Document 1

# The Status of Nuclear Safety Reform Initiatives

## Initiatives for continual improvement

January 26, 2021

Tokyo Electric Power Company Holdings, Inc.

# Report contents



- At the previous NRMC meeting, the Committee commented that even though there are still issues to address, "stricter self-assessments are being implemented and large steps have been taken to strengthen the company and governance."
- This report will provide an update on the status of initiatives for continual improvement in light of achievements to date and our handling of key issues

## Primary recommendations made during the previous NRMC meeting (2020.2.4)

- Stricter self-assessments are being implemented and large steps have been taken to strengthen the company and governance. We would like to see internal oversight departments continue to oversee these issues under the leadership of management.
- We would like to see IT technology, etc., further employed to reduce increasing workloads and prevent errors.
- We would like to see the opinions of third-parties incorporated so as to prevent corporate communications activities from becoming self-centered.

## Report contents

1. Initiatives to date
2. Initiatives for continual improvement

# 1. Initiatives to date

# Overview of our initiatives to date



- In March 2013, we announced our "**Overview of the Fukushima Nuclear Accident and the Nuclear Safety Reform Plan**"
- We have swept away the pride and overconfidence in safety that we had prior to the accident, and implemented multiple countermeasures to address the underlying causes of our "lack of **safety awareness, technological capability, and the ability to promote dialogue**."
- In response to the **expectations and key issues** presented by the NRMC, we have engaged in initiatives to become an organization that **can identify weaknesses and make corrections independently by making continuous improvements through self assessments**.

**Reform plan implementation** ▶ **Self-assessments** ▶ **Continuous improvements (Management Model)**

## Root causes

We were not prepared for the accident because we were convinced that safety had already been achieved

Enhance governance and develop the world's highest levels of technological capability and management skill
⇒ **Management Model (2017)**

## Expectations

- Measure② Strengthen oversight and support for management
- Measure① Management-lead reforms
- Measure③ Strengthen the ability to propose defense-in-depth measures
  - Safety awareness
  - Ability to promote dialogue
  - Technological capability
- Measure④ Develop risk communication activities
- Measure⑤ Strengthen emergency response capabilities
- Measure⑥ Train human resources that can improve nuclear safety

| | |
|---|---|
| 1 | Prioritize safety |
| 2 | Strengthen governance |
| 3 | Continuous risk management |
| 4 | Learning attitude |
| 5 | Technological capability |
| 6 | Emergency response capability |
| 7 | Build trust |
| 8 | Reduce exposure doses |

## Key issues

Continuous improvement through self assessments
⇒ **Strengthen performance monitoring**

| | |
|---|---|
| 1 | Strengthen governance |
| 2 | Improve human resource training |
| 3 | Improve communication |
| 4 | Cultivate nuclear safety culture |
| 5 | Strengthen internal oversight functions |

| | |
|---|---|
| 1 | **Self-assessments** |
| 2-1 | **Improving safety/quality** |
| 2-2 | **Improve the quality of communication** |

Preventing troubles and accurate communication

**Sep. 2012~** **Mar 2013** **2016** **2018** **2020**

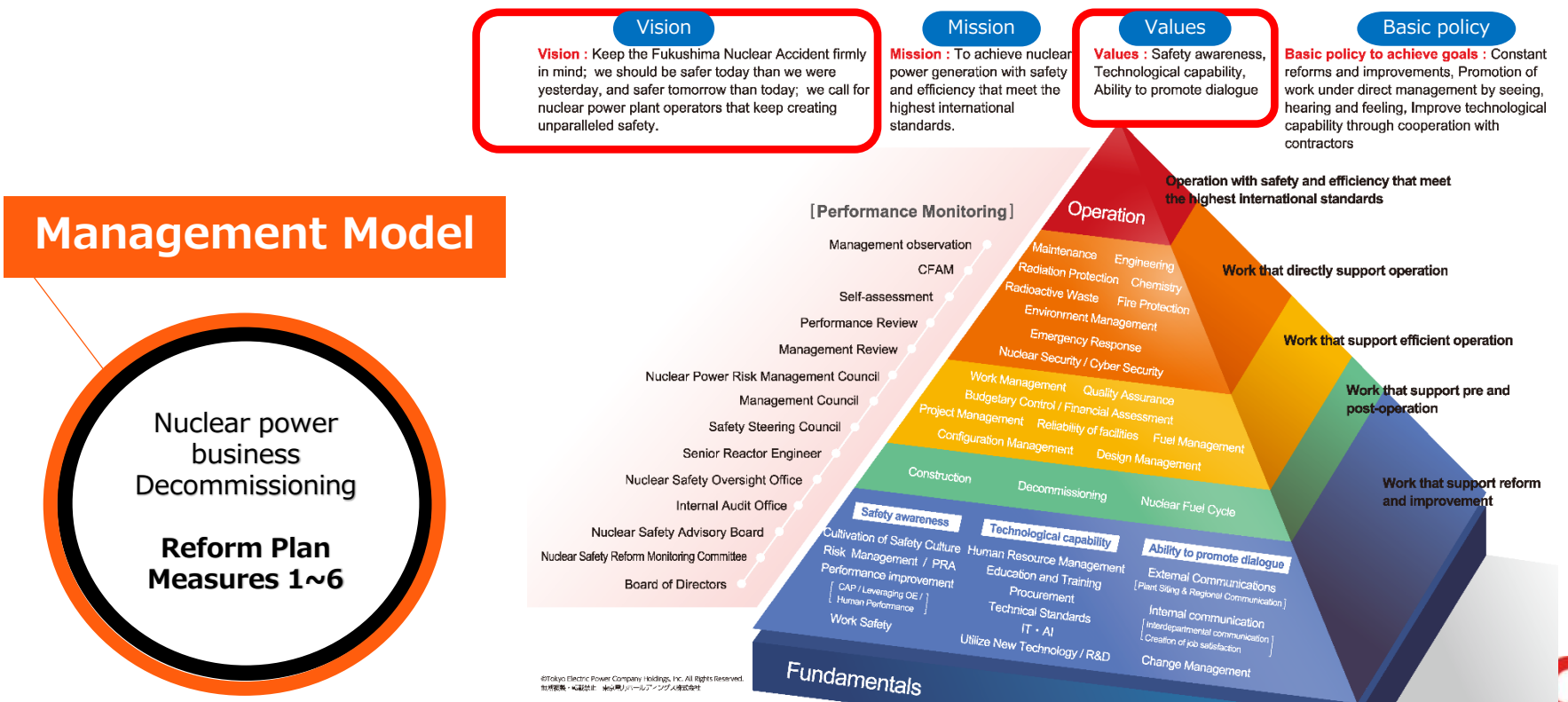
# Work mechanisms for improving nuclear safety ~Management Model~



■ In 2017 we created the Management Model to carry on the regrets and lessons learned from the Fukushima Nuclear Accident put forth in the **Nuclear Safety Reform Plan**

What is the Management Model?

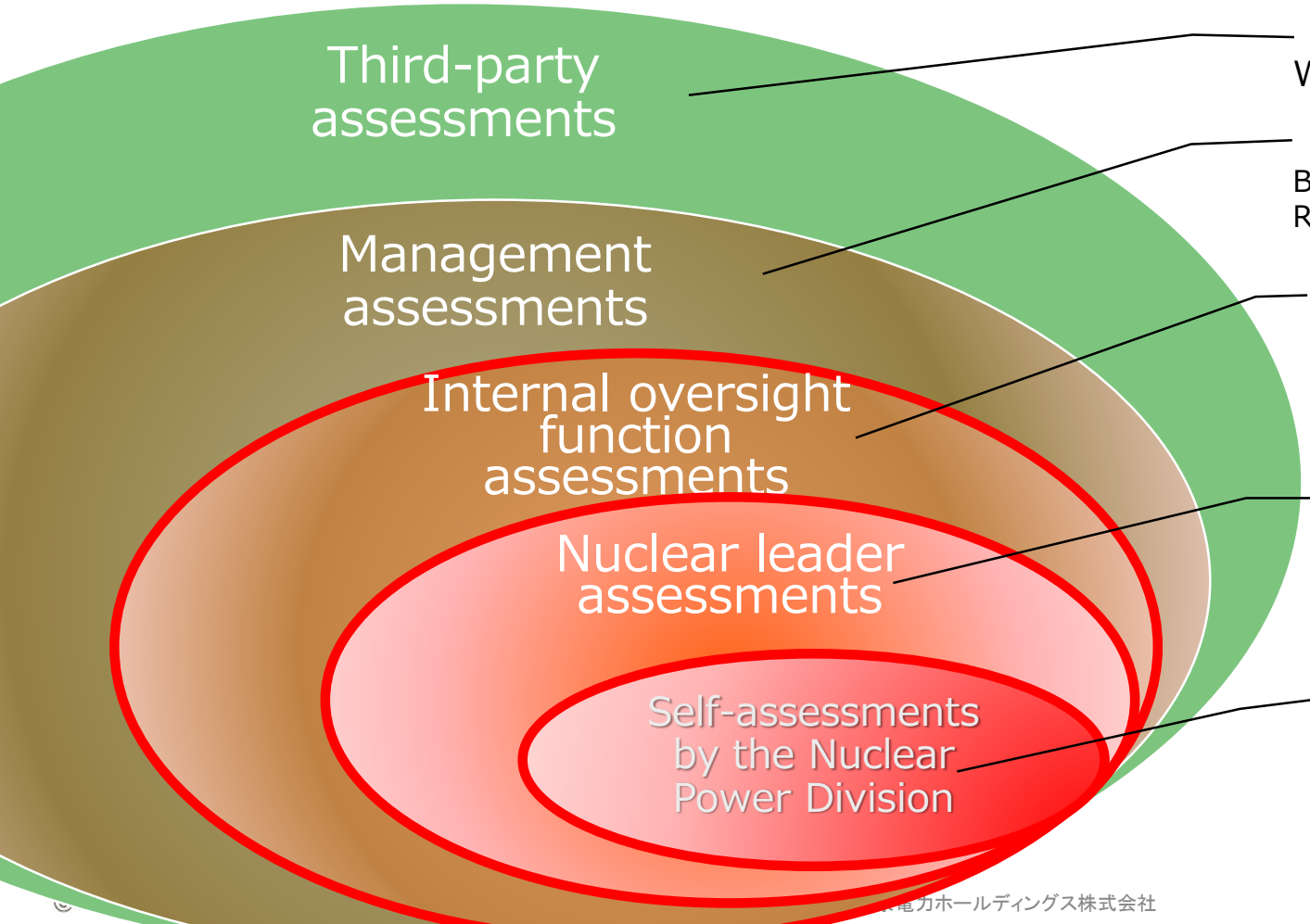
- Document that stipulates "methods for engaging work" in order to achieve the world's highest levels of safety and work quality
- Clearly presents the ideal state of work processes for achieving safe and efficient nuclear power station operation
- Provides road signs for understanding the true nature of our work and continually implementing kaizen



# Mechanism for achieving continuous improvements
## -Performance Monitoring-



- Weaknesses are identified and improvements made independently by strictly assessing one's own department in the **first and second layers of the process (self-assessments and assessments by nuclear leaders, respectively)**
- Strengthening the organization to **enable weaknesses to be corrected before they are pointed out by third-parties** while leveraging the results of monitoring by **internal oversight departments** shown in layer 3




【Layer 5】
WANO, JANSI, IAEA, etc.

【Layer 4】
Board of Directors (Nuclear Reform Monitoring Committee)

【Layer 3】
NSOO, NSAB, Nuclear Safety Oversight Office

【Layer 2】
Management reviews, performance reviews, etc.

【Layer 1】
MO, CFAM gap analysis, self-assessments, etc.

# 2. Initiatives for continuous improvement

- Improving safety awareness
- Improving technological capability
- Improving the ability to promote dialogue

# Improving safety awareness

(1) Strengthening risk management
⇒ Deliberate countermeasures for events while they are still undetermined/uncertain

(2) Strengthen self-assessments

(3) Strengthen internal oversight functions
⇒ Analyze gaps with excellence and make corrections

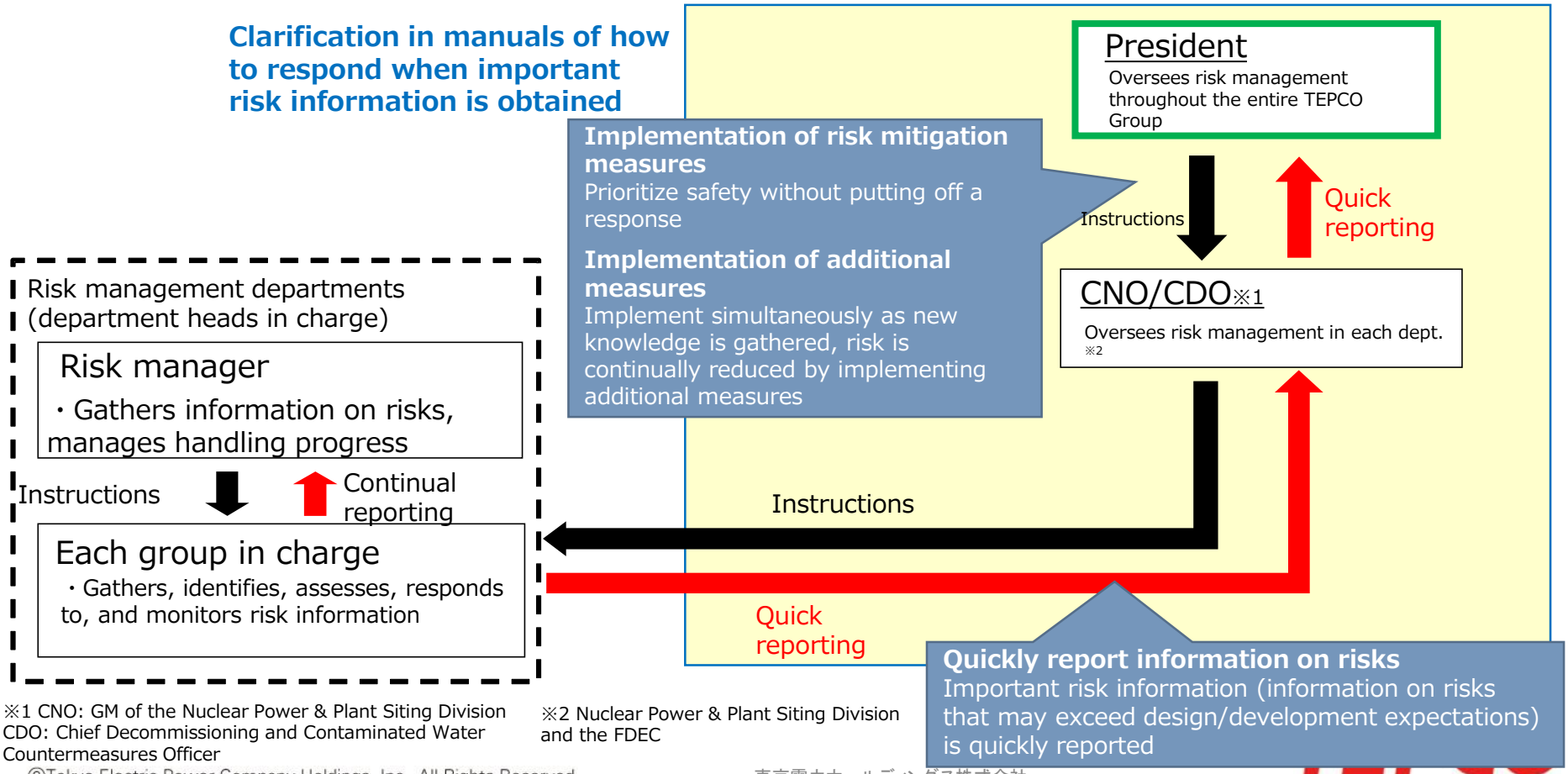
■Ideal state (from the Management Model)

We have the responsibility to protect people and the environment from the harmful effects of radiation. In order to protect the health and lives of ourselves, our colleagues, and the people of the community, **each and every one of us must be aware of the risks unique to nuclear power, continually question whether or not the current conditions/activities are suitable without overconfidence, pay meticulous attention to anything that could threaten safety**, and thoroughly ensure that safety is prioritized above anything else.

# （1） Strengthening risk management



- Quickly report information on important risks to the President, prioritize safety and decide on risk mitigation measures and additional measures to prevent nuclear safety from being compromised due to cost or construction schedules
- Example: Mitigation/additional measures implemented at Fukushima Daiichi/Daini in response to the tsunami assessment by the Cabinet Office's "Committee for Examining Models of Large Earthquakes generated in the Japan Trench/Kuril–Kamchatka Trench"




※1 CNO: GM of the Nuclear Power & Plant Siting Division
CDO: Chief Decommissioning and Contaminated Water Countermeasures Officer

※2 Nuclear Power & Plant Siting Division and the FDEC

# "Investigating/examining unconfirmed/unsolved issues" and reflecting them in safety measures

- Issues that remained unsolved at the time the Nuclear Safety Reform Plan was announced will continue to be examined, and the **knowledge gained from those investigations disclosed and reflected in safety measures at Kashiwazaki-Kariwa.**
- We shall strengthen mechanisms for **leveraging the new knowledge** gained by ascertaining the causes of the Fukushima Nuclear Accident, and reflect it in power station safety measures (pertaining to equipment and training).

## TEPCO HD

**Investigate and examine unconfirmed/unresolved issues**
(2013~present)

- Five progress reports have been given to date
- In conjunction with the progress of decommissioning at 1F, the results of accident analysis related to plant behavior during the accident and field investigations will be inputted into deliberations about safety measures.

Main issues being deliberated:
Power loss caused by the tsunami, loss of RCIC reactor cooling water injection function, RCW system pipe damage caused by the core meltdown accident, flooding of the reactor building during venting

## NRA

**Accident analysis review**※
Review of Accident Analysis Pertaining to the TEPCO Fukushima Daiichi Nuclear Power Station
(1st term: 2013~2104, 2nd term: 2019~present)

- During the first term opinions were compiled in regards to issues deemed to be unresolved in the Japanese Diet's Accident Investigation Report.
- During the second term, the investigation was analyzed using records from field investigations and records from the accident in light of field environment improvements, and a midterm report (draft) was released (December 2020).

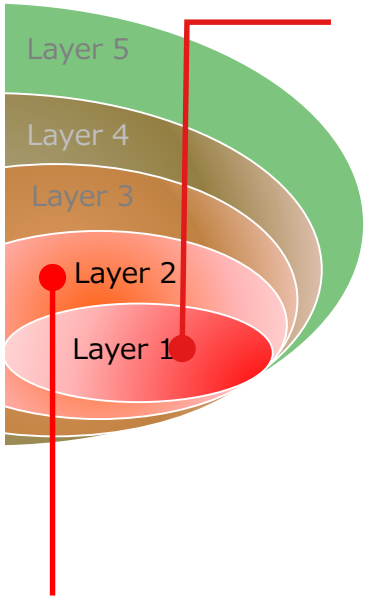
**Knowledge gained to date that will reflected in KK safety measures**

Countermeasure examples
- ✓ Waterproofing measures, flooding countermeasures
- ✓ Augmentation of DC storage batteries, creation of black start procedures
- ✓ Installation of corium shields
- ✓ Installation of redundant isolation valves

**Strengthening review bodies**
Establishment of committee for sharing information related to the field investigation/analysis of the 1F accident※
※Comprised of representatives from each related department In the FDEC and Plant Siting Division
Party in chare: FDEC Vice-President, Plant Siting Division HQ GM

# (2) Strengthening assessments by nuclear leaders and self-assessments

- Observe and report on the behavior of individuals and conditions in the field independently (promote the creation of condition reports and improve management observation skills)
- Implement activities to identify gaps with excellence, identify weaknesses and make corrections in order to perform strict assessments of ourselves as an organization (FSA, CFAM gap analysis)
- Continue to have nuclear leaders from Headquarters participate in power station performance review meetings. And, discuss important issues in a timely manner at management.




**Self-assessments (Layer 1)**

- Increase in condition reports (year-on-year comparison of quarterly quantity)

  ⇒1F 10→500,2F 300→600,KK 800→800

- Rooting management observation amongst managers

  ⇒3/4 times/week at all sites, issues pointed out around 60~70% of the time

- Implementation of self-assessments for each field

  ⇒Reflect results of FSA and CSAM gap analysis in the business plans for the following year while implementing Kaizen

FSA field observation
(Fukushima Daiichi)

Management meetings (leader discussions)

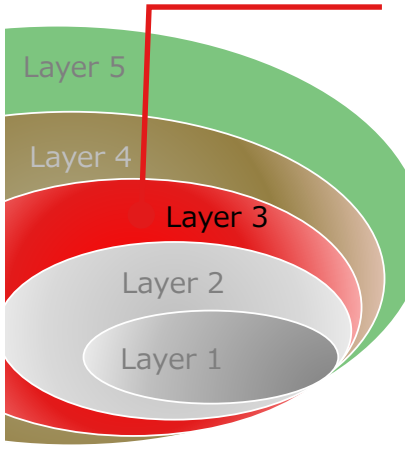
**Assessments by nuclear leaders (Layer 2)**

- Discussed how to handle issues that need to be addressed in light of the internal/external environment

# (3) Strengthening internal oversight functions (recommendations from the NSOO)



- The NSOO has been established to enable engineers with expert knowledge about each functional area (including licensed reactor engineers residing at the power station) to provide oversight of the Nuclear Power Division from an independent standpoint.
- In response to NSOO recommendations, the Nuclear Power Division shall implement corrective measures and the NSOO shall follow up with those measures (To date, 185 out of 197 recommendations have been completed.)




**Assessments by internal oversight functions (layer 3) <Recent NSOO recommendations>**

- **Solving latent issues related to operator performance (Kashiwazaki-Kariwa: FY2019)**

✓ During simulator training it was observed that shift supervisors lacked the ability to teach and that commanders were not complying with procedures.

✓ Based on recommendations common to US industry, latent issues related to operator performance shall be ascertained and structural improvements made.

⇒Benchmarking data is being leveraged to implement kaizen for simulator training and skill management

- **Weaknesses with change management pertaining to department reorganization (Fukushima Daiichi: FY2019)**

✓ Measures to prevent secondary risks (errors made due to interface changes) from manifesting and maintain cord department functions during planned large-scale Department reorganizations are lacking. Change management should be sufficiently executed.

⇒After Department reorganizations, efficacy assessments shall be continually implemented in order to prevent nonconformity recurrence and enhance risk management in order to improve safety/quality and project management.

- **Weaknesses with managing requirements for newly equipment design**

**(Fukushima Daiichi: FY2020)**

✓ Standardize the process for managing requirements during which the expectations of stakeholders are converted from technical requirements to equipment specifications during the design of new equipment.

- **Enhancing decisions about when self-assessments have been completed**

**(Kashiwazaki-Kariwa/Fukushima Daini: FY2020)**

✓ In light of the importance of issues identified during focused self-assessments, the process for determining completion shall involve ensuring that improvements have been made by confirming that all corrective actions have been completed

# Improving technological capability



（4）Equipment safety measures

⇒Voluntarily implement equipment countermeasures that exceed regulatory requirements

（5）Enhance emergency response capabilities

⇒Enable TEPCO employees to respond in-house to emergencies

（6）Insource technological capability

（7）Improve safety and quality

⇒Implement reforms and improvements on our own by thoroughly focusing on field conditions, the conditions of equipment in the field, and reality.

■Our ideal state (from the Management Model)

**As the nuclear operator that was witness to the Fukushima Nuclear Accident, we will focus on field conditions, the conditions of equipment in the field,** and reality in order to cultivate the ability to accurately analyze and assess latent risks and issues, the ability to propose, and quickly execute, measures to resolve such issues, **and the ability to continually implement reforms and improvements through creative innovation and flexible thinking** that leverages IT and other cutting-edge technologies.

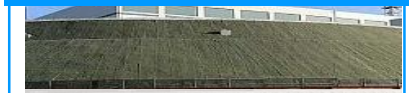
# (4) Equipment safety measures



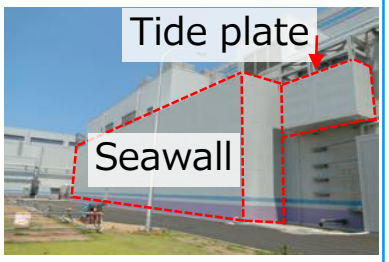
- The lessons from the Fukushima Nuclear Accident shall be reflected in safety measures, **such as tsunami countermeasures, the strengthening of power sources, the strengthening of cooling functions, and measures to prevent the dispersion of radioactive substances, etc.**
- **We will continue to voluntarily pursue safety and not become satisfied just because we have complied with regulatory requirements**

〈Safety Measures at the Kashiwazaki-Kariwa Nuclear Power Station (primary equipment)

## Tsunami countermeasures/power source enhancements



Seawall (unit 5~7 side)

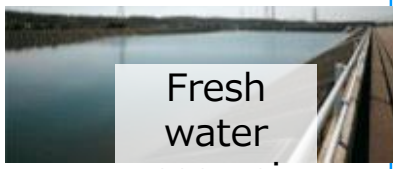



Gas turbine generators/power supply trucks

**【Seawall】**
- 15m high in order to provide protection against a predicted tsunami height of 8.3m

## Strengthening cooling functions

Fire trucks



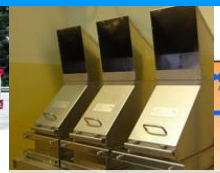
Fresh water reservoir

High-pressure substitute cooling water injection system equipment

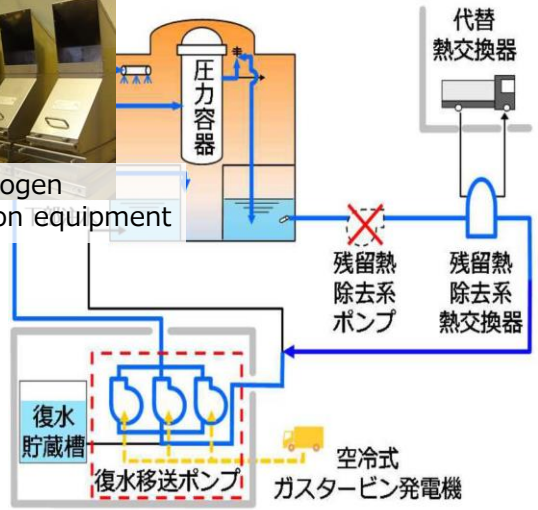
**【High-pressure substitute cooling water injection system equipment】**
- Design started prior to issuance of new regulatory requirements

## Preventing the dispersion of radioactive substances

Large volume water cannons



Hydrogen recombination equipment




Filter vent equipment

Substitute circulation cooling system

**【Filter vent equipment】**
- Developed in-house

**【Substitute circulation cooling system】**
- In-house proposal for new heat removal system
- **Newly regulated in light of new knowledge**

# (5) Strengthening emergency response capabilities (example: Kashiwazaki-Kariwa Nuclear Power Station)



- In light of the lessons learned from the Fukushima Nuclear Accident, we have introduced ICS, and are enabling departments to be more flexible so as to be able to respond to unforeseen events.
- The field skills of employees are being strengthened to enable them to engage in emergency repairs under the assumption that external support will not be received for seven days in the event of an accident.
- Due to the Covid-19 pandemic, training is being implemented while implementing thorough measures to prevent the spread of the disease, such as wearing face shields, etc.

Removing debris using wheel loaders

Injecting cooling water using fire trucks

Training on connecting cables to power supply trucks

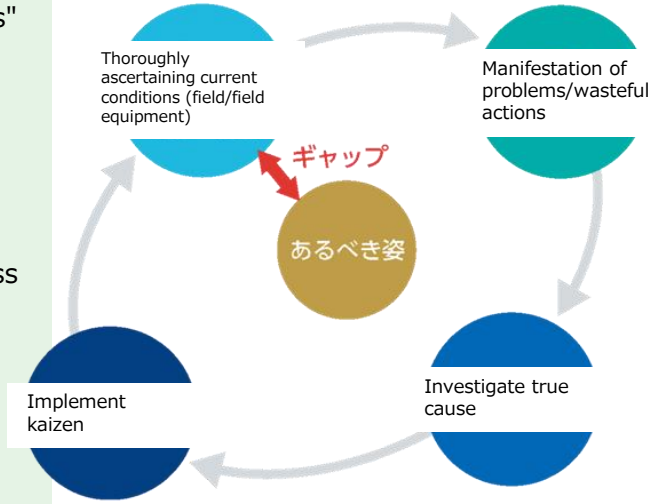
Emergency response center of Unit 5(Kashiwazaki-Kariwa)

Emergency response training during the Covid-19 pandemic(Headquaters)

Emergency response training during the Covid-19 pandemic(Kashiwazaki-Kariwa)

# (6) Insourcing technological capability

- Kaizen methodology being used to materialize "never-ending reforms and improvements" as put forth in the Management Model.
- Focus being put on going into the field to observe the condition of actual equipment and thoroughly ascertaining actual conditions, and identify the true causes of problems.
- Through these activities we are training human resources with superior technical prowess as they become intimately familiar with fieldwork and perform required tasks on their own.
- We are having external experts provide guidance and proactively incorporating best practices from other departments and other industries.




## <Kaizen examples>

Remote dismantling of exhaust stacks
・World first achieved in cooperation with local companies.
・Accumulated experience with remote operations technology, which is indispensable for decommissioning.

Disassembly inspections of emergency pumps by employees
・Employees started with easy tasks and then gradually moved to disassembling large pumps.
・Employees gained a deep understanding of the structure of equipment.

Improving the safety of oil drum transport, and reducing exposure
・TEPCO employees teamed up with contractors to deliberate issues.
・Best practices from group companies employed.

# (7) Improving safety and quality (key issue)



- Although the number of high-grade nonconformities is showing a decreasing trend overall, human errors continue to occur.
- At the FDEC, we are analyzing past nonconformities to enhance our ability to identify risks in advance and thoroughly implement recurrence prevention measures, which are weaknesses.
- In the Plant Siting Division we are creating mechanisms to improve the skill of operators, which is a key issue.

## <FDEC Initiatives>

- Enhance our ability to identify risks in advance and thoroughly implement recurrence prevention measures

| | |
|---|---|
| **Enhance our ability to identify risks in advance** | • Reeducation on management observation (MO) that focuses on safety, quality and radiation control will be provided to all group managers.<br>• Advice shall be provided through joint MO with contractors, and support shall be provided for MO and RCA training conducted at contracting companies.<br>• Not only the department in charge, but also the Decommissioning Safety and Quality Office shall confirm efforts to identify risks during pre-work safety meetings and the implementation of such meetings in the field. |
| **Thoroughly implement recurrence prevention measures** | • We are gradually employing IT to automate the data entry of approximately 100,000 pieces of information annually in order to prevent errors in the vast amount of data publicly disclosed (using smart glasses, and enabling instrument values to be automatically sent, etc.). |


Visiting contractors to provide MO training

Performing analyses using smart glasses

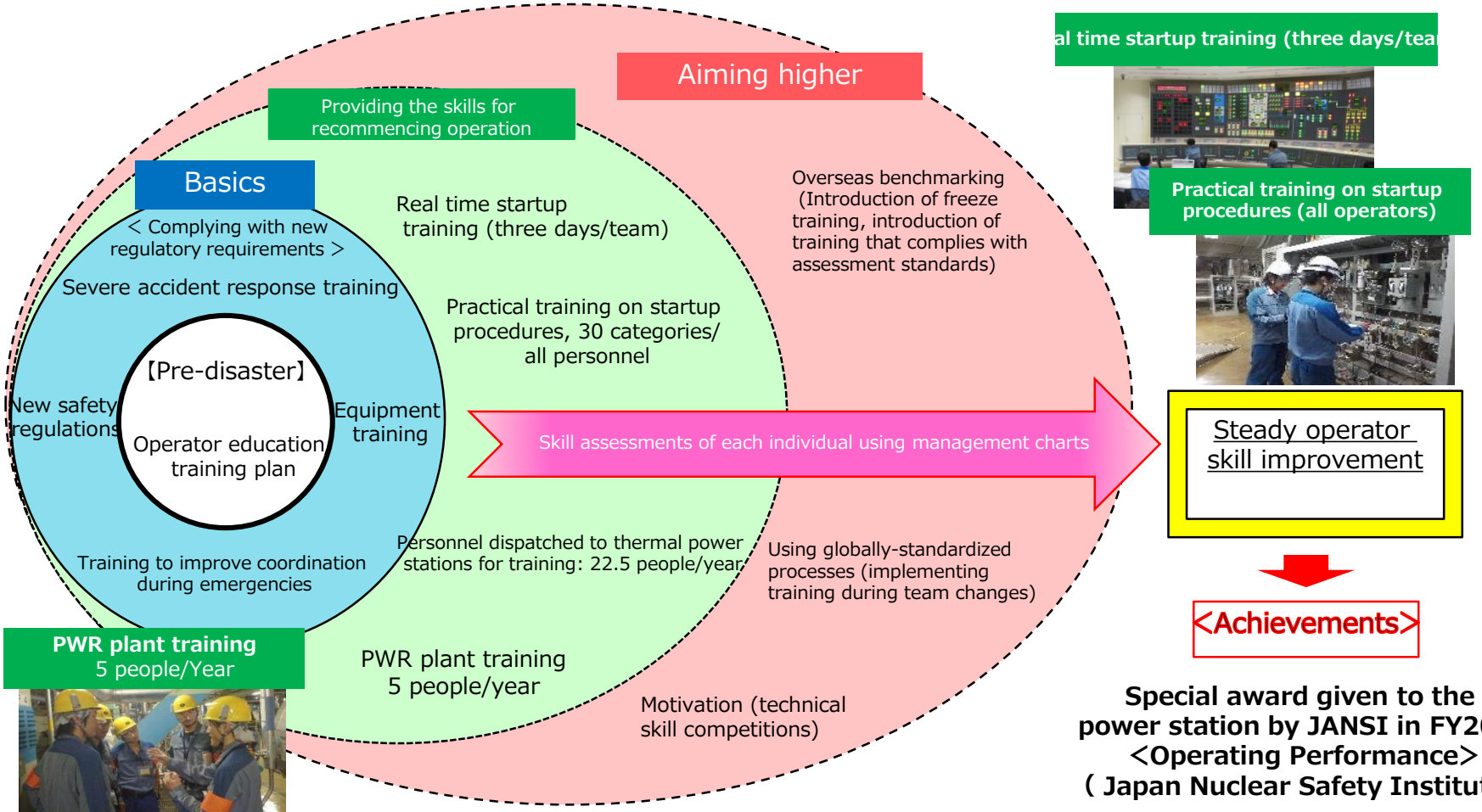
- As a result of these initiatives, the number of times managers are going to the field has increased from 500/month (March)➔2,200/month, and the number of CR created has increased from approximately 50/month (October 2019) ➔Approx. 200/month compared to last fiscal year.

# (7) Improving safety/quality (key issues)

## <Plant Siting Division Initiatives>

- In order to ascertain field conditions and the conditions of actual equipment in the field, Headquarter personnel have been assigned to Kashiwazaki-Kariwa in order to support power station activities, such as activities to eliminate all temporarily stored items that are being implemented in order to reduce nuclear safety risks (since March 2020)

- A key issue to address is the fact that the number of operators that have never actually operated a power station is increasing. Therefore, management charts are being used to keep track of the degree of required skill that each individual has based upon the experience gained through actual operation. And, while aiming to go above and beyond what is required, operators in all positions are voluntarily coordinating with each other to create systems that enable startup and stable operation.




**Special award given to the power station by JANSI in FY2020 <Operating Performance> ( Japan Nuclear Safety Institute )**

# Improving the ability to promote dialogue

（8）Strengthening corporate communications governance

⇒Initiatives to proactively and quickly disclose information

（9）Improving the quality of communication

⇒Transition from "conveying information" to "convey information that is easily understood."

■Ideal state (from the Management Model)

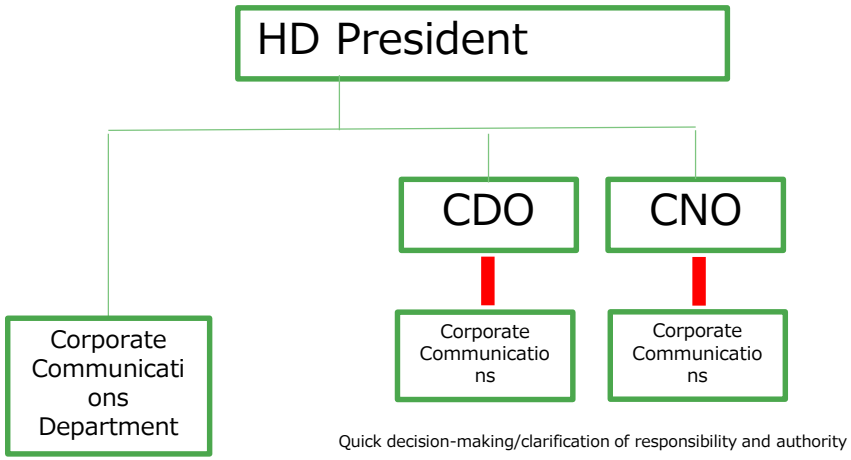
**Based on our belief that "nuclear safety cannot be absolute (zero-risk)**," we are facing the questions and concerns of our stakeholders face on, **proactively and quickly disclosing information, and striving to provide detailed explanations from the standpoint/viewpoint of our stakeholders in an effort to deepen trust** so that we can protect the safety of society.

# (8) Strengthening governance in corporate communications



- Restructure corporate communications teams to clarify responsibility and authority and enable quick decision-making. And, strengthen risk communicator mechanisms in order to quickly keep up with information on troubles.
- Through these initiatives improvements will be made to proactively and quickly disclose information by "**publicly disclosing information on troubles without delay**," and "**proactively disclosing information without becoming over concerned about the category of disclosure**."
- We will continue to proactively disclose information and give careful explanations so as to eliminate concerns that society has about information pertaining to each power station disclosed by TEPCO.

## 【Corporate communications structure】




## 【RC mechanism】

・When risk communicators were first assigned (April 2013) they were assigned to each department involved in nuclear power (total: 28 people)
・In order to enhance this mechanism, risk communicators have been assigned to each department in order to quickly keep up with information on troubles in each department at the power station (total: 45 people as of January 2021)

Corporate communications department personnel and risk communicators are continually undergoing training to improve skills

# (9) Improving the quality of communication (key issue)



- Initiatives to convey accurate information quickly are underway in light of the experience we have had with internal/external communication errors and communication mistakes we have made, such as the KK notification error.
- Going forward, we shall make improvements based on the opinions we have received from regional residents, and continue to improve the quality of communication and prevent mistakes before they happen by further systemizing functions.

| Issue | Status of initiatives |
|---|---|
| 1. Strengthening shift systems | • As part of team improvement initiatives, we are introducing training that focuses on ingraining basic actions in addition to current notification training.<br>• Issues noticed during training are being shared in order to make improvements and enable mistakes to be prevented. |
| 2. Leveraging IT to revise work processes | • iPhones have been distributed to local government to improve the accuracy of information being conveyed.<br>• In January 2021 we put an automated system into use to eliminate manual labor and further improve speed and accuracy. |
| 3. Work improvements based on the opinions of regional residents | • In order to improve the ability to promote dialogue, we have distributed a "questionnaire on communications activities relating to nuclear power" in order to examine the information conveyed by TEPCO (timing, ease of understanding, whether all required information was conveyed, etc.).<br>• The opinions received are being used to improve our ability to promote dialogue and how we go about our business. |
| 4. Standardization and lateral dissemination | • Experience with handling external parties will be added to the recommended requirements for upper-level positions. |

# Conveying the facts and the lessons learned from the Fukushima Nuclear Accident



- As the party responsible for the Fukushima nuclear accident, we are providing training to all employees, including management, to teach them about the facts and lessons learned from the accident in order to fulfill our responsibilities to Fukushima and cultivate safety culture.

- **Implementing "training for all employees to teach them about the facts and lessons learned from the Fukushima Nuclear Accident" (from July 2018)**
  - Training objectives
    - To give accurate explanations based on facts, engage in group discussions that urge employees to point out things they noticed and passed out experience, and declare action.
  - Training content
    - Learn how to talk about the facts and lessons learned in one's own words. Promise to each other that we will fulfill our responsibilities to Fukushima.


- **Training facilities/program revisions**
  - Revise training facilities and programs while focusing on the three-tiered safety culture model.
  - By using video footage and increasing the amount of information available at training facilities, we shall present the facts and the lessons learned that should be passed on to future generations in an easy-to-understand manner (construct fully developed archives).
  - Reflecting instructor know-how accumulated through training to date (2,400 group discussions) in the training program so as to ingrain the concept of safety awareness in the minds of trainees through discussions.
- **Future development**
  - Organically link 3.11 group company events, and daily work activities with the PDCA cycle so as to prevent the achievements of training from being temporary. Managers should leverage every opportunity to provide guidance to departments and members that will enable them to carry out and further develop their declarations of action.
  - Training at the new facility began in October 2020 based on a new program.

# 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."**

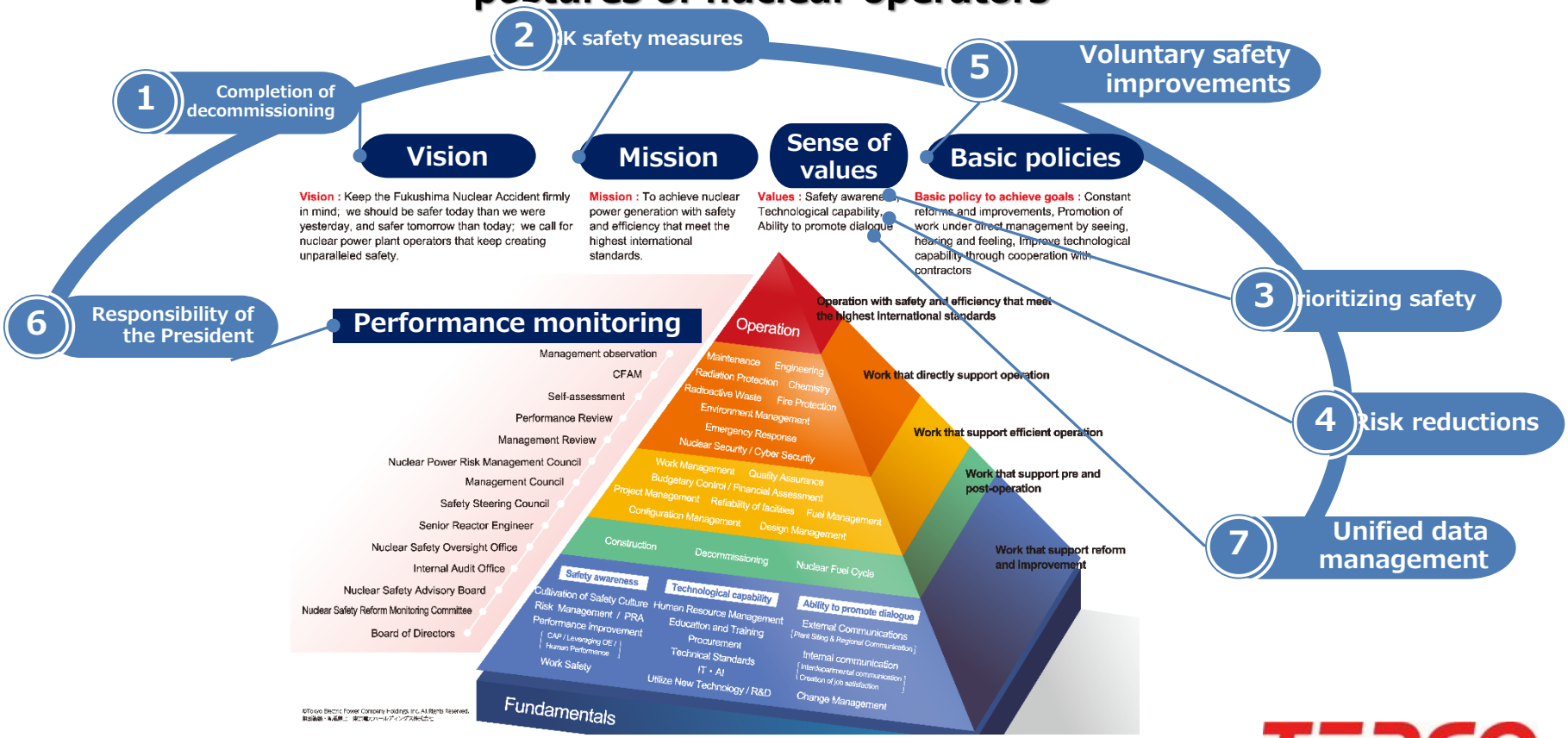
# Reference documents

# The relationship between the Management Model and the seven basic postures



- The seven basic postures of a nuclear operator **needed to be eligible to operate a nuclear power station are included in the Management Model.**
- These basic postures will be achieved by combining concepts common to each task (vision/mission/sense of values/basic policies) with mechanisms for performance monitoring.

## The relationship between the Management Model and the seven basic postures of nuclear operators



# "Investigating/examining unconfirmed/unsolved issues" and reflecting them in safety measures

- Issues that remained unsolved at the time the Nuclear Safety Reform Plan was announced will continue to be examined, and the **knowledge gained from those investigations disclosed and reflected in safety measures at Kashiwazaki-Kariwa.**
- We shall strengthen mechanisms for **leveraging the new knowledge** gained by ascertaining the causes of the Fukushima Nuclear Accident, and reflect it in power station safety measures (pertaining to equipment and training).

| | 1st | 2nd | 3rd | 4th | 5th |
|---|---|---|---|---|---|
| Disclosure date | December 13, 2013 | August 6, 2014 | May 20, 2015 | December 17, 2015 | December 25, 2017 |
| Main issues for review | • Loss of power due to building flooding by tsunami | • Loss of RCIC reactor cooling water injection function | • Inability to confirm Unit 2 PCV venting | • Damage to RCW system pipes caused by melted core that fell onto the pedestal | • Flooding into the reactor building during venting |
| Reflection in KK safety measures | • Waterproofing countermeasures (Seawall, watertight walls, watertight doors, waterproofing)<br>• Internal inundation assessment and flooding countermeasures | • Augmentation of DC batteries<br>• Creation of black start procedures | | • Installation of corium shields | • Installation of redundant isolation valves between PCV vent pipes and other system pipes connected to them |

# Third-party assessments and follow-ups (FY2019 WANO-CPR)



- The CPR (FY2019) assessed Headquarter leadership (CO.1) and governance (Co.2) to be strengths. In regards to AFI, FSA should be implemented self-critically and effectively upon identifying weaknesses with departments in advance using CPR-FSA.
- The action plan is being carried out in preparation for the 2022 follow-up review.

**Action plan review meeting March 2020**

- TEPCO's action plan to address the AFI (areas for improvement) mentioned in the WANO-CPR results is being reviewed with WANO.

**FY2020 management meeting**

- Nuclear leaders are reviewing the status of efforts to address AFI.

**WANO Follow-up self-assessment Q2~Q3 2021**

- Self-assessments of the status of handling of AFI will be implemented.
- A document review will be performed based upon check sheets.

**WANO-CPR 2019 Follow-up review June 2022**

- A follow-up review of the WANO-CPR will be conducted two~three years from now. The progress with TEPCO's action plan will be reviewed.

**WANO-CPR 2025~6 years**

- Planned timing of the next CPR.

# Examples of improvements in the quality of communication

## Work improvements based upon opinions from community residents

Questionnaire targets: Local government, chambers of commerce, private companies, reporters, etc.

Questions: Pertain to TEPCO communication (timing, ease-of-understanding, whether or not necessary information was provided, etc.)

FY2020 results: Positive rating: 80.2%　(205 replies)【Target: Positive rating of 80% or higher for communications assessments】

| Received opinions | Examples of measures |
|---|---|
| It would be nice to have you simplify explanations and give us the big picture sometimes. | Content on nuclear safety measures that employs videos and cartoons is being created. |
| Information should be conveyed from the perspective of the people receiving it. | Information on "the status of measures to prevent the spread of Covid-19," which is of concern to many, has been posted on TEPCO's website and conveyed through emails and telephone calls. |

## Leveraging IT to revise work processes

【Overview of automated notification system】