start up/accident response, etc.) has been assessed by internal and external parties, and it is been determined that the passing line is being maintained. Furthermore, JANSI and WANO have also confirmed the effectiveness of training itself through reviews.
- Furthermore, in response to the issues pointed out during the WANO PR (May 2021), we have strengthened training observation by Operation Management Department managers and Human Resource Training Group instructors. We have repeatedly implemented training to overcome weaknesses in order to improve skills.

Training for operators (unit start up/accident handling)

Internal assessment
(Operation Management
Department Managers)
(Human Resource Training
Group Instructors)



Operators: 243
(No experience with
actual operation: 84)
※ As of January 1, 2024



Passing line: 90 points
Example of assessment
scenario

- System upset/earthquake/intake water storage water level decrease/D/W internal leak/feed water loss, etc.

Training effectiveness assessment

Effectiveness assessment summary

- Construction of education/training effectiveness programs
- Initiatives to promote mutual observation/assessment of performance by electric companies operating BWR
(Joint training with Hokuriku Electric implemented up until FY2022)
- Training observed by JANSI
- WANO reviews

External
assessment
(BTC)
(TEPCO)

- FY2023 planned/actual
- BTC Family training (accident training): 10 times
 - PC Simulator training (startup/shutdown training): 5 times

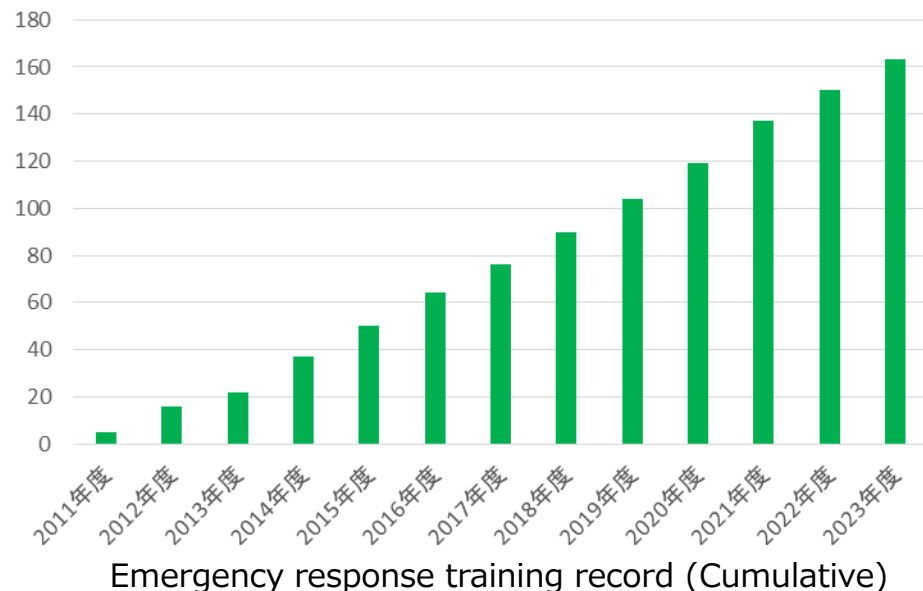
※ BTC: (BWR Operator Training Center)

1-3. Emergency response training implementation

- Since the Fukushima Daiichi Nuclear Accident we have implemented emergency response training 163 times (as of the end of December 2023), and individual training approximately 30,000 times (as of the end of September 2023).
- The Fukushima Daini Nuclear Power Station and Kashiwazaki-Kariwa Nuclear Power Station received the highest marks in all 14 categories of the Nuclear Regulatory Agency's FY2022 assessment of nuclear operator preparedness training (A Assessment ※¹). The Fukushima Daiichi Nuclear Power Station received A assessments for all categories except indicator 4※²

※1: Assessed using a three-step scale from A~C

※2: Indicator 4 (Notifying/contacting without fail)



Rubble removal training



Air-cooled turbine generator truck start up training



Cooling water injection training



Training in the Emergency Response Center

At the Kashiwazaki-Kariwa Nuclear Power Station, emergency response training is repeatedly conducted under various conditions. Some of the training was "blind training" (scenario details are not conveyed to participants prior to training) in order to cultivate the abilities to adapt and make decisions.

1-4. Training at thermal power stations / PWR

- In conjunction with long-term plant shut down the number of younger operators that have no experience with actual operation has increased and it is feared that technical prowess has declined. Therefore, we have dispatched operators to thermal power and PWR plants to gain experience in preparation for a nuclear power station startup.
- All operators from Units 6/7 that have no operating experience were dispatched to thermal power stations (as of December 2023), which has led to an improvement in motivation to restart the plant. Training at thermal power stations will continue through next fiscal year.

Thermal power plant training

- Accompanying patrol inspections
- Performing regular testing in the MCR and in the field
- Observing operations in the MCR, such as responding to plant output adjustment alarms
- Exchanging opinions with JERA operators

Period: FY2015~

Number of operators dispatched: 10

Number of dispatches: 33



PWR training

- Operational unit shifts and maintenance management
- Enabling inexperienced operators to experience working at an operational plant and gain knowledge
- Checking initiatives aimed at restart after the issuance of new regulatory requirements
- Exchange opinions with PWR operators

Period: FY2018~

Number of operators dispatched: 5

Number of dispatches: 6



1-5. Pair MO (dialogue-based MO for auxiliary operators)

- To improve the skill of field operators we started full-scale pair MO in August 2023, in order to question them about basic skills, pass along technical field knowledge, and share information on things noticed from multifaceted point of view.
- During pair MO, two people, one of which is a manager, act as observers upon determining from what point of view they are going to assess the work being observed. The pair of observers then ask questions and provide feedback about the equipment/devices being worked on by the workers being observed thereby resulting in dialogue-based MO. This contributes to identifying, weaknesses with field operators and improving the coaching skills of observers.

Number of times implemented: 48 (people)

◇ Unit 1~5: 37 times (people)

◇ Unit 6/7: 11 times (people)



※ Full-scale launch of pair MO in August 2023



Points

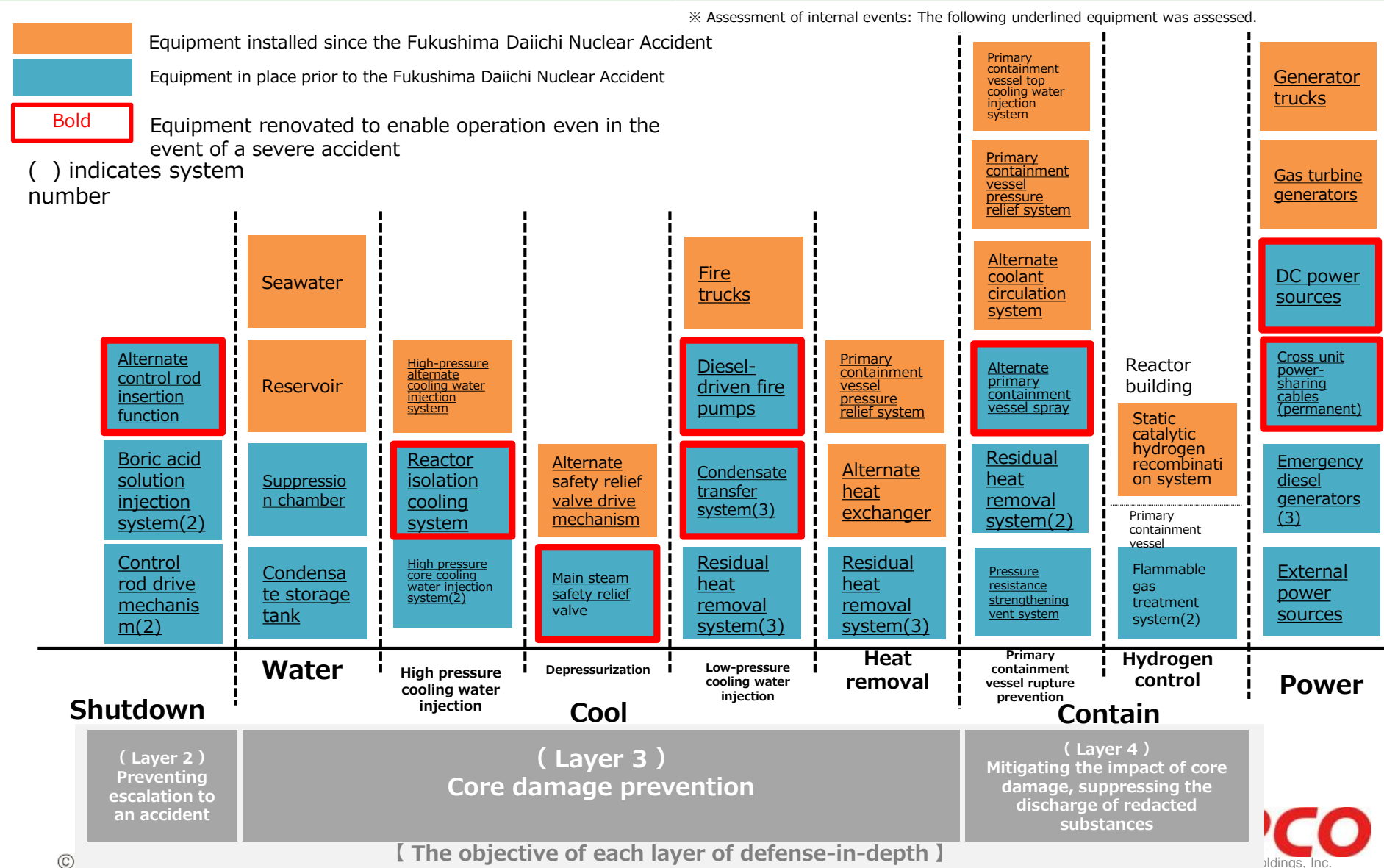
- Observers determine the point of view from which the assessment is to be performed
- Dialogue-based MO during which the workers being observed are asked questions about the equipment/devices they're working on based upon field conditions and the condition of actual equipment in the field
- Responses are followed up with or further questions are asked depending upon the number of years of experience of the workers being observed (objectives are set depending upon skill level/experience)
- Common weaknesses identified through common inquiries

(Example of basic skills) From the perspective of pair MO

- Practical use of human performance tools
- How to read instruments (the meaning of instrument markings)
- Protecting important equipment (equipment guards, scaffolding, temporarily placed items)
- Work area behavior (high-dose, high elevation, flame work, etc.)
- Status of issuing CR/ODM during patrols
- Handling dripping water/oil

2-1. Primary safety equipment at the Kashiwazaki-Kariwa Nuclear Power Station Unit 6/7

- Safety measure renovations resulting in additional/renovated equipment that have been implemented since the Fukushima Daiichi Nuclear Accident has greatly reduced the risk of core damage (reduced by approximately 1/100* compared to prior to the Fukushima Daiichi Nuclear Accident)



(Reference) Power station conditions in the wake of the Noto Peninsula earthquake

Plant

8

- We saw no impact on the external environment from radiation or damage, such as plant equipment abnormalities or liquefaction, etc., after the Noto Peninsula earthquake. The acceleration of the earthquake was actually much less than the Niigata Chuetsu Earthquake.
- Sloshing was seen at the spent fuel pools in Units 2, 3, 4, 6, 7, but internal inundation countermeasures, such as pool water leak prevention measures and the waterproofing of penetrations, etc., prevented water from leaking outside of the operating floor (controlled zone).

A comparison of the acceleration and vibration of the Noto Peninsula earthquake and the Niigata Chuetsu earthquake measured at observation points in each reactor building (lowermost floor)

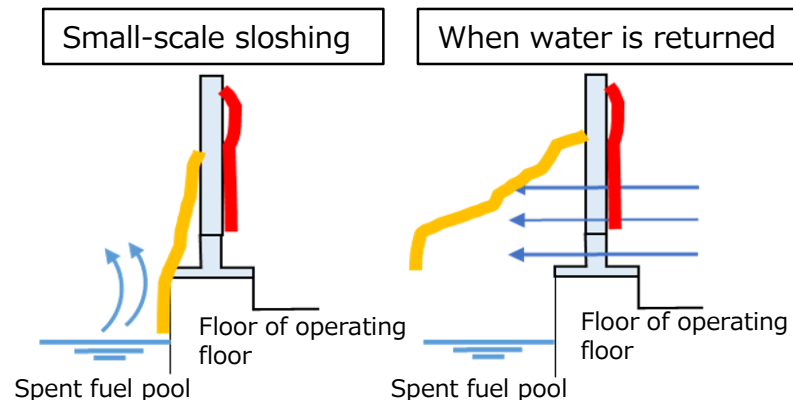
(Units: GAL)

Unit	Noto Peninsula earthquake (January 1, 2024, 4:10 PM)			Niigata Chuetsu earthquake (July 16, 2007, 10:13 AM)		
	NS	EW	UD	NS	EW	UD
1	76.3	51.1	38.0	311	680	408
2	75.2	45.4	46.7	304	606	282
3	87.1	60.5	50.9	308	384	311
4	66.7	63.7	42.2	310	492	337
5	80.9	63.7	45.1	277	442	205
6	86.4	61.9	51.8	271	322	488
7	84.2	72.3	61.8	267	356	355

- ✓ When Unit 6 Main Control Room records were carefully examined as part of plant inspections, it was found that a reactor automatic scram signal that exceeded the threshold setting (lateral 185gals) was sent from the control seismometer on the third floor of the reactor building, but since no fuel had been charged there was no impact on the plant.
- ✓ This data has been disclosed because the acceleration for the lowermost floor is the basis for the design of each building, and because it was from a location close to bedrock and not easily affected by other conditions.

Spent fuel pool water leak countermeasures

- Red line: Tarp to prevent contamination by foreign substances
- Yellow line: Flame retardant flow tarp

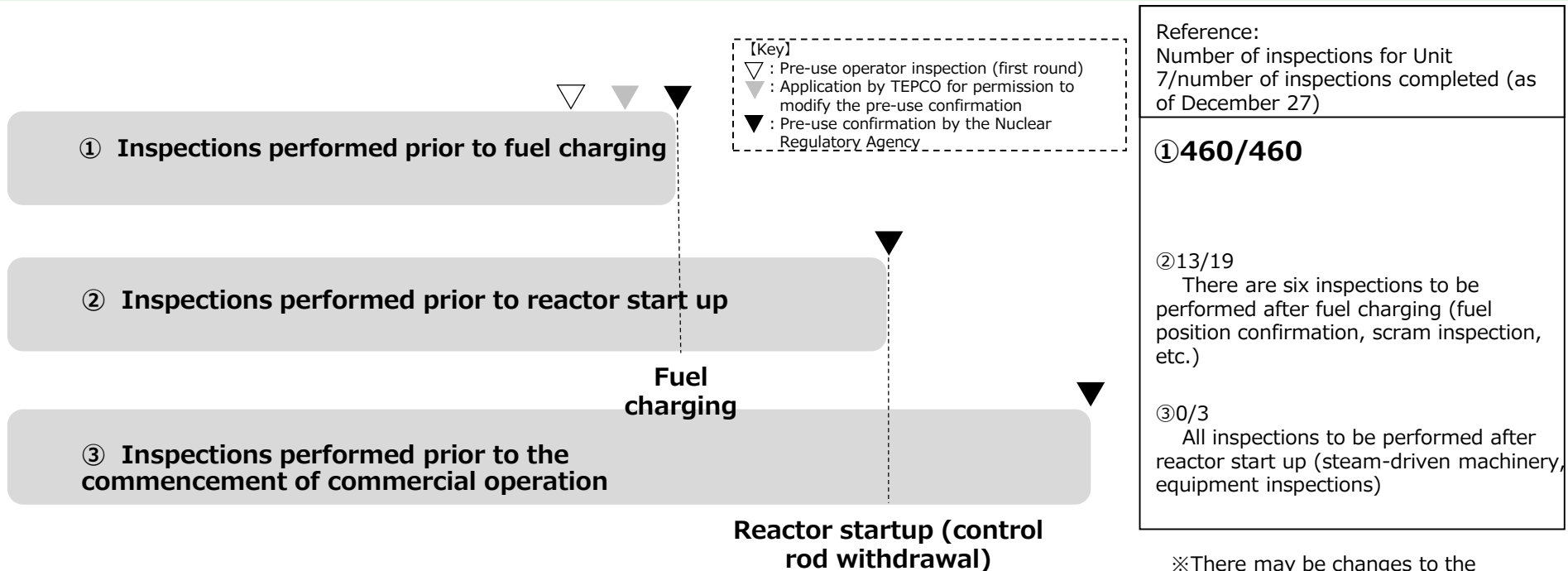


At Units 6 and 7, if a large amount of water overflows from the spent fuel pool, water is returned to the pool to cool the spent fuel.

TEPCO











2-2. Pre-use operator inspections

- Safety measure renovations have been made in compliance with the new regulatory requirements
- The first round of planned pre-use operator inspections of safety measure renovations that are to be performed prior to fuel charging has finished (referred to diagram 1 below: 460/460)
- We are currently checking to see that nothing has been overlooked during the pre-use operator inspection as we prepare to submit an application to modify the pre-use confirmation to the Nuclear Regulatory Agency
- TEPCO will deem the safety measure renovations until fuel charging to be completed after the Nuclear Regulatory Agency has completed its pre-use check, and until this time we will take corrective action for anything that is noticed.



3-1. Developing/newly creating procedures

- In order to ensure that we address all of the safety requirements made after the Fukushima Daiichi Nuclear Accident, we have developed existing accident operating procedures, and have created new procedures. Furthermore, we are also creating procedures for the equipment that was added/renovated in conjunction with safety measure renovations, and have reflected this equipment in the training simulator.
- We have also created new security manuals in order to incorporate countermeasures that were implemented in the wake of the series of physical protection-related incidents that occurred at the Kashiwazaki-Kariwa Nuclear Power Station and also strengthen cyber security regulations.

	Requirement	Reflected/created procedures
Safety	<ul style="list-style-type: none"> ● Installation permission standard rules ● Technical standard rules ● Safety regulations ● Overseas knowledge (joint research reports) ● Lessons learned from the Fukushima Daiichi Nuclear Accident ● OSART※ indications <p>※ The Operational Safety Review Team is organized by the IAEA and comprised of international experts.</p>	<p>Key</p> <p> : Newly created</p> <p> : Existing</p> <ul style="list-style-type: none"> ● Operating procedures used during an accident <div>    </div> <div></div> ● Individual operating procedures for each piece of equipment <div></div>
Security	<ul style="list-style-type: none"> ● Physical protection rules ※ ● Suggestions from expert assessment committee <p>※ Fundamental Law Commercial Reactor Rule clause 91.2 includes INFCIRC225/Rev5</p>	<div></div> <div></div> <div></div>

AOP : Accident Operating Procedure ; event-based

EOP : Emergency Operating Procedure ; symptom-based

SOP : Severe Accident Operating Procedure ; severe accident

For each piece of AM equipment : Accident Management

Obtained information

On April 21, 2020, the Cabinet Office’s Investigative Commission for Models of Large Earthquakes originating in the Japan Trench/Kuril Trench released its tsunami simulation results for two wave source models; a Japan Trench (Sanriku/Off coast of Hidaka) model (Mw9.1), and a Kuril Trench (Tokachi/Off coast of Nemuro) model (Mw9.3). The aforementioned simulation was based on different conditions than those used by TEPCO.

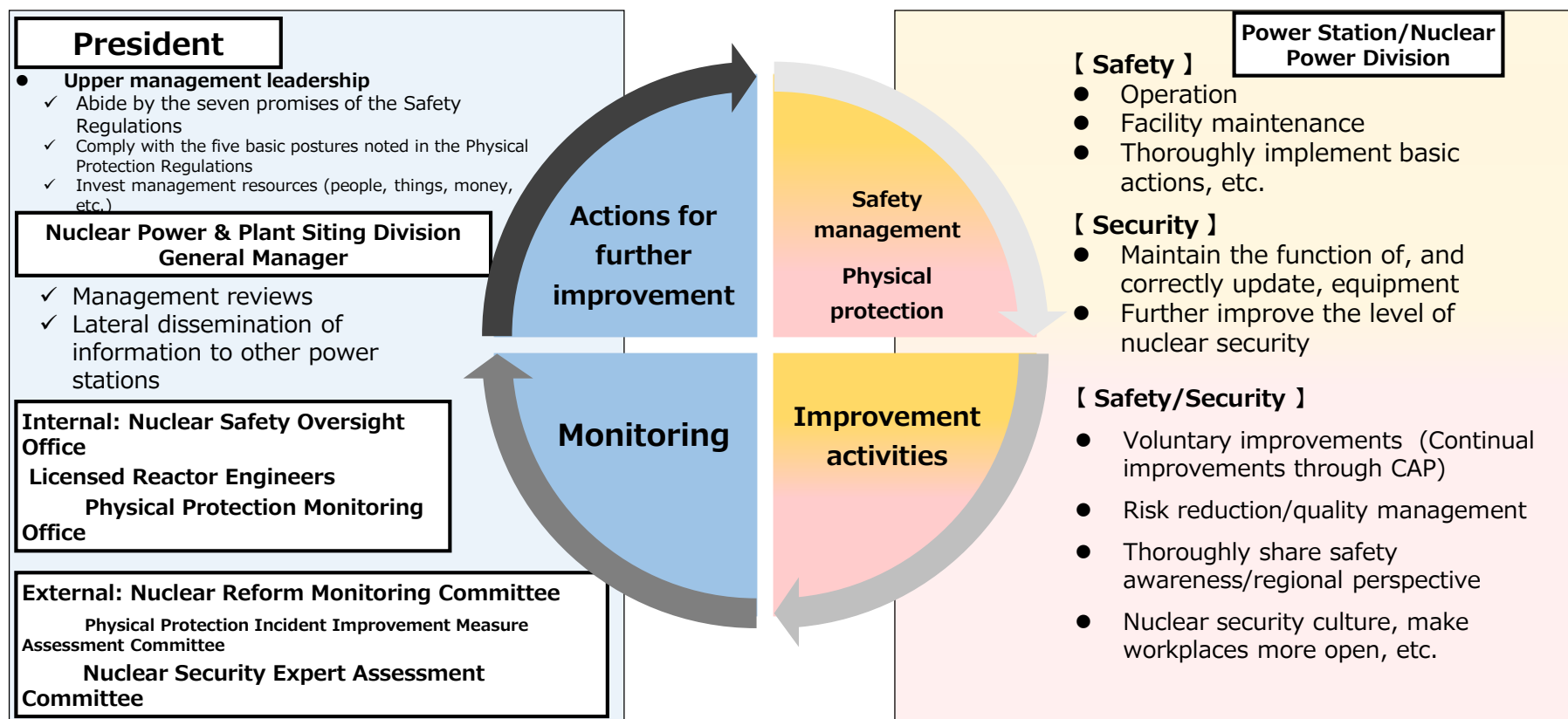
	Response
①Gathering risk information	[2020.4.21] Aforementioned information obtained. The results of the Cabinet Office’s investigation indicated that the tsunami may exceed the height of the seawall that is currently being built based on TEPCO’s investigation.
②Quickly report risk information	[2020.4.22, 27]The Chief Decommissioning Officer (CTO) <u>reports this to the president.</u> <u>Presidents instructions: Deliberate methods for preventing the leakage of contaminated substances</u>
③Implement risk mitigation measures	The following was implemented in accordance with the President's instructions •Materials/equipment ⇒[2020.4.28]It was determined that additional equipment is necessary. Additional material/equipment were put in place during FY2020. •Training ⇒[2020.4.28] It was decided that additional training is required. Additional training was commenced in FY2020 and is ongoing.
④Implementation of additional measures	<div><div><ul style="list-style-type: none">• A tsunami simulation was implemented after obtaining the Cabinet Office’s wave source model. ⇒Completed during the first half of FY2020• As an additional measure we began construction of a Japan trench tsunami seawall in FY2021. The seawall should be completed in March 2024.</div><div><div><p>Seawall (2023.10.03)</p><p>Seawall</p><p>Slope reinforcement</p><p>2.5m T.P.</p></div><div><p>Built at 2.5m T.P (2023.10.03)</p><p>Seawall</p><p>Slope reinforcement</p><p>Access road</p><p>2.5m T.P.</p></div></div></div>

※ We continue to gather data pertaining to the Noto Peninsula earthquake from various research agencies and shall reflect such knowledge in plant design if necessary



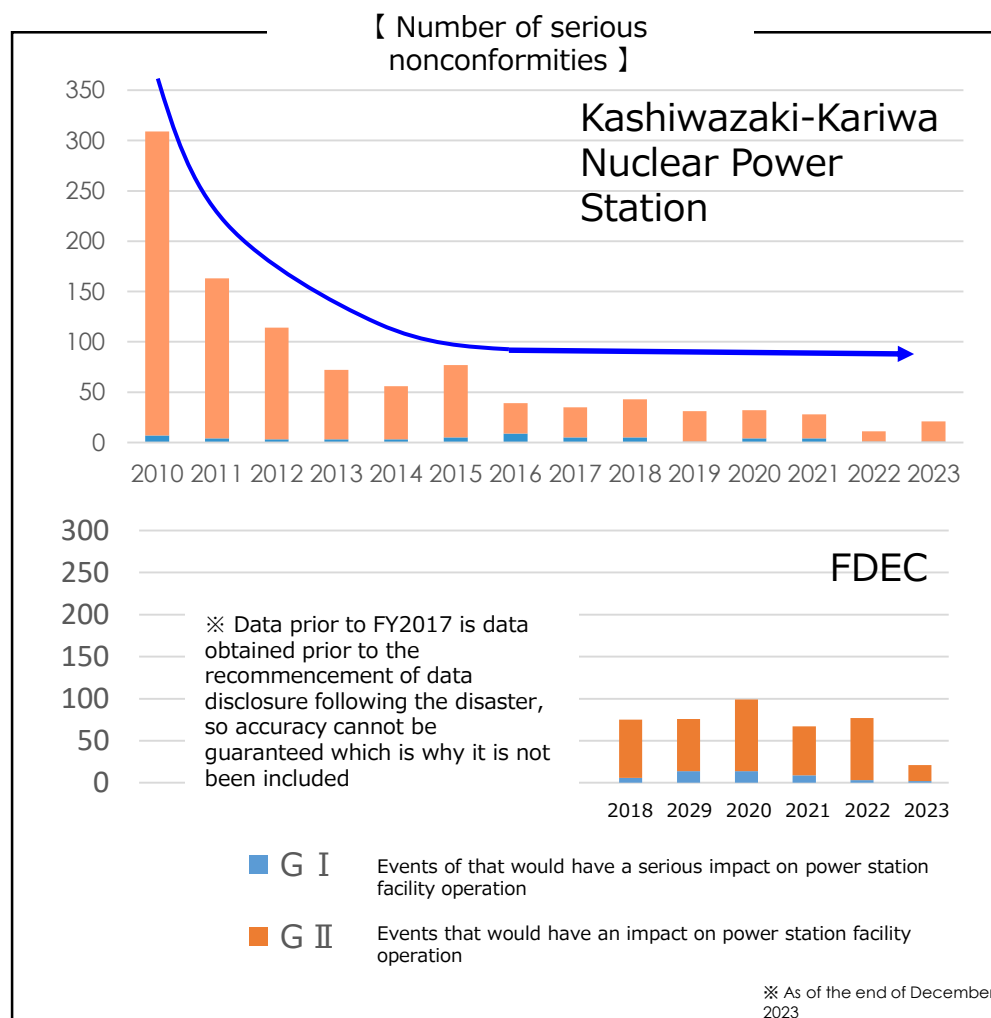
3-3. Corrective action programs (CAP) ~Initiative Overview~

- Through corrective measures implemented in the wake of physical protection incidents we are constructing mechanisms for autonomous and continual improvement. In order to help safety awareness permeate through the entire power station we are laterally disseminating these measures to safety-related departments and reflecting them in the “basic posture of a nuclear operator” as noted in the Safety Regulations.
- After verifying performance at the Kashiwazaki-Kariwa Nuclear Power Station safety and security initiatives shall be laterally disseminated to the Fukushima Daiichi Nuclear Power Station and the Fukushima Daini Nuclear Power Station.



3-3. Corrective action programs (CAP) ~Performance improvements

- The number of serious nonconformities has steadily decreased thanks to nonconformity reduction initiatives
- Going forward, we will not just focus on the nonconformity itself, but also shift to activities aimed at preventing nonconformities that utilize improvement information, such as things noticed in the field. And, we will strive to further reduce nonconformities by promoting the use of information gained through the opinions of contractors (field workers)



● Utilizing improvement information

- Noting improvement information related to issues other than nonconformities is encouraged as we strengthen initiatives to reduce the risk of nonconformities
- Utilizing RPA (Robotic Process Automation) to create an environment in which it is easier to issue condition reports

● Utilizing the opinions of contractors (field workers)

- We are shifting to initiatives that focus on carefully listening to the opinions of contractors (utilizing RPA, etc.)
- The security department has also started directly issuing condition reports for things noticed by contractors

Going forward we will...

Aim to root these mechanisms※2 so that security department improvement initiatives do not fall by the wayside

- ※2
- ①Construction of physical protection-related monitoring systems
 - ②Documentation of monitoring duties
 - ③Identify issues through behavior observation
 - ④Organization culture assessment by monitoring departments

- It is necessary to improve the organization's ability to steadily execute plans by ensuring that all personnel that work at the power station are formulating such plans upon understanding the objective of their duties and ascertaining field conditions (weakness)
- We will cultivate frontline leaders, who serve as the core of this body of personnel, while also providing effective career paths and creating role models.
- Firstly, we are providing management improvement training for each hierarchy (executives, managers, project managers)
 - ✓ While providing support to upper managers we will create leaders through the execution of field duties (improving the ability to execute duties in the field)
 - ✓ We are also improving mechanisms to create successor training plans in order to continually improve the ability to take action.

<Hierarchy-based management improvement training>



4-2. Communication activities improvements (Conveying information within the power station)

- The Physical Protection Improvement Measure Assessment Committee (December 2023) pointed out issues about conveying information internally and to external parties, such as having upper management and power station upper management convey a singular message through multiple voices so that everyone that works at the power station shares common awareness, and also conveying information that stakeholders want to receive.
- As part of our "one message, multiple voices" initiative, we're not just giving instructions on what to do, but rather strengthening initiatives that seek to get each and every employee and contract worker to understand the objective of the initiative, and have it spread throughout the organization (explanatory briefings given to all station personnel, and participation by managers in the morning meetings of contractors)

< Monthly participation by managers in the morning meetings of contractors (47 companies) >



< Topics covered during the morning meetings of contractors >

自分と同僚の身の安全を守りましょう、そのための“ルール”です

- ✓ 放射線・放射能のリスクから皆さまの身を守るため、法令で**個人線量計の着用、防護指示書で示された装備の着用**などが義務づけられています
- ✓ これは原子力発電所における**基本的なルール**です

----- 放射線防護・放射線管理に関する重大な不適合が発生しました -----

KK
(柏崎刈羽)

管理区域内での個人線量計の取外し

せまい場所での作業中、体勢を変えると作業服の胸ポケットから個人線量計が何回も落ちてしまった。
破損をおそれ、**個人線量計を取り外してしまった**

- 管理区域では、個人線量計（ガラスバッジ等やAPD）を外さないで下さい
- 難しいとき困ったときは**いったん立ち止まり**、放射線管理員や周りの人に**相談しましょう**

1F
(福島第一)

増設ALPS※配管洗浄作業における身体汚染

増設ALPS配管を洗浄していたところ、廃液タンク内の仮設ホースが外れ、洗浄廃液が飛び散った。廃液がかかった作業員二人は、**アノラックを着用していなかった**

- 防護指示書で、事前に指示された装備を着用しましょう
- 作業手順や内容に変化があったときは**いったん立ち止まり**、上長や周りの人に**相談しましょう**

※ ALPS（多核種除去設備）：汚染水に含まれる放射性物質を取り除く設備

4-2. Improving communication activities (Engaging with the regional community)

- Newsletters and SNS, etc., are being used to convey information on the power station to regional residents. In order to address the issues that regional residents want to know about, we are providing information on examples of improvements that have been made in response to questions/opinions from the local community.
- Instead of just conveying information, we are increasing opportunities to engage in two-way communication, such as by holding briefings for residents of the Prefecture and setting up communication booths, etc.
- Going forward, we will increase opportunities for each and every employee to engage with the community so they can convey their feelings about working at the power station, and also further develop public relations activities based upon the opinions and requests from regional residents.

[Addressing the issues that regional residents want to know about]

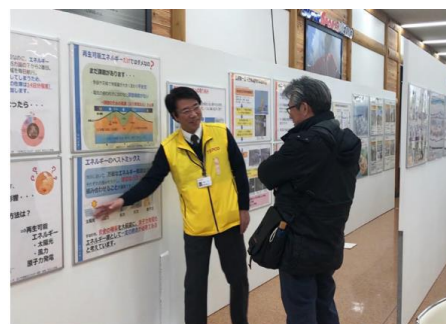
皆さまの声から改善しました

発電所では、地域の皆さまからいただいた声を受けて、より良い発電所の運営を行うための改善活動を行っています。その一例をご紹介します。

発電所の通勤バスが交差点付近で停車することで、渋滞したり右折の際に対向車が見えにくかったり困ったことがある。道幅の狭いところでは危ない思いも何度かしているため、停留場所を検討してほしい。

改善 通勤バスの乗降箇所について、地域の皆さまにはご迷惑をおかけしました。今回ご指摘いただいた箇所の現地確認を行い、社内でも検討の上、停車位置の調整を行いました。なお、当社の通勤バスは、可能な限り地域の皆さまにご迷惑をお掛けしないよう交差点付近を避けて設定したり、路線バスのバス停を利用させていただいたりしています。地域の皆さまにおかれましては、引き続きご理解とご協力をお願いします。

今後も皆さまからのご意見を発電所運営に活かしてまいります



Communication booths



Dialogue with regional residents



Briefings for prefectural residents

Improvements made based upon the questions/opinions received from the community (newsletter)

Our resolution

"Keep the Fukushima Nuclear Accident firmly in mind; we should be safer today than we were yesterday, and safer tomorrow than today; we call for nuclear power plant operators that keep creating unparalleled safety."

Reference documents

Results of gathering and analyzing risk information

The strengthening of risk management, which is a nuclear reform plan initiative, is also positioned as part of "TEPCO's basic stance as a nuclear operator" in the safety regulations, and we have commenced risk management based upon the constructed mechanisms. The following are examples of achievements.

(1) What information is gathered?

Examples of information that is gathered are reports from government agencies, operating experience information, academic papers/reports, published articles, such as from academic journals, and information from overseas.

(2) How is this information organized?

Knowledge from information sources is gathered, and risk information that may exceed the envisioned design/development limitations of nuclear facilities is identified as "serious risk information" that is of particular significance.

(3) Results

After gathering and identifying information in accordance with (1) and (2) above, we have found no (zero) serious risks to report at this time.

The attachment provides more information on the following:

- Definitive examples of serious risk informations and information sources from which information is gathered
- Overview of method by which information is organized

Furthermore, information on risks that are not deemed serious, but can contribute to improving the safety of nuclear facilities is reflected as needed in the design and operation of such facilities in an effort to continuously make improvements.

Information sources from which information is gathered

Type of information gathered	Source (Approximately 280. The following are examples)
Safety-related research	<ul style="list-style-type: none"> •TEPCO research •Joint research by electric companies •Japan Atomic Energy Agency (JAEA) •U.S. Electric Power Research Institute (EPRI)
Operating experience information	<ul style="list-style-type: none"> •Nuclear Information Archives (NUCIA) •The Federation of Electric Power Companies of Japan •World Association of Nuclear Operators (WANO) •U.S. Institute of Nuclear Power Operations (INPO)
Information needed to conduct probabilistic risk assessments	<ul style="list-style-type: none"> •Joint research by electric companies •Central Research Institute of Electric Power Industry reports •NRRC Technical Advisory Committee (TAC) comments •U.S. Nuclear Regulatory Commission (NRC) report
Information on domestic and overseas standards	<ul style="list-style-type: none"> •Japan Electric Association standards •Japan Society of Mechanical Engineers standards •International Atomic Energy Agency (IAEA) standards •U.S. American Nuclear Society (ANS) standards
Information from international agencies and domestic/overseas academic societies	<ul style="list-style-type: none"> •Atomic Energy Society of Japan •Japan Society of Mechanical Engineers •U.S. American Nuclear Society (ANS) •U.S. American Society of Mechanical Engineers (ASME)
Information from international agencies and domestic/overseas academic societies (natural phenomena)	<ul style="list-style-type: none"> •Headquarters for Earthquake Research Promotion •Geospatial Information Authority of Japan •Volcanological Society of Japan •Japan Meteorological Agency

Summary of method for organizing information

