Topic 1

# Further Reinforcing Our Ongoing Voluntary Initiatives to Enhance Nuclear Safety

In the light of the nuclear accident at the Fukushima Daiichi Nuclear Power Station, we reviewed our own practices and attitudes toward nuclear power operations and felt profound remorse, such as “our efforts on countermeasures against Severe Accidents, which are considered to be extremely infrequent, might have been inadequate”; “our awareness of voluntarily enhancing nuclear safety beyond legal and regulatory requirements might not have been enough”; and “our efforts to learn from abroad, such as collecting information on activities for enhancing safety and improving our nuclear power stations, might have been insufficient.” Accordingly we have been undertaking an all-out effort to further enhance nuclear safety in order to build public confidence in nuclear power generation.

We seek to achieve the highest level of global safety through ongoing voluntary initiatives in addition to adhering stringently to the new regulatory requirements enforced in July 2013.

## Further Reinforcing Ongoing Voluntary Initiatives

In the aftermath of the Great East Japan Earthquake, we have continued to implement company-wide efforts to enhance nuclear safety beyond legal and regulatory requirements based on recognitions of the Fukushima Daiichi nuclear accident.

As part of this process, we will further reinforce our ongoing voluntary initiatives to enhance nuclear safety considering the lessons learned from the accident, such as the possibility of inadequate awareness of risks specific to nuclear power generation and an attitude insufficient to address them.

### Four Major Initiatives and Our Implementation Roadmap

| Initiative | FY 2013 and prior years | FY 2014 | FY 2015 | FY 2016 onward |
|---|---|---|---|---|
| 1 Clearly Stating and Sharing the Philosophy on Nuclear Safety | Presidential declaration, quality policy | Statement of philosophy | Instilling into all members and permanently passing on to future generations | |
| 2 Reinforcing Risk Management<br>● Enhancing corporate governance by top management<br>● Reinforcing risk management in the Nuclear Power Division<br>● Reinforcing risk communication | Evaluation review Identifying the Risk Management Officer | Establishment of the Nuclear Power Subcommittee | Continuous improvement of structures and functions | |
| | Initiative to learn from experiences and findings outside the country | Strengthening and continuous improvement of learning initiatives | | |
| | Application of PRA to operation shutdown | Promotion of probabilistic risk assessment (PRA) | | |
| | Nuclear power business operations rooted in the community | Risk communication with external stakeholders (especially with the people in the plant-hosting communities) | | |
| | Cooperating with efforts to improve the evacuation plan: Adopting the results of risk communication in the evacuation plan and emergency drills | | | |
| 3 Establishing an Infrastructure for Enhanced Safety in the Nuclear Power Division<br>● Strengthening our emergency response capability<br>● Strengthening our system | Promotion of safety enhancement measures [ensuring safety with Defense-in-Depth, enhancing safety beyond legal and regulatory requirements] | | | |
| | Establishment of an initial response in emergency | Enhancing emergency response capabilities and training personnel to oversee the entire nuclear power safety system | | |
| | Establishment of the Nuclear Safety Department<br>Appointment of Nuclear Safety Supervisor<br>Organizational strengthening of sharing of responsibility for power plant safety | Continuous improvement of structures and functions | | |
| 4 Development of Safety Culture | Strengthening initiatives to foster a safety culture in the aftermath of the Fukushima Daiichi nuclear accident | Continuous improvement of initiatives to foster a safety culture | | |

## 1 Clearly Stating and Sharing the Philosophy on Nuclear Safety

We will prepare a statement of Nuclear Safety Philosophy, which is permanently passed on to future generations and the President will issue it to all members of the company with a target date in August 2014. Our future initiatives related to nuclear safety will be implemented standing on this philosophy.

### Outline of Nuclear Safety Philosophy

#### Preface

- Every one of us shall **remember the lessons** learned from the Fukushima-Daiichi nuclear accident and ceaselessly strive to enhance nuclear safety to **protect the people not only in the plant-hosting communities but also the whole country, and to preserve the environment.**

#### Characteristics of nuclear power generation and risk awareness

- **Nuclear power generation** has superior characteristics in terms of energy security, prevention of global warming and economic efficiency, and is an **essential power source** for the future. On the other hand, nuclear power generation **has risks of radiation exposure and environmental contamination.** Every one of us **shall always bear in mind that once a severe accident happens** due to lack of proper management, **it could cause enormous damage to the people and the environment.**

#### Continuous removal / reduction of risk

- To enhance nuclear safety, we shall fully understand the characteristics and risks of nuclear power generation and **continually remove or reduce such risks while identifying and evaluating them, never believing at any moment that we have reached the goal of ensuring safety.** These efforts shall be conducted at each level of the Defense-in-Depth.

#### Development of safety culture

- **Safety culture is the basis** for continuously removing or reducing risks. Since the accident of Mihama Unit No. 3, we have been reviewing and improving our safety culture, and **we shall develop such safety culture.**
- To this end, we shall always be ready to question anything, learn from others and listen to the voices of society and discuss issues uninhibitedly while respecting diverse opinions with further efforts.

#### Commitment to enhancing nuclear safety

- Enhancing nuclear safety is the **overriding priority in the company.** It is also important to promote **two-way communications** with the people in the plant-hosting communities and the whole country, and to **share common perceptions** on nuclear safety.
- Under **the President’s leadership, every one of us** shall work together to **tirelessly enhance nuclear safety.**

## 2 Reinforcing Risk Management

Our management will strengthen corporate governance by maintaining greater focus on risk management related to releasing radioactive substances. In June 2014, we established the Nuclear Power Subcommittee under the Risk Management Committee to assess efforts related to managing the risk of releasing radioactive substances. This initiative is based on a broader knowledge gained from segments other than nuclear power. In addition, our Nuclear Power Division will strengthen its risk management, such as reinforcing risk analysis and assessment systems through the use of probabilistic risk management (PRA).

We will also communicate risks to various internal and external stakeholders in order to gain a shared perspective on risk.

## 3 Developing an Infrastructure for Enhanced Safety in the Nuclear Power Division

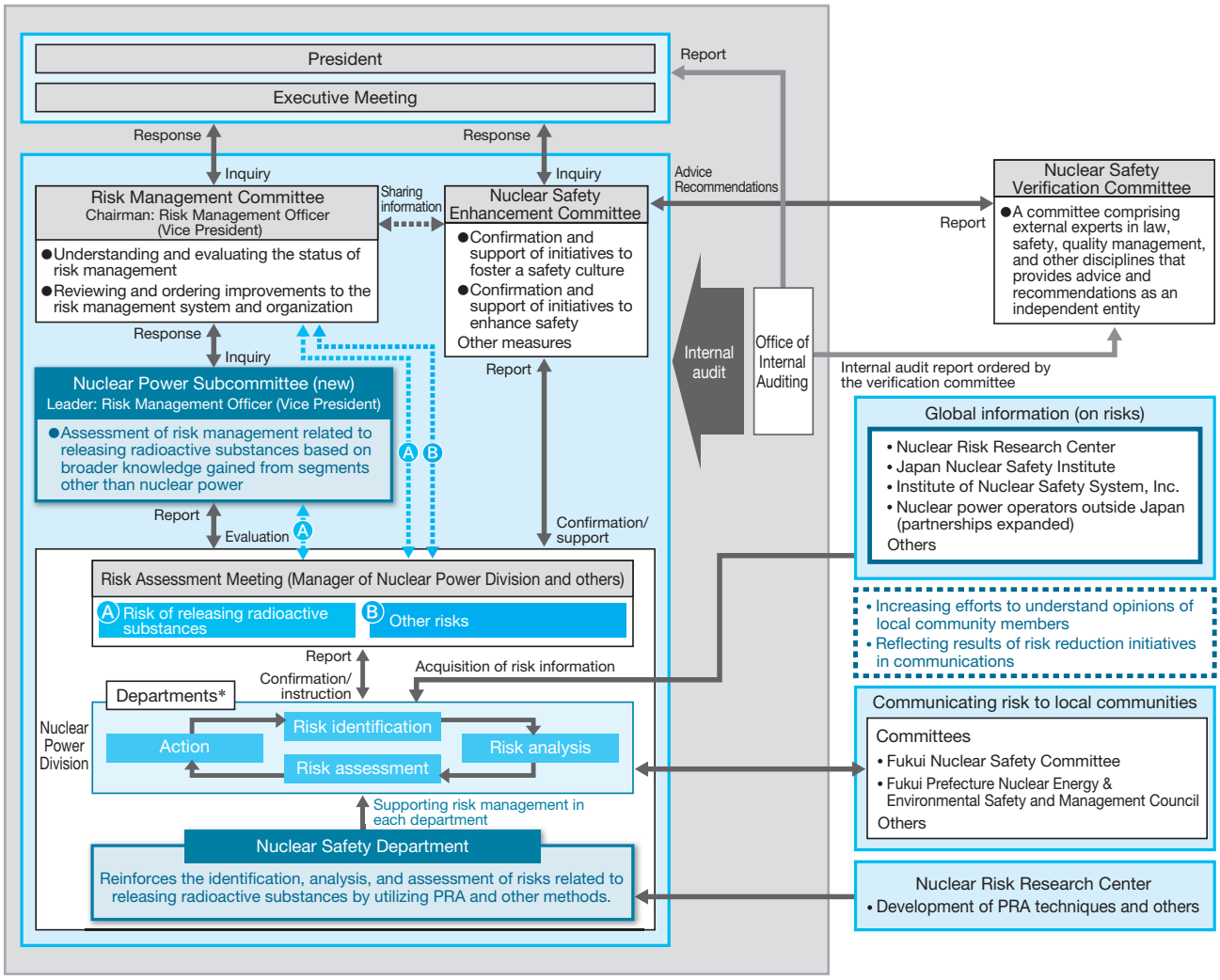
In June 2014, the company established the Nuclear Safety Department in the Nuclear Power Division by integrating functions related to nuclear safety and nuclear security in order to streamline safety enhancement activities. In addition, the new position of Nuclear Safety Supervisor was created and assigned under the direct supervision of the power plant manager. A safety overseer (an employee overseeing the entire nuclear safety system)* was posted to this position. During normal operation, the Nuclear Safety Supervisor promotes safety and performs various functions in support of technical decision-making by the plant manager in an emergency. Safety overseers are trained according to a plan.

* Personnel familiar with power plant facilities and situational changes of the plant during an emergency and capable of suggesting safety measures to management during normal operation or an emergency.

## 4 Developing a Safety Culture

We continue to improve initiatives to foster a safety culture under the Nuclear Safety Philosophy and will elevate our safety culture to the next level so that risk elimination and risk reduction become routine activities.

■ **Strengthening the Organization for Nuclear Safety and Risk Management in the Nuclear Power Division**




* Nuclear Planning and Administration, Nuclear Safety, Nuclear Power Generation, Nuclear Technology and Nuclear Fuel Departments

# Promoting Safety Measures

With the adoption of new regulatory requirements for nuclear power plants in July 2013, we applied for conformity examinations of Units 3 and 4 of Ohi Power Station and Units 3 and 4 of Takahama Power Station. We have responded to the examination diligently while implementing additional safety enhancement measures.

Although the conformity examinations are still in progress, we are determined to respond to the results quickly and accurately while improving the safety and reliability of the plants by incorporating best practices and new findings from around the world.

## Status of Conformity Examinations for Units 3 & 4 of Ohi Power Station and Units 3 & 4 of Takahama Power Station (2013–2014)

| | |
|---|---|
| **2013 July 8** | New regulatory requirements come into force. We apply for permission to install and upgrade nuclear reactor facilities of Units 3 and 4 of Ohi Power Station and Units 3 and 4 of Takahama Power Station. (Ohi Power Station Units 3 and 4 have been maintaining constant operation at their rated thermal power output following a preliminary examination by the Nuclear Regulation Authority.) |
| **July 25** | The final report for the crush zone investigation on the premises of Ohi Power Station is submitted. |
| **September 2** | Regular inspection of Ohi Power Station Unit 3 begins. |
| **September 15** | Regular inspection of Ohi Power Station Unit 4 begins. |
| **2014 February 12** | The Nuclear Regulation Authority concludes that "the new F-6 crush zone on the premises of Ohi Power Station does not fall under the category of faults with the potential to become active in the future." |
| **May 16** | The design-basis ground motion for the Takahama Power Station (700 Gal: consideration of a three-fault interaction between FO-A, FO-B and Kumagawa, defining the depth of the seismogenic fault beneath the surface as 3 km, and other factors) was generally accepted at an examination meeting regarding conformity with new regulatory requirements. The examination of the Ohi Power Station continues. |

## Enhancing Safety through Strict Enforcement of Defense-in-Depth

Defense-in-depth is one of the approaches used to ensure the safety of nuclear power facilities. It refers to a structure in which multiple levels of safety measures are implemented. In addition to compliance with design standards for resistance to natural phenomena, such as volcanic activity and tornadoes, protective measures against severe accidents such as containment vessel failure are included in this approach.

**Examples of implementation of safety measures**

Defense-in-depth to 5 levels

| | | | |
|---|---|---|---|
| Beyond design criteria (severe accidents) | 5th Layer | | Prevent human casualties<br>Restore the environment |
| | 4th Layer | | Prevent large-scale release of radioactive substances<br>Prevent damage to containment vessels (release control, dispersal mitigation) |
| | 3rd Layer | Mitigate accident effects | Prevent serious core damage |
| | | | Prevent core damage<br>Maintain soundness of containment vessels |
| Within design criteria | 2nd Layer | | Control of abnormal operation and detection of failures |
| | 1st Layer | | Prevention of abnormal operation and failures |

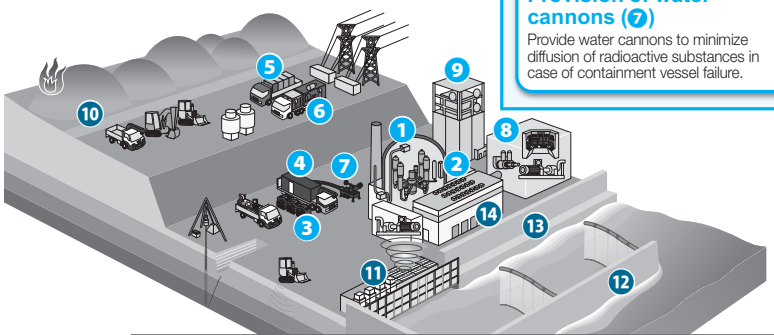


Illustration of major safety measures

1. Filtered ventilation systems
2. Passive autocatalytic recombiner/igniter
3. Fire pump
4. High-capacity pump
5. Power supply vehicle
6. Air-cooled emergency generator
7. Water cannon
8. Facility for dealing with specific severe accidents
9. Seismic isolated office building
10. Fire protection zone
11. Facility protected against flying objects from tornadoes
12. Breakwater
13. Tide embankment
14. Watertight door

### Measures against severe accidents

#### Measures to prevent containment vessel failure and hydrogen explosion (1 2)

In order to prevent damage to the containment vessel due to increased pressure and damage to the facility due to a hydrogen explosion, install filtered ventilation systems (within 5 years of the enforcement of new regulatory requirements) and hydrogen concentration reduction devices (passive autocatalytic recombiners/igniters).

#### Provision of emergency power supplies (5 6)

In anticipation of loss of external power, provide multiple units of diesel generators, vehicles with generators (power supply vehicles), and air-cooled emergency generators and the like.

Power supply vehicle

Air-cooled emergency power generator

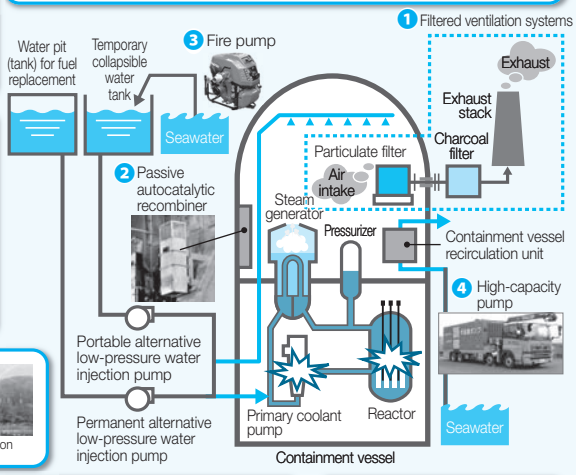
#### Provision of water cannons (7)

Provide water cannons to minimize diffusion of radioactive substances in case of containment vessel failure.

Water cannon

#### Providing a cooling function for the reactors and facilities (3 4)

Provide high-capacity pumps, portable water pumps, and fire pumps and the like to secure a cooling function for the reactors and facilities even if all other power supplies are lost.




#### Installation of facility for dealing with specific severe accidents (within 5 years of enforcement of new regulatory requirements) (8)

Construct alternative facilities for emergencies such as the intentional crashing of an airplane.

#### Installation of a seismic isolated office building (9)

Develop and secure a command center for use in an emergency. Secure a space for housing the workforce, power supplies, and communications functions.

### Addressing design standards

#### Measures for dealing with natural phenomena (volcano, tornado, and wild fire and the like) (10 11)

In order to prevent simultaneous loss of functionality of essential safety equipment due to natural phenomena, implement protective measures by assuming natural phenomena will be of a higher severity.

**■Protection against external fire**

Create a fire protection zone by cutting down trees in the periphery of the station premises to prevent the equipment from being damaged by a forest fire close to the station.



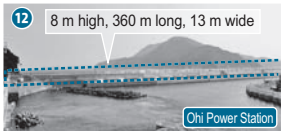
**■Protection against flying objects from tornadoes**

Install tornado protection for seawater pumps on the assumption that steel items can be projected by a tornado with a wind speed of 100 m/sec.


Facility protected against flying objects from tornadoes

#### Measures against tsunami and flooding (12 13 14)

Install a tide embankment or increase the height of the breakwater to protect the power station from flooding. In addition, replace the doors for buildings containing essential safety equipment with watertight doors to prevent the building from flooding in the event a tsunami strikes the premises.




Increase height of existing breakwater (from 5 m to 8 m).

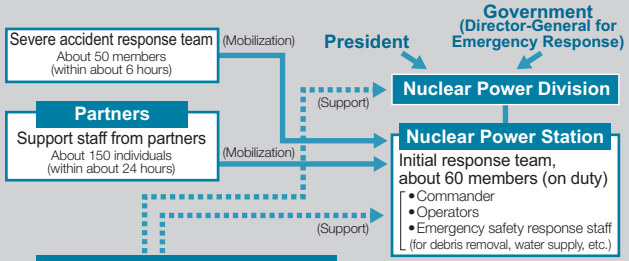

A tide embankment outside Wakasa Bay (11.5 m in height)


Watertight door

## ●Enhancing Emergency Response Capabilities

In preparation for emergencies, we reserve the necessary manpower to ensure an adequate emergency response on weekday nights and on weekends and holidays. At the same time, we continuously improve our training programs to upgrade the response capabilities of those involved. In addition, we have put in place an organization to ensure plant manufacturers and other suppliers can provide timely technical support as well as materials and equipment.

### Organization




**Plant manufacturers & suppliers**

- Mitsubishi Emergency Response Center and others
  - Wakasa area: 11 individuals
  - Kobe area: 400 to 500 individuals
  - Technical support for repairs and the like
- Nuclear Emergency Assistance Center
  - Loans materials and equipment such as remote control robots.
- Institute of Nuclear Safety System, Inc.
  - Predicting the course of events and the like
- Local support base
  - Serves as a base for housing employees, materials, and equipment.

### Training programs

**General nuclear disaster prevention drill**

In order to enhance emergency response capabilities and strengthen cooperation among relevant organizations, drills are conducted in coordination with the government and various organizations. These drills allow for monitoring of overall operations, including those of the local support base.

Our president, Makoto Yagi, commanding the Nuclear Emergency Response Center

**Training programs for specific roles**

- **Commander**: Tabletop exercises to study measures to contain the accident; practical drills performed without prior disclosure of the nature of the scenario; other training
- **Operators**: Training with tools for visualizing plant response; drills on a simulator including situations involving extended power outages; other training
- **Emergency safety response staff**: Training in procedures to remove debris, supply water, and supply power, as well as practical drills in these tasks; other training

Extended power outage drill on a simulator

Nighttime power supply drill (connection and startup of power supply vehicle)

## ●Collection of Global Knowledge for Ongoing Improvement of Plant Safety

We are committed to gathering the latest knowledge from around the world on a timely basis, studying it, and reflecting it in our operations through our participation in the World Association of Nuclear Operators (WANO) and the Institute of Nuclear Power Operations (INPO). We will also sign information exchange agreements with utility companies outside Japan.

### ◆Proactive Participation in WANO Initiatives

With the knowledge gained from the accident at the Fukushima Daiichi Nuclear Power Station, WANO is focused on performing more frequent peer reviews and other enhancement efforts to promote nuclear safety. We participate in these initiatives proactively.

In September 2013, the company hosted WANO's Small-scale CEO Meeting (a meeting of CEOs held by each WANO regional center) in Osaka. Attended by the presidents of eleven Japanese power operators; Jacques Regaldo, Chairman of WANO; and the CEOs of several utility companies outside Japan, the meeting supported the active exchange of opinions.

### ◆Information Exchange Agreements with Utility Companies outside Japan

Although we had already entered into information exchange agreements with utility companies outside Japan before the accident at the Fukushima Daiichi Nuclear Power Station, we renewed our agreement with Korea Hydro & Nuclear Power Co., Ltd. in April 2014 for the first time after the accident and entered into a new agreement with Iberdrola, Nuclear Generation in Spain S.A., in May 2014.

We plan to increase the knowledge of all parties by exchanging information and opinions on issues such as ongoing efforts to strengthen the response to severe accidents and improve operation and maintenance of nuclear power plants.

WANO Small-scale CEO Meeting (September 2013)


Renewal of information exchange agreement with Korea Hydro & Nuclear Power Company (April 2014)

# ■Reflecting the Advice of the Nuclear Safety Verification Committee Composed Mainly of Outside Experts

Kansai Electric Power established the Nuclear Power Integrity Reform Verification Committee, composed mainly of outside experts, in April 2005 after the accident at Unit 3 at the Mihama Power Station. It was established to examine, from an independent perspective, the validity of the measures taken to prevent a recurrence of the type of accident that occurred there. We continuously pursue improvements based on the opinions of the committee.

We have received advice from the committee regarding our nuclear power safety culture advocacy activities since November 2008, and regarding our ongoing voluntary safety initiatives in nuclear power generation since June 2012 in response to the Fukushima Daiichi Nuclear Power Station accident. The committee was furthermore renamed as the Nuclear Safety Verification Committee.

The 6th meeting of the Nuclear Safety Verification Committee was held on May 12, 2014. The committee reviewed and provided advice on three topics: the progress of measures to prevent the recurrence of the Mihama Power Station Unit 3 accident; the progress of initiatives to foster a safety culture; and the status of ongoing voluntary safety initiatives targeting nuclear power generation. We will continue pursuing improvements based on this committee's advice as we go forward.

### ◆Results of the 6th Meeting of Nuclear Safety Verification Committee (May 12, 2014)

- "Ongoing voluntary safety initiatives targeting nuclear power generation"

[Viewpoints on verification]

Discussion of whether to undertake additional ongoing voluntary safety initiatives in addition to satisfying the new regulatory requirements

[Confirmation of results]

Implementation of a stable and ongoing mechanism to incorporate the latest knowledge and lessons learned; implementation of measures to enhance safety appropriately according to plan and to constantly maintain their effectiveness

6th Nuclear Safety Verification Committee Meeting

[Issues to be focused on in future]

Monitoring of planned and implemented safety measures without interruption for further enhancement of safety; evaluation of results of safety programs to confirm they are implemented continuously

Kazuhiro Watanabe, chairman (left), and Kunio Higashi, ex-vice chairman (right)