Risk Management in the Nuclear Business

October 7, 2013
Kansai Electric Power Co., Inc.
1. Safety-First Business Operation
   —Activities to foster a safety culture is essential to ensure risk management

2. Risk Management at Kansai Electric Power
   —Corporate schemes of risk management and nuclear risk management

3. Improved Risk Management in Light of the Earthquake
   —Lessons learned and points of enhancing nuclear risk management in light of the accident at the Fukushima Daiichi Nuclear Power Station
1. Safety-First Business Operation
Statement of President (March 2005)
"We ensure safety. That is my mission and the company's mission.

We give top priority to safety to ensure the safety of all people concerned. We will all make a strong commitment to keeping our colleagues and their families happy, care about others in our daily communication, foster a culture of open communication, and make improvement continuously to establish a safety-first culture.

We will promptly take voluntary safety action whenever we perceive danger, in order to ensure the safety of oneself and others at work and eliminate disasters.

Safety-First Business Operation

Incorporated in principles and plans

Safety-First Business Operation

Commitment to fostering a safety-first culture in the organization (excerpted from the Kansai Electric Power Group's Plans for Fiscal Year 2013)

- The management will keep communicating with front-line workers and sending out messages and will promote safety activities based on the leadership of the manager of each workplace and the integrated effort of all workers in the workplace.
- Each worker will take due responsibility, be aware of risks, and take safety actions on one's own initiative.
- We will perform the plan-do-check-act (PDCA) cycle effectively at each workplace and conduct safety activity creatively in a self-sustained manner.
- We will share the code of conduct and relevant philosophy with our partner companies, keep communicating with each other, and promote mutually enlightening activities on a group-wide basis.

It is understood that fostering a safety culture is essential to ensure risk management activities.
Activities to Foster a Nuclear Safety Culture

To remember lessons learned from the Mihama Unit 3 accident and promote safety-first business operations, a system was built to evaluate various aspects of nuclear safety culture from different viewpoints and make improvements continuously.

President
President's statement: "We ensure safety. That is my mission and the company's mission."

Quality policies for safety-first nuclear business operations
(1) We give top priority to safety.
(2) We positively direct resources to ensure safety.
(3) We improve nuclear safety continuously and strengthen collaboration with domestic and overseas manufactures and partner companies.
(4) We make efforts to regain confidence from local communities and the public.
(5) We evaluate our safety commitments objectively and provide information widely.

Quality policies are applied to all activities

Safety culture evaluation
I. Evaluation of the awareness and action of the organization and people
   - Top level commitments
   - Three pillars of safety culture — Viewpoints of evaluation (14 items)
     - Plant safety (increase/decrease of trouble occurrences)
     - Workplace safety (increase/decrease of occupational accidents and unintentional exposure)
     - Society's confidence (increase/decrease of noncompliance)

II. Evaluation of safety performance
   - Communication
   - Organization that learns lessons

III. External evaluation
   - Local opinions and inputs from the Nuclear Safety Verification Committee

Support and cooperation
Company-wide support to Nuclear Power Division

**History (summary)**

- **April 2005**: Nuclear Maintenance Improvement Committee was established
- **June 2012**: H24.6 Work contents of the Committee were changed

**Nuclear Maintenance Improvement Committee**

- Mihama-3 Accident: ▼Aug. 2004
- Action Plan: ▼March 2005
- Implementation Plan: ▼July 2005

**Nuclear Safety Promotion Committee**

- Mihama-s restart: ▼Feb. 2007
- Fukushima Daiichi Accident: ▼March 2011
- Ohi-3/4 restart: ▼July 2012
- New regulatory criteria: ▼July 2013

**[Measures to prevent recurrence of the Mihama-3 accident]**

- Recurrence prevention
- Proactive prevention
- Review/coordination of the implementation plan, analysis and monitor the implementation status
- Confirmation and support for the efforts

**[Activities to foster safety culture]**

- Integrated coordination to prepare the fostering activities
- Integrated coordination, confirmation and support for the fostering activities

**[Voluntary and continuous efforts to improve safety]**

- Integrated coordination, confirmation and support for the efforts to improve safety

**Scheme**

- President (executive board)
- Community and Society
- Nuclear Safety Verification Committee
- Proposal of discussion
- Report
- Advice
- Audit Report
- Nuclear Power Division

**Nuclear Safety Promotion Committee**

- Role of the Committee
  - With the consultation from the president, discusses various issues related to nuclear safety and responds the results to the president.
  - Mainly consists of the officers other than Nuclear sector. Most of the VPs and managing directors are included. Total 24 persons
- **Meeting Frequency (as of the end of September, 2013)**
  - Committee 170 times
  - Yearly Performance
Problem-solving and development of a sense of unity through communications with the sites

○ Problem-solving as to internal systems by companywide support
  ➢ Through listening to troubles and requests by staffs at the sites, support problem-solving at the sites such as reviewing internal systems by different divisions.
    ▪ Expansion of the range of discretion by staffs at the sites (Division of Accounting)
    ▪ Payment of the costs necessary for technology transfer of contract manufacturers (Purchasing Division)
    ▪ Reinforcement of staff (Division of Human Resources)
    ▪ Improvement of working environment such as setting up ATMs, expansion of rental housing provided by the company at the sites

○ Development of a sense of unity with the sites
  ➢ Commissioners outside the sites participate communication sessions with young staffs other than communications within each division.
     (The number of communication sessions participated by commissioners outside the sites)
     2012: 18 times (27 participants in total), First half of 2013: 6 times (10 participants in total)

  ➢ At the same time, share common outlooks towards issues at the sites through inspection of safety measures and exchange of opinions with executives at the sites.

  ➢ Also, commissioners who visited the site of Mihama bow in silence before “the Monument of Oath of Safety” build in memory of the accident at unit 3 of the Mihama nuclear power plant.
Framework and viewpoints of safety culture evaluation

I. Evaluation of the awareness, action of the organization and people

- Top level commitments
- Communication
- Organization that learns lessons

*Examples*

1. Basically good
2. Room for improvement
3. Basically good
4. Room for improvement
5. Basically good
6. Room for improvement

*Viewpoints of evaluation (14 items)*

1. Whether top priority is clearly given to safety (plant safety, workplace safety and society’s confidence)
2. Whether the authority and responsibility of organizations are clearly defined and appropriate
3. Whether front-line workers understand and implement managerial conceptions and values (including partner companies)
4. Whether resources are directed and allocated appropriately
5. Whether the management, Nuclear Power Division and plant managers clearly understand the situation of front-line workers including trouble events and concerns
6. Whether there is good coordination within and between organizations (between the Nuclear Power Division and power stations and within each power station)
7. Whether good communication with partner companies is maintained
8. Whether information is released to outside parties in a timely and straightforward manner
9. Whether technical capabilities necessary to ensure safety are maintained and improved (including partner companies)
10. Whether rules are observed, and rules are reviewed to improve business operations.
11. Whether trouble and problems are solved and improvements are implemented proactively in consideration of overseas information
12. Whether external opinions are heard actively and reflected in business operations
13. Whether efforts are being made to improve safety and confidence and to prevent workers’ accidents by questioning the current status and using the capability of the entire organization to perceive risks
14. Whether the motivation of the Nuclear Power Division and plant personnel is maintained and improved

*Evaluation result (FY2012)*

- Plant safety: Evaluate and identify issues based on assessments of trends of troubles derived from serious troubles and human factors, etc. (Number of troubles: 8 cases (FY2012): No issue
- Labor safety: Evaluate and identify issues based on assessments of trends of workers’ accidents and unplanned radiation exposure (Workers’ accidents: 4 cases, unplanned radiation exposure: no cases (FY2012): No issue
- Societal trust: Evaluate and identify issues based on assessments of trends of inappropriate events related to compliance (Violation of the law (intentional or released to the press): no cases, other violation of the law: 1 case (FY2012): No issue

Analyze external responses towards our activities and identify issues: No issue.
Continuous tracking of communication with contractors

A questionnaire survey is conducted every year to track how contractor companies view the measures taken to prevent any recurrence of the Mihama Unit 3 accident and the behavior and action of Kansai Electric Power personnel.

Such surveys were conducted nine times from 2005 to 2012; questionnaires were sent out to about 5,000 people of contractor companies, of which about 60% responded.

The survey results and requests and other comments given in the comment field are fed back to power stations, contractor companies and the management, and reported to the Nuclear Safety Promotion Committee.

Successful results have been obtained in the development and modification of safety-first processes.

Successful results have been obtained in workplace safety.

There is willingness to hear opinions and requests from contractors.

There is an easy atmosphere to talk to Kansai Electric Power personnel.

Evaluation of the implementation of the measures to prevent recurrence shows steady improvement trend.

The result of evaluation of the behavior and action of Kansai Electric Power personnel has plateaued recently.

There is a substantial gap between the self-awareness of Kansai Electric Power personnel and the partner companies’ perception regarding the behavior and action of the personnel.

Further enhancement of communication including direct talks is being pursued.
Examples of communication-related activity

We are taking the following measures while strongly focusing on communication with front-line workers, partner companies and external parties including local communities.

- **Talks between the management and front-line workers**
  A system that allows direct inputs from front-line workers to the management was developed by introducing talks with the President, i.e. the President exchanges views with the employees to visit the all offices, and face-to-face meetings with directors.

- **Bidirectional communication with contractor companies**
  To make partnership even stronger, talks with the President and Nuclear Division managers are arranged and questionnaires are sent out.

- **Door-to-door visits**
  - After the Mihama Unit 3 accident, the head of the Nuclear Div. and other company personnel visit door-to-door continuously in the host communities (Towns of Mihama, Ohi and Takahama).
  - We have visited about 7,000 houses/year for nine years to hear people's voices.

Various opinions and requests obtained through these activities will be used effectively for risk management.
Companywide support for nuclear division

1000 paper cranes contributed to the sites (2013.Jul)
- 1000 paper cranes and messages contributed to the Mihama, Takahama, and Ohi sites from Toyooka office

Messages for the sites (2013.Sep)
- Messages sent by 510 staffs in total from Wakayama branch and regional offices

Messages for Wakasa district (2012. Jun)
- Messages of encouragement from labor union Himeji district to Wakasa district

Companywide messages of encouragement raise the morale of staffs who belong to the nuclear division such as at the sites.
2. Risk Management at Kansai Electric Power
Risk management schemes

**Corporate governance**

- Shareholders' meeting
  - Report
  - Appointment, dismissal

- Board of directors (directors)
  - (decision-making and supervision on important management issues)
  - Proposal of discussion, report
  - Approval
  - Appointment, dismissal, supervision

- President
  - (executes operations according to the policy decided by the board of directors)

- Executive board
  - (discusses important issues related to the execution of operations)

- Committee Organization
  - [Planning Coordination/ Review/ Discussion]

- Each operations executive unit
  - (business divisions, internal control divisions and subsidiaries)

- Management audit office
  - (internal auditing)

- Risk Management Committee
  - Chair: VP
  - Members: VP, Managing Directors

- Operations executive units
  - Cross-cutting risk management issues

- Fields of risks
  - Information security
  - Safety and health
  - Market risks
  - Reliability of financial statements
  - Environment
  - Disaster
  - Compliance
  - Management control of subsidiaries

- Risk Management Committee
  - Report
  - Advice, guidance

- Business headquarters, etc.
  - Branch offices, etc.
  - Power stations, business offices, etc.

- Management audit office
  - Internal audit
  - Internal audit report

- Risk Management Committee
  - Report
  - Advice, guidance
① Six events which should not be let happen are set in the risk management table such as fatal and injury accidents and identification of risk is ordered for each division.

② Each division examines measures to be taken for identified risks and evaluates impacts and frequencies of risk based on standards.

③ Each division reports risks significant from the managerial point of view to the Risk Management Committee as results of evaluation.

④ Comprehensiveness of events related to risks and validity of evaluation are checked through hearings.

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### Risk Management Table

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<td>1. 災害事故</td>
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<td>2. 被害</td>
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<td>3. 業務中断</td>
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<td>4. 環境被害</td>
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<td>5. 信用影響</td>
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<td>6. 明確な経済影響</td>
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### Standards for comprehensive evaluation of risk

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<thead>
<tr>
<th>Impact</th>
<th>Degree of death or injury</th>
<th>Degree of societal impact</th>
<th>Degree of power shortage</th>
<th>Economic loss</th>
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### Frequency

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<th>Small</th>
<th>Medium</th>
<th>Large</th>
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<tr>
<td>Less than once in 20-30 years</td>
<td>Less than once a year, more than once in 20-30 years</td>
<td>More than once a year</td>
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### Degree of significance

<table>
<thead>
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<th>Degree of significance</th>
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Management of Nuclear Risks

Risk Study Group in the Nuclear Division (central control of risk in Nuclear Division)

Risk identification

- Bringing out voices of front-line workers through talks with the President and face-to-face meetings
- Identification and shared awareness of challenges through daily meetings including members from power plants and other divisions
- Communication with local people and hearing people's voices through door-to-door visits
- Active collection and use of domestic and overseas nuclear-related information
- Use of quality management systems (managerial review by the President) and others

Risk identification planning by the lead unit

Risk evaluation and review of countermeasures

- Risk assessment and countermeasure planning through discussion in the Nuclear Division
- Decision-making by executive board, board of directors, etc.
  - Reported to and discussed at the executive board periodically (monthly)
  - Company-wide management of nuclear risk with discussion in any time on promotion scheme for safety improvement and modifications important to safety, etc.
  - [Issues discussed at the executive board of the Nuclear Div.]

Risk assessment and countermeasure planning by the lead unit

Information sharing by managements

- Share and discuss nuclear risk flexibly at the meetings by the President and the Vice Presidents
- Share nuclear risk among managements at each section, branch office and front-line jobsite

Decision-making by executive board, board of directors, etc.

Information sharing by managements

- Daily management based on the Nuclear Division's annual plans or quality targets
- Evaluation and improvements
  - Confirmation of the handling policy of key risks.
  - Evaluation/review of the established countermeasures

Company

Risk Management Committee

Report

Advice, Instruction

Number of risk management cases
FY2011: 419/company, 50/Nuclear Div.
FY2012: 462/company, 57/Nuclear Div.
FY2013: 488/company, 60/Nuclear Div.
3. Improved risk management in light of the earthquake
3-1 Company-wide efforts
1. Each operations executive unit extends the range of postulated risks by enhancing measures against conventional risk events and responding to new risks.

2. Risk events that have not been postulated previously will be taken into consideration when each operations executive unit discusses countermeasures with the management.

- The number of events reviewed by the Risk Management Committee has increased about 15% since the earthquake

[Company: 419, Nuclear Div.: 50 in 2010 ⇒ Company: 488, Nuclear Div.: 60 in 2012]
1. Risks reported to the Risk Management Committee are categorized into 33 items of significant risks from the companywide perspective.

2. As to each significant risk, its impact and frequency are evaluated and its significance for management is judged and reported to the board of directors.

After the Fukushima accident, degrees of significant risks including those related to nuclear power have been raised based on related events which have occurred inside and outside the company.

- The risk for radiation leak accident has been identified as a risk with low frequency but large impact.
3–2 Efforts in Nuclear Division
It should be said that sensitivity to risk was not enough in view of the Fukushima Daiichi accident, although "radiation leak accidents, including severe accidents" has been positioned to be significant risk.

Reflection from the viewpoint of risk management

- We may not have been sufficient in considering severe accidents whose probability of occurrence is very low.
- We may not have been sufficiently conscious to improve safety beyond the statutory requirements.
- We may not have been sufficient in learning safety improvements from the world and making improvements voluntarily.

Main points of enhancing risk management

★ Securing safety by enhancing defense in depth (five layers) → Enhancement of countermeasures

★ Promotion of safety improvement beyond the regulatory framework → Enhancement of countermeasures

★ Enhancement of safety improvement activities by learning from the world → Responding to new risks
## Securing safety by enhancing defense in depth (five layers)

<table>
<thead>
<tr>
<th>Layer</th>
<th>Prevention of Abnormal Operation</th>
<th>Accident Management</th>
<th>Emergency Plan</th>
<th>Development of a nuclear emergency preparedness support center</th>
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<tbody>
<tr>
<td>1st</td>
<td>Prevention of Abnormal Operation</td>
<td></td>
<td></td>
<td>Hydrogen Igniter</td>
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<tr>
<td>2nd</td>
<td>Control of Abnormal Operation</td>
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<td>Permanent EDG</td>
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<tr>
<td>3rd</td>
<td>Mitigation of accident</td>
<td>Prevention of significant core damage</td>
<td></td>
<td>Base-isolated administration building</td>
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<tr>
<td></td>
<td></td>
<td>Prevention of core damage, Maintenance of CV integrity</td>
<td></td>
<td>Filtered venting system</td>
</tr>
<tr>
<td>4th</td>
<td>Prevention of large release, Prevention of CV failures (release suppression, diffusion mitigation)</td>
<td>Accident management measures for preventing core damage and containment failure by using normal equipment.</td>
<td>Measures against severe accidents - Deployment of heavy machinery for removing rubble, etc</td>
<td>Specific safety features</td>
</tr>
<tr>
<td>5th</td>
<td>Prevention of casualties, Environmental recovery</td>
<td>Emergency safety measures Securing power Securing cooling capability Measures against flooding</td>
<td>Enhancement of emergency preparedness systems</td>
<td>Air-cooled heat exchanger</td>
</tr>
</tbody>
</table>

### Before Fukushima Daiichi Accident (Red: Voluntary)
- Development of a nuclear emergency preparedness support center
- Hydrogen Igniter
- Permanent EDG
- Base-isolated administration building
- Filtered venting system
- Specific safety features
- Air-cooled heat exchanger
- SG alternative FW pump
- Middle pressure pump
- Fire protection measures
- Raising breakwater height

### After Fukushima Daiichi Accident
- Training, developing procedures and human resources
- Assign specialists for nuclear disaster countermeasures
- Establish a project team for severe accident countermeasures, etc.
Emergency Planning Including Systems and Staffing

**Emergency systems**

- **Head office’s headquarters**
  - Head: President (Give directions from Nuclear Division)
  - Nuclear Division: Early response center
  - Communications with staffs from the government
  - Information gathering and communications
  - Safety support
  - Support for mitigation measures

- **Offsite center headquarters**
  - Head: Director Assistant of Nuclear Division
  - Response to Joint Committee
  - Cooperation with related organizations

- **Onsite headquarters**
  - Head: Manager of the site
  - Communications
  - Severe accident measures
  - Restoration measures, etc.

- **Onsite supporting base**
  - Support for working units
  - Support for the site through goods delivery
  - Management of in and out

**Supporting systems by vendors and contract companies**

- **INSS** (Institute for Nuclear Safety Systems)
  - Emergency response support center
  - Mitsubishi emergency safety technologies center, etc.

- **Wakasa District**: 11 people
- **Kobe District**: approx. 400~500 people

- **Headquarters at Government of Japan, and local authorities**
  - Police, Firehouse, Coast Guard
  - Self-Defense Forces

- **Supporting staffs**
  - Approx. 150 people

- **Supporting systems by vendors and contract companies**
  - Contract company
  - Approx. 150 people

**Staffs needed for initial response**
- 54 people (onsite)

**Staffs needed for accident response**
- 160 people (approx. 2 hours later)

**Supporting systems by vendors and contract companies**

- 800 people in total

**Red**: Installed after the Fukushima accident
Establish a support system capable of providing diverse and advanced emergency response measures in the case of accidents even under high radiation based on lessons learnt through the Fukushima accident.

- The new organization will be responsible for the integrated management and operation of materials and equipment such as those used under high radiation.
- In January 2013, the Nuclear Emergency Support Center was set up in Tsuruga.
- The details of the organization are being discussed so as to establish the organization in FY2015.

### 1. Roles of the organization

- The support organization will support restoration activities by the relevant utility company under the directions of the company by jointly utilizing remote-controlled equipment such as robots, reconnaissance of the situation at the site, measurement of radiation levels, removing debris, etc. so as to minimize the radiation exposure of workers under high radiation due to nuclear disasters.

### 2. Materials and equipment (draft)

- Remote-controlled equipment
- Trucks for giving directions and for transportation of goods
- Equipment and materials for radiation protection, decontamination, etc.

### 3. Facilities of the organization (draft)

*Image of the facilities*
Take safety improvement measures voluntarily and continuously beyond the regulatory framework to achieve top level safety in the world.

- Before the Earthquake
  - Emergency Safety Measures (May 2011)
  - Ohi-3/4 Restart (July 2012)

- New Regulatory Requirements (July 2013)
  - Planned measures
    - Construction of tidal walls
    - New Regulatory Requirements
    - Installation of large-capacity pumps
    - Installation of air-cooled EDG
    - Installation of permanent EDG
    - Construction of a base-isolated administration building
    - Installation of passive autocatalytic hydrogen recombiner
    - Installation of Filtered Venting System
  - Implemented measures
    - Installation of hydrogen igniters
    - Installation of SG alternative FW pumps
    - Installation of air-cooled heat exchangers
  - Commitments that go beyond the new regulatory requirements
    - Securing an alternative command post
    - Facilities to handle specific severe accident, etc.
    - Fire protection
    - Arrangement of water spray equipment
    - Nuclear emergency preparedness support center

- Present Time
  - Undertake voluntary and continuous improvement of safety with PRA application

- Voluntary effort to improve safety and reliability
Enhancement of safety improvement activity by learning from the world

Kansai Electric Power
Coordination between the headquarters and power stations + Promotion of nuclear safety on a company-wide basis

JANSI (Japan Nuclear Safety Institute)

Domestic and Foreign Nuclear Vendors

INSS (Institute of Nuclear Safety System, Inc.)
- Institute of Social Research
- Institute of Nuclear Technology

INPO (Institute of Nuclear Power Operations)

WANO (The World Association of Nuclear Operators)

EPRI (Electric Power Research Institute)

Foreign Utilities

【Activities after Fukushima Daiichi Accident】
- Peer Reviews
  - Takahama (Nov. 2012)
  - Mihama (Jan. 2013)
  - Takahama (Aug. 2013)
- Technical Support Missions (TSM)
  - Restart after a long outage (Dec. 2012)
  - Emergency preparedness and severe accident (Feb. 2013)
- Participated in CEO Meetings
  - CEO Mtg. at Moscow (May 2013)
    (8 Japanese utility presidents participated)
  - Small CEO Mtg.* at Osaka (Sep. 2013)
    (11 Japanese utility presidents participated)
- Board of Directors Meetings
  - VP of Kansai (Feb. 2012)
  - President of Kansai (Sep. 2013)
- Chief Nuclear Officer (CNO) Meeting
    (11 Japanese utilities, 23 US utilities)
- Opinion exchange with EPRI CEO
  - President & VP of Kansai (Feb. 2012)
  - President & VP of Kansai (Apr. 2013)

*Small-scale CEO meetings are held by region.

Conclusion of information exchange agreements, etc.
[Before Fukushima Accident]
1 utility in Europe, 1 utility in the US
[After the accident]
1 utility in Europe is concluded, 1 European and 1 in the US are to be concluded
Top-management is important for enhancement of nuclear safety.

WANO’s small CEO meeting (2013 Sep)

- Mr. Regaldo, WANO’s Chairman and a CEO from each company participated and discussed.

JANSI’s CEO meeting (2013 Sep)

- Mr. Dale Klein, former Chairman of the NRC and a CEO from each company exchanged opinions.
Summary

○ The clarification of firm safety awareness and speedy decision-making by the top management is essential for the risk management of the nuclear power business.

○ Fostering a safety culture is reaffirmed as an important activity that is the basis for risk management.

○ In risk management, the risk sensitivity of organization is important to identify risk precursors from various indications, including communication with the frontline workers and results of PRA.

○ We will maintain our commitment to voluntary and continuously strengthen our risk management in the nuclear business on a company-wide basis.