IAEA-2012
ORIGINAL: English

IAEA
International Atomic Energy Agency
Atoms for Peace

IAEA MISSION TO REVIEW NISA'S APPROACH TO THE "COMPREHENSIVE ASSESSMENTS FOR THE SAFETY OF EXISTING POWER REACTOR FACILITIES" CONDUCTED IN JAPAN

Tokyo and Ohi, Japan

23 – 31 January 2012

IAEA MISSION REPORT

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY

INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA)
REPORT TO
THE GOVERNMENT OF JAPAN

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Mission date:	23 to 31 January 2012
Regulatory body:	Nuclear and Industrial Safety Agency
Location:	Tokyo and Ohi, Japan
Organized by:	International Atomic Energy Agency (IAEA)

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EXECUTIVE SUMMARY

To strengthen global nuclear safety, the IAEA Action Plan on Nuclear Safety asks Member States to undertake promptly an assessment of nuclear power plant (NPP) protections against site specific extreme natural hazards and to implement the necessary corrective actions in a timely manner.

At the request of the Government of Japan, the IAEA reviewed the Nuclear and Industrial Safety Agency's (NISA) approach to the *Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* and NISA's approach to the review of the results of the licensee's assessments. NISA issued its Instruction on *Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* in July 2011.

The IAEA safety review mission was conducted by a team of five IAEA and three international experts with support from IAEA public information and administrative staff from 23-31 January 2012. The mission consisted of meetings at NISA's offices in Tokyo and a visit to the Ohi Nuclear Power Station (NPS) that provided an example of how the Comprehensive Safety Assessment was being implemented by the licensee.

The scope of the IAEA mission covers the NISA review process of *the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* and uses the IAEA document *A Methodology to Assess the Safety Vulnerabilities of Nuclear Power Plants Against Site Specific Extreme Natural Hazards* and the associated IAEA Safety Standards to identify whether NISA's Comprehensive Safety Assessment process appropriately considers: external hazards, evaluation of safety margins, plant vulnerabilities and severe accident management.

The mission was divided into four areas:

- Regulatory Review and Assessment Process;
- External Hazards and Evaluation of Safety Margins;
- Plant Vulnerabilities against Station Blackout and Loss of Ultimate Heat Sink; and
- Severe Accident Management.

The first day of the mission was devoted to presentations by NISA on the instructions and review process of the Comprehensive Safety Assessment and by Kansai Electric Power Company (KEPCO) on the results of the Comprehensive Assessment for the Safety of Ohi Units 3 and 4. The mission team also presented its initial review comments and areas for additional discussion. The second and third days included detailed discussions and travel to Obama, Japan. The fourth day the team met with KEPCO officials and toured the Ohi NPS. The remainder of the mission was devoted to clarifying the issues and preparing the report. On the final day of the mission, the preliminary summary report was provided to the Director General of NISA and a press conference was held.

NISA explained the Comprehensive Safety Assessment process, which comprises a Primary and a Secondary Assessment, to the mission team. On 11 July 2011, the Chief Cabinet Secretary, the Ministrer of Economy, Trade and Industry (METI) and the Minister for the Restoration from and Prevention of Nuclear Accident issued a *Confirmation of the Safety of Nuclear Power Stations in Japan*. This document explains that the national Government will implement Comprehensive Safety Assessments utilizing the

stress tests as introduced in Europe for further ensuring safety and ensuring peace of mind. The results of the assessments will be confirmed by NISA and their validity will be further confirmed by the Nuclear Safety Commission (NSC). For the technical review of the assessments NISA receives support from the Japanese Nuclear Energy Safety Organization (JNES).

The Primary Assessment will inform the decision whether to restart operations at suspended NPPs and the Secondary Assessment will inform whether to continue or halt operations at operating NPPs. The Secondary Assessment is explained as being based on the stress tests in Europe and the deliberations of the *Investigation and Verification Committee on the Accidents at the Fukushima Nuclear Power Station (TEPCO).*

The distinction between Primary and Secondary Assessments was also explained. The Primary Assessment is to assess the degree of margin of safety. The Secondary Assessment is for the purpose of implementing an overall evaluation at all NPPs, including those that are currently in operation and also those that are subject to the Primary Assessment. NISA confirmed to the IAEA mission team that the Comprehensive Safety Assessments would be considered as completed when both the Primary and Secondary Assessments had been completed, reviewed and confirmed by NISA.

The Comprehensive Safety Assessments were conducted following the implementation of the emergency safety measures that were directed by METI on 30 March 2011. The emergency safety measures assume that an earthquake/tsunami causes the loss of all AC power and the loss of the ultimate heat sink. In addition, on 7 June 2011, METI directed the nuclear utilities to complete additional measures regarding the working environment in the Main Control Room, communications inside the NPP premises, protective gear for high-level radiation areas, measures to prevent hydrogen explosions and heavy equipment for removing rubble. The mission team observed some of the measures that were implemented at the Ohi NPS.

On 21 July 2011, NISA issued *Assessment Procedures and Implementation Plan the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* which sets out the expectations for licensees when undertaking the Comprehensive Safety Assessment. The nuclear utilities were informed of the NISA document via a letter on 22 July 2011. NISA has confirmed that it has received 15 Primary Assessments. NISA has started to review the submitted Primary Assessments, and the review of Ohi NPS Units 3 and 4 is at an advanced stage. In addition to the documents referred to above, the mission team received a draft copy of the NISA review of the Ohi NPS Primary Assessment upon arrival in Japan. This document, together with the visit to Ohi NPS, enabled the mission team to consider a practical example of a Primary Assessment and a NISA review.

The IAEA mission received excellent cooperation from all parties, receiving information from NISA, JNES, and KEPCO. The mission identified a number of good practices, and also made recommendations and suggestions to enhance the effectiveness of the Comprehensive Safety Assessments.

The conclusion of the team is that NISA's instructions and review process for the Comprehensive Safety Assessments are generally consistent with IAEA Safety Standards.

Good practices identified by the mission team are the following:

- Based on NISA instructions and commitments of the licensees, emergency safety measures were promptly addressed in NPPs in Japan following the accident on 11 March 2011;
- NISA conducted an independent plant walkdown of emergency measures implemented by the

licensee. This walkdown was appropriate and enhanced confidence that postulated actions could be performed;

- NISA demonstrated a notable level of transparency and interested party consultation related to the Comprehensive Safety Assessment and its review process; and
- By observing the European stress tests, NISA is demonstrating its commitment to further enhance nuclear safety by gaining experience from other countries.

The mission team identified issues that would enhance the overall effectiveness of the Comprehensive Safety Assessment process and further regulatory activities, and made the following recommendations:

- NISA should clarify its guidance regarding the expectations for conducting and reviewing Comprehensive Safety Assessments. The instructions can be improved by being more descriptive without being prescriptive, and by setting standard expectations;
- NISA should ensure that if any future actions by the licensees are needed for its safety decision, then they are documented and subjected to follow-up inspection as appropriate. Otherwise, NISA should confirm that interim measures are implemented prior to facility operation, as applicable;
- NISA should conduct meetings with interested parties near the nuclear facilities that are subject to Comprehensive Safety Assessment, in addition to those activities already undertaken;
- NISA should ensure that the definition of the safety margin capacity with appropriate confidence level is specified and communicated to the licensees;
- NISA should ensure that the seismic safety margin assessment includes the system walkdowns for checking completeness of the basic safety function success path, and the seismic/flood capability walkdowns for identification of interactions and collecting as-built and as-operated information to be used in safety margin calculations;
- NISA should ensure that in the Secondary Assessment the provisions for mitigation of severe accidents should be addressed more comprehensively. Such an assessment should form a basis for medium and long term implementation plans of the licensees; and
- In the medium and long term following the Comprehensive Safety Assessments NISA should require licensees to develop comprehensive accident management programmes in compliance with recently issued IAEA Safety Standards in the area of severe accident management.

In addition, the mission team had the following suggestions:

- NISA should seek to identify, document and implement lessons from the experience gained during early assessments and reviews to confirm or improve its guidance and to maximize consistency for subsequent reviews;
- NISA should ensure that the Secondary Assessments are completed, evaluated and confirmed by regulatory review with appropriate timescales;
- The effectiveness of safety improvements by implementation of the upgrades aimed to increase safety margin against seismic and tsunami hazards should be checked by conducting Seismic and Tsunami Probabilistic Safety Assessment using methodologies consistent with IAEA Safety Standards and international practice; and

- For the Secondary Assessment, NISA should consider closer integration of accident management and on-site emergency preparedness measures by verification of additional components, taking into account the relevant IAEA Safety Standards as well as lessons learned from the European stress tests.

1. BACKGROUND, OBJECTIVES AND SCOPE OF THE MISSION

1.1 BACKGROUND

To strengthen global nuclear safety, the IAEA Action Plan on Nuclear Safety encourages Member States to promptly undertake a national assessment of the design of nuclear power plants against site specific extreme natural hazards and to implement the necessary corrective actions in a timely manner.

The Government of Japan requested the IAEA to review the Nuclear and Industrial Safety Agency's (NISA) approach to the *Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* based on NISA's instruction and to review NISA's approach to the assessment of the results of the licensee's assessments.

NISA issued its Instruction on *Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* to the Japanese NPP licensees in July 2011. The Instruction requested Primary and Secondary Assessments. Currently the licensees are providing Primary Assessment reports to NISA.

1.2 OBJECTIVES

The objectives of the mission were:

- Review NISA's safety review process for the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities based on NISA's instruction; and
- Provide specific findings and recommendations on NISA's approach.

1.3 SCOPE

The scope covers the NISA review process of the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities and uses the IAEA document *A Methodology to Assess the Safety Vulnerabilities of Nuclear Power Plants against Site Specific Extreme Natural Hazards* and the associated IAEA Safety Standards to identify whether NISA's safety assessment process has the appropriate consideration of: external hazards, evaluation of safety margins, plant vulnerabilities and severe accident management.

2. CONDUCT OF THE MISSION

The mission was conducted by a team composed of five IAEA and three international experts with support from the IAEA public information and administrative staff.

The mission was conducted from 23 January through 31 January 2012. The mission consisted of meetings at NISA's offices in Tokyo and a visit to the Ohi NPS. The visit to Ohi NPS was to provide an example of how the NISA review process was being implemented by the licensees.

The first day of the mission was devoted to presentations by NISA on the instructions and review process of the Comprehensive Safety Assessment and by Kansai Electric Power Company (KEPCO) on the results of the Comprehensive Assessment for the Safety of Ohi Units 3 and 4. The mission team also presented their initial review comments and areas for additional discussion. The second and third days included detailed discussions and travel to Obama, Japan. The fourth day the Team met with KEPCO officials and toured the Ohi NPS. The remainder of the mission was devoted to clarifying the issues and preparing the report. On the final day of the mission, the preliminary summary report was provided to the Director General of NISA and a press conference was held.

The mission was divided into four areas:

- Regulatory Review and Assessment Process;
- External Hazards and Evaluation of Safety Margins;
- Plant Vulnerabilities against Station Blackout and Loss of Ultimate Heat Sink; and
- Severe Accident Management.

3. MAIN FINDINGS AND CONCLUSIONS

3.1 REGULATORY REVIEW AND ASSESSMENT PROCESS

3.1.1 Comprehensive Safety Assessment in Japan

The initiating requests and the scope of the Japanese Comprehensive Safety Assessments were presented to the mission team by NISA. The initiating document of relevance is a letter from the Nuclear Safety Commission to METI, 6 July 2011 stating that NISA should carry out comprehensive safety reviews of NPPs, and formulate and report to the NSC the methods of assessment and timetable.

A document from the Chief Cabinet Secretary, the Minister of Economy, Trade and Industry and the Minister for the Restoration from and Prevention of Nuclear Accident, 11 July 2011 explains that the national Government will implement safety assessments utilizing the stress tests as introduced in Europe for further ensuring safety and peace of mind. This document further explains that the Comprehensive Safety Assessments will be carried out by the licensees in accordance with the stipulated assessment items and implementation plan. It goes on to explain that the Primary Assessment will inform the decision whether to restart operations at suspended NPP and the Secondary Assessment will inform whether to continue or halt operations at operating NPP. The Secondary Assessment is explained as being based on the stress tests in Europe and the deliberations of the *Investigation and Verification Committee on the Accidents at the Fukushima Nuclear Power Station (TEPCO)*. The distinction between Primary and Secondary Assessments is also explained. The Primary Assessment is to assess the degree of margin of safety. The Secondary Assessment is for the purpose of implementing an overall evaluation at all NPPs, including those that are currently in operation.

The document from NISA, 21 July 2011 titled *Assessment Procedures and Implementation Plan Regarding the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities* sets out the expectations for licensees when undertaking the Comprehensive Safety Assessment. The licensees were informed of the NISA document via a letter on 22 July 2011.

NISA confirmed to the IAEA mission that the Comprehensive Safety Assessments would be considered as completed when both the Primary and Secondary Assessments had been reviewed and confirmed by NISA.

Upon arrival in Japan, the mission team received a draft copy of the NISA review of the Ohi NPS Primary Assessment. This document, together with discussions and the mission team tour of Ohi NPS, enabled the mission team to consider a practical example of a Primary Assessment and the associated NISA review.

Primary Assessment

The licensees were requested to undertake a Primary Assessment of the Comprehensive Safety Assessment as part of the process to restart operations. NISA informed the mission team that although this assessment was not a regulatory requirement, it was requested by the highest levels of Government and should therefore not be seen as voluntary or optional.

NISA has confirmed that it has so far received 15 Primary Assessments of Japanese nuclear facilities.

There are currently three teams (A, B and C) within NISA reviewing these Primary Assessments. Team A is at an advanced stage of reviewing the submission regarding Ohi NPS Units 3 and 4. To further aid consistency, teams B and C have been observing Team A's review process. The mission team was told by KEPCO staff that they are preparing further Primary Assessment reports regarding other units.

The guidelines for the NISA review of the Primary Assessments are described within a document titled *Review Perspective Related to Stress Tests (Primary Assessments)*, 14 November 2011. The NISA document is high level and no lower level detailed guidelines or advice has been offered for review to the IAEA mission team. NISA is of the opinion that their staff are highly experienced at undertaking safety reviews and therefore needed no further guidance. However, the mission team is of the opinion that, under the principle of continuous improvement, this guidance should be reviewed to learn from experiences gained by undertaking the review of the Ohi Primary Assessment.

The instruction provided by NISA to licensees in July 2011 is similarly of a high level. NISA explained that this was to encourage licensees to pursue optimal safety solutions, and that interactions between NISA and the licensees were aimed at clarifying expectations. However, the mission team has identified examples, which are explained elsewhere in this report, that indicate that this instruction may not provide sufficient detail.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GS-G-1.2, paragraph 4.2, states: *"The regulatory body should have a system to audit, review and monitor all aspects of its review and assessment process to ensure that it is being carried out in a suitable and efficient manner, and that any changes to the process necessitated by advances in knowledge or improvements in methods or for similar reasons are implemented."*
S1	**Suggestion:** NISA should seek to identify, document and implement lessons from the experience gained during early assessments and reviews to confirm or improve its guidance and to maximize consistency for subsequent reviews.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GSR Part 1, Requirement 22, paragraph 4.26, states, in part: *"The regulatory process shall be a formal process that is based on specified policies, principles and associated criteria, and that follows specified procedures as established in the management system. …In connection with its reviews and assessments and its inspections, the regulatory body shall inform applicants of the objectives, principles and associated criteria for safety on which its requirements, judgments and decisions are based."*
(2)	**Basis:** GSR Part 4, Requirement 16, states: *"Criteria for judging safety shall be defined for the safety analysis."*
R1	**Recommendation:** NISA should clarify its guidance regarding the expectations for conducting and reviewing Comprehensive Safety Assessments.

NISA Review of the Primary Assessment of Ohi NPS Units 3 and 4

The mission team was provided with the document *Review Report on the Comprehensive Assessment (Primary Assessment) of the Safety of Units 3 and 4 in Ohi NPS of the Kansai Electric Power Co., Inc.* (Draft), dated 18 January 2012. This provides NISA's summary of the results of their review of the licensee report submitted by KEPCO.

NISA describes within this document its approach for durability to earthquakes and tsunamis. It describes the site walkdown conducted to support NISA's assessment. It describes the licensee's actions to be taken without outside assistance and it discusses the future of safety improvements.

NISA concluded within this document "that KEPCO has implemented measures, for Ohi NPS Units 3 and 4, to prevent an accident similar to that at Fukushima Daiichi even if it is hit by an earthquake/tsunami of the safety scale as the one that hit Fukushima Daiichi and have made further efforts for safety improvement. NISA requests that KEPCO will continue such efforts without letup."

NISA repeatedly states in its review report that KEPCO will complete certain actions in the future. For example, unused pipe and hoses will be removed from the Darayama Tunnel by September 2012. Also, a protective fence will be installed by June 2012. There are additional examples in the report.

It was not clear to the mission team whether those actions are important to the statement made by NISA that KEPCO "has implemented measures for safety improvement." The assessment does not clearly specify what measures NISA relied upon to make its safety decision. It is the opinion of the mission team that any future measures that are relied upon for the safety decision should be controlled through commitments by the licensee and subjected to follow-up inspection as appropriate.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GSR Part 1, Requirement 31, states: *"In the event that risks are identified, including risks unforeseen in the authorization process, the regulatory body shall require corrective actions to be taken by authorized parties."*
R2	**<u>Recommendation</u>:** NISA should ensure that if any future actions by the licensees are needed for its safety decision, then they are documented and subjected to follow-up inspection as appropriate. Otherwise, NISA should confirm that interim measures are implemented prior to facility operation, as applicable.

The mission team was provided with the document *Regarding the Site Investigation Report of Ohi Power Station*, Material ST-6-1-9, dated 6 January 2012. A site investigation was conducted by NISA to verify the effectiveness and reliability of the protective measures discussed in the KEPCO primary assessment. NISA conducted a site walkdown on 26 December 2011. There were five members of NISA and six members of JNES on the walkdown. The mission team reviewed the qualifications of the staff members who participated and were of the opinion that the skill-set of those staff members was appropriate to the evaluation of emergency measures in KEPCO's submittal. NISA also reviewed tolerance levels of protective measures against earthquakes; the impact of tsunami on equipment; and confirmed the licensee's ability to conduct the assigned tasks.

With regard to the NISA documented review in Material ST-6-1-9, the mission team participated in a demonstration of many tasks associated with this review. During this demonstration the mission team learned that in addition to the matters discussed in Material ST-6-1-9, NISA requested the licensee consider other potential improvements to the licensee's procedures for emergency measures.

The mission team considered NISA's walkdown and questioning a good practice in reviewing the actual implementation of the plant safety measures.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GS-G-1.2, paragraph 3.63, states, in part: *"…the regulatory body should also verify claims made in the documentation, as a necessary part of the process, by inspections of the facility."*
G1	**Good Practice:** NISA conducted an independent plant walkdown of emergency measures implemented by the licensee. This walkdown was appropriate and enhanced the confidence that actions postulated by the licensee could be performed.

Secondary Assessment

The mission team considered that the Secondary Assessment is the process that aims to emulate the specification of the stress tests undertaken in Europe, and similarly aims to emulate the IAEA methodology document.

NISA has confirmed that they have received no reports regarding Secondary Assessments. Also, there have been no guidelines (similar to the 14 November 2011 document for Primary Assessments) developed for the NISA review of Secondary Assessments, as none are yet submitted. The NISA document issued to power companies stated that the target deadline for Secondary Assessments was for licensees to submit their reports by the end of the year (2011).

The mission team was told by NISA that it regards the Secondary Assessment as very important and NISA will continue to play its role in ensuring these assessments are conducted. Furthermore, although NISA may cease to exist shortly and this transition schedule is not yet decided, the importance of Secondary Assessments will remain unchanged. NISA further confirmed that it has the regulatory authority to compel licensees to perform safety reviews such as the Secondary Assessments.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** SSR-2/2, Paragraph 5.28, states: *"Events with safety implications shall be investigated in accordance with their actual or potential significance."*
S2	**Suggestion:** NISA should ensure that the Secondary Assessments are completed, evaluated and confirmed by regulatory review with appropriate timescales.

3.1.2 Transparency of the Comprehensive Safety Assessment

The mission team was informed by NISA that hearings have been undertaken regarding the Ohi NPS Primary Assessment. These hearings included many experts as well as observers and news organizations.

Openness is being achieved through the hearings process, supported by written questions and answers being publicly available on the website. The mission team was informed by NISA that the questions submitted to its website were compiled and common themes extracted for consideration. NISA has plans in place to report the outcome of their deliberations regarding these common themes, thereby closing the feedback loop to the submitted questions. Openness is further achieved by the publishing of licensee assessment reports and NISA review reports.

The mission team was informed by NISA that no hearings have been undertaken in the locality of the relevant NPPs. The mission team suggests that NISA consider undertaking hearings or public meetings in localities close to the NPPs under review to facilitate public engagement.

Transparency is being achieved by the open publication of the process to be followed by the licensees (Document from NISA, 21 July, titled *Assessment Procedures and Implementation Plan the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities*) as well as the process to be followed by NISA (*Review Perspective Related to Stress Tests (Primary Assessments)*).

The transparency of NISA during the hearings regarding their deliberations of the submitted Ohi NPS Primary Assessment report, together with the availability of a web page seeking public comment, enabled a wide range of stakeholders to comment. NISA plans to respond to these comments, or at least to the key themes of the comments.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GSR Part 1, Requirement 36, states: *"The regulatory body shall promote the establishment of appropriate means of informing and consulting interested parties and the public about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body."*
G2	**Good Practice:** NISA demonstrated a notable level of transparency and interested party consultation related to the Comprehensive Safety Assessment and its review process.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GSR Part 1, Requirement 36, paragraph 4.67, states, in part: *"In particular, there shall be consultation by means of an open and inclusive process with interested parties residing in the vicinity of authorized facilities and activities."*
R3	**Recommendation:** NISA should engage interested parties near the nuclear facilities that are subject to Comprehensive Safety Assessment, in addition to those activities already undertaken.

3.2 EXTERNAL HAZARDS, EVALUATION OF SAFETY MARGINS

Seismic and Tsunami Hazards Safety Margin Assessment

The seismic/tsunami safety margin assessment has the goal to determine the safety margin of NPPs and to verify the robustness of the design under current as-built and as-operating conditions relevant for such assessment. The IAEA has a number of safety standards that provides requirements and guidelines for conducting safety evaluations.

According to IAEA GSR Part 4 (Requirement 16), criteria for judging safety shall be properly addressed by the regulatory authority. Also all safety functions shall be specified and assessed, as required by GSR Part 4 (Requirement 7). IAEA NS-G-2.13 and IAEA methodology provides guidelines to meet these requirements, specifically for evaluation of safety margin for seismic and flood hazards.

NISA and the team understand that the seismic safety margin was evaluated by Japan's own approach within the Comprehensive Safety Assessment. While the Japanese approach is acceptable for determining seismic design basis, the current international methodology, also adopted by the IAEA, for determining the seismic safety margin is to use the High Confidence Low Probability of Failure (HCLPF) capacity. In this way the level of safety against seismic hazards will be measured in a consistent manner among all Japanese NPPs, and with appropriate confidence level.

As described earlier in this report, the NISA instructions for the comprehensive assessment concerning the seismic safety margin are at a high level only (see Recommendation R1). Also, the team's evaluation of NISA's review report of Ohi NPS concerning seismic/tsunami safety margin revealed some differences in comparison with IAEA Safety Standards and international practice. These differences are related to the following areas:

- Definition of the acceptable level of the safety margin by means of Review Level Earthquake/Tsunami (e.g. recurrence period 10,000 years). This implies the review of the seismic/tsunami hazard studies used to establish the design basis (IAEA, NS-G-2.13 SSG-9 and SSG-18) and on that basis to define acceptable safety margin.
- Selection of the structures systems and components (SSCs) needed to perform the main safety functions (success path) – applicable for both seismic and tsunami safety margin assessment. Verification of completeness of the success path equipment list by conducting specific systems walkdowns - applicable for both seismic and tsunami safety margin assessment.
- Definition of the safety margin capacity and required confidence level.
- Plant walkdowns represent a key activity in seismic/tsunami Safety Margin Assessment and are aimed for:
    - Collecting field information needed for seismic capacity calculations of SSCs and checking seismic interactions (specific seismic capability walkdowns).
    - Observing potential vulnerabilities and water path to areas where safety equipment are installed (flood/tsunami walkdowns).
- Criteria to be used for evaluation of the realistic seismic capacity of SSCs.

The safety relevance of the recommendation (below) is to ensure that seismic/tsunami safety margin capacities are defined with appropriate confidence level in compliance with IAEA Safety Standards and consistent with the applicable safety requirements. In other words the probability of losing one or more of the main safety functions due to seismic and/or tsunami hazards is acceptably low (consistent with the safety goal). IAEA guidelines for complying with the requirement supporting this recommendation are given in NS-G-2.13 and IAEA methodology.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GSR Part 4, Requirement 16: Criteria for judging safety, states: *"Criteria for judging safety, sufficient to meet the fundamental safety objective and to apply the fundamental safety principles as well as to meet the requirements of the designer, the operating organization and the regulatory body, have to be defined for the safety analysis"*
(2)	**Basis:** GSR Part 4, Requirement 17, states: *"Uncertainty and sensitivity analysis: Uncertainty and sensitivity analysis shall be performed and taken into account in the results of the safety analysis and the conclusions drawn from it."*
R4	**Recommendation:** NISA should ensure that the definition of the safety margin capacity with appropriate confidence level is specified and communicated to the licensee to be used in the Comprehensive Safety Assessment.

The following recommendation was provided to ensure completeness of the structures systems and components selected for the evaluation (Success Path) and factors that affect seismic and tsunami safety margin capacity are properly addressed (e.g. seismic interactions, relay chatter, anchorages check, water propagation, etc.) and as-built and as operated conditions have been properly considered in safety margin evaluation. IAEA guidelines for complying with the requirement supporting this recommendation are given in NS-G-2.13 and IAEA methodology.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** GSR Part 4, Requirement 7: Assessment of safety functions, paragraph 4.20, states: *"All safety functions associated with a facility or activity are to be specified and assessed. This includes the safety functions associated with the engineered structures, systems and components, any physical or natural barriers and inherent safety features as applicable, and any human actions necessary to ensure the safety of the facility or activity."*
R5	**Recommendation:** NISA should ensure that the seismic safety margin assessment includes the system walkdowns for checking completeness of the basic safety function success path, and the seismic/flood capability walkdowns for identification of interactions and collecting as-built and as-operated information to be used in safety margin calculations.

To confirm the safety improvement after implementation of the upgrading measures as a result of the Comprehensive Safety Assessment, it is suggested to perform Seismic/Tsunami Probabilistic Safety Assessment. Guidelines for supporting this suggestion are given in IAEA NS-G-2.13 and IAEA methodology.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**Basis:** A Methodology to Assess the Safety Vulnerabilities of Nuclear Power Plants against Site Specific Extreme Natural Hazards, paragraph 4.7, states: *"PSA is an integrated process whose end goal is to provide an estimate of the overall frequency of failure of a pre-determined plant level damage state, such as reactor CDF, or frequency of large releases."*
S3	**Suggestion:** NISA should consider requiring the licensees to confirm the effectiveness of safety improvements by conducting Seismic and Tsunami Probabilistic Safety Assessment (S-PSA and T-PSA) using methodologies consistent with IAEA Safety Standards and international practice.

3.3 PLANT VULNERABILITIES AGAINST STATION BLACKOUT (LOSS OF ALL AC POWER SOURCES) AND LOSS OF ULTIMATE HEAT SINK

In April 2011 NISA issued the instruction *Regarding Reliability Assurance of External Power Supply to Nuclear Power Stations and Reprocessing Facilities*. This instruction requested the installation of diverse back-up power supply sources and an evaluation of the reliability of the power supply to the facility. NISA's Instruction for the Primary Assessment defines station blackout (SBO) and loss of ultimate heat sink (LUHS) as the scenarios for analysis. In contrast, the IAEA methodology as well as the European stress test define the Loss of Offsite power and LUHS as the initial scenarios of analysis for assessing the robustness of the existing design provisions before making recommendations about additional emergency measures.

During the mission, potential issues on the overall approach of assessment were clarified with additional information that was provided by NISA, JNES, and KEPCO representatives. The team was provided information on NISA's review process for the Comprehensive Safety Assessment including: NISA's request for additional information from the licensee and evidence of iterations; Ohi NPS's Comprehensive Safety Assessment; NISA's draft review report; and the steps taken by NISA for ensuring adequacy, transparency, and completeness of the Comprehensive Safety Assessment and the associated NISA review.

The review team also visited Ohi NPS to observe demonstrations of some emergency safety measures as described in the Comprehensive Safety Assessment.

The team reviewing NISA's approach initially considered the instructions provided by NISA to be non-specific with respect to the event description, required information, and acceptance criteria when they are compared to those of the IAEA assessment method. NISA's stated intent in providing non-specific guidance was to encourage licensees to pursue optimal safety solutions supported by continuous dialogue with the licensee. The review team noted that instructions could be improved by being more descriptive. The more descriptive (but not prescriptive) specifications establishing expectations and review standards would be beneficial. This issue has been previously addressed (See Recommendation R1).

As a result of the review, the following issues related to NISA's guidance are noted:

- *Consideration of implications of loss of power supply or heat sink for confinement of radioactive materials*

The IAEA methodology examines the impact of loss of power supplies and ultimate heat sink on the plant fundamental safety functions, one of which is the confinement of radioactive material. Therefore, the assessment of SBO and LUHS scenarios should consider the implications for confining the radioactive materials after the onset of fuel damage for the severe accident management. NISA has indicated that potential implications of the loss of power supply or ultimate heat sink would be taken into account in the area of severe accident management analysis (Section 3.4).

- *Analysis of design robustness, potential vulnerabilities, mitigation actions, and recommendation of measures for improvement.*

NISA's instruction defines SBO as the scenario to be analyzed. This approach does not credit initially existing design features such as multiplicity of external lines, provisions for isolated operation of the plant, system redundancy, diversity, physical separation, and measures that go beyond the strict compliance with standards and regulations to prevent a SBO or enable recovery from loss of offsite power. It is common international practice in the stress test assessments to demonstrate first the robustness of the design provisions by describing external sources, emergency power generation, and back up sources, particularly in multiunit sites, for reducing the likelihood of station blackout scenarios. It would be beneficial to place more emphasis in highlighting the robustness of the existing design features in addition to assessing the capabilities of the newly installed back up emergency measures.

- *Use of PSA models for the analysis of impact of SBO and LUHS on main safety functions*

NISA's instruction requires the licensees to take into account the knowledge gained from the PSA for internal events for identifying the progress of SBO event up to any significant damage to the fuel. NISA indicated that the PSA models, as in the case of Ohi NPS, are not being directly used by the licensees in the assessment, but only PSA event trees to analyze the progress of accidents starting from loss of power supply or heat sink. NISA clarified that the use of PSA is limited to the elaboration of such event tree models. In cases where the plant PSA does not include some scenario under consideration, for instance the analysis of spent fuel pools, new event trees have been specifically developed for the Comprehensive Safety Assessment.

- *Identification of limiting situations (cliff edge effects)*

NISA's instruction is not explicit with regard to the definition and identification of cliff edge effects. In the case of Ohi NPS, the identification of cliff edge effects appears to have been properly conducted. However, to promote consistency from various licensees, NISA should consider standardizing its expectations.

The team reviewed and discussed with NISA the review of identification, verification, and change control of design. NISA explained that existing facility design was previously reviewed and approved in accordance with the applicable design criteria. Similarly, NISA stated that any new plant changes are controlled by the existing regulations with respect to impact on the existing design.

The review team acknowledged the important efforts made in establishing the emergency safety measures in this area, such as the additional emergency power supplies and water sources. The functionality of some of these measures was demonstrated during the site visit.

3.4 SEVERE ACCIDENT MANAGEMENT

Regulatory Instructions on the Scope of Assessment of Accident Management within the Stress Tests

The scope of the assessment of the severe accident management was outlined in the NISA instruction *Assessment Procedures and Implementation Plan Regarding the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities Taking into Account the Accident at Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co. Inc.* (21 July 2011), with reference made to the document *Accident Management for Severe Accidents in Light Water Power Reactor Installations* published by the Nuclear Safety Commission (NSC) in May 1992, as revised in 1997. The instruction requested for the secondary assessment to identify cliff edges in accident management measures, specify time margins until the cliff edges and assess effectiveness of both hardware as well as software countermeasures to prevent cliff edges. The scope of the work to be performed within the stress tests was further clarified in subsequent communications with the licensees. This process resulted in a reasonable scope of the assessment as it was demonstrated by an example of the licensee's report for the Ohi NPS Units 3 and 4. Nevertheless in order to ensure consistency of all future reports by different licensees and to extend the scope of the assessment into the area of mitigative severe accident management, it seems appropriate that for the secondary assessment NISA issues more detailed guidelines taking into account lessons learned from the primary assessment (see more general recommendation in section 3.1 of this mission report).

Scope of Accident Management Covered by the Stress Tests

In the instruction of 21 July 2011, NISA indicated the scope of the measures within the stress tests as those for prevention of significant damage to the fuel as well as for maintaining the integrity of containment functions to prevent the large scale release of radioactive material. Consideration of accident conditions for all units at a given site was postulated for the stress tests.

As it was shown in the licensee's report on the Primary Assessment for Ohi NPS, attention was primarily devoted to the hardware and software measures aimed at prevention of accidents caused by earthquakes and tsunami and their progression into a phase with severely damaged fuel in the reactor core as well as in the spent fuel pool. Effectiveness of the preventive measures was thoroughly analyzed for twelve different initiating events with conservatively postulated subsequent failures of plant provisions. NISA's *Review Report on the Comprehensive Assessment (Primary Assessment) of the Safety of Units 3 and 4 in Ohi Power Station of the Kansai Electric Power Co., Inc.* demonstrated that the efforts resulted in identification and elimination of the cliff edges and significant extension of the coping time following the earthquakes and tsunami, including those potentially leading to the station blackout and loss of the ultimate heat sink. In addition to the assessment of existing plant systems, additional "emergency safety measures" were identified, such as deployment of power supply vehicles necessary to cool reactors and spent fuel pools, and deployment of coolant by fire engines, together with associated operating procedures and emergency response training. Implemented safety measures are applicable also for strategies for maintaining containment integrity, such as alternative containment gas-phase cooling (spraying by means

of fire engines), containment natural convection cooling, and prevention of the hydrogen explosion outside the primary containment.

Nevertheless, in order to ensure full consistency with the IAEA methodology in the Secondary Assessment of the stress tests in Japan it is necessary to cover more comprehensively the fulfillment of the safety functions and identification of challenges to the containment integrity for later stages of the severe accidents, following major damage of the reactor core and relocation of molten corium into containment, in spite of extremely low likelihood of such scenario. In particular, the feasibility and effectiveness of the following mitigative strategies should be more comprehensively covered: reliable depressurization of the reactor coolant system, long-term containment isolation, molten corium stabilization either in the reactor pressure vessel or in the containment, hydrogen mitigation inside the primary containment taking into account not only in-vessel hydrogen sources but also potential decomposition of containment materials due to molten corium attacks, and possible over pressurization of the containment by non-condensable gases. Potential for occurrence of a severe accident in the spent fuel pool and possibilities for its mitigation should be addressed as well. Although the provisions for mitigation of severe accidents are currently out of regulation scope in Japan as well as in many IAEA Member States, in view of lessons learned from the Fukushima accident, they should be considered in the assessments of coping with severe accidents. Implementation of the corresponding mitigation measures should become part of the medium and long term programme of the licensees.

In future updating of the Japanese requirements on accident management it is also advisable to consider the capability of the hardware measures to resist the environmental conditions resulting from the external hazards and also to consider to the reasonable extent independence of such measures on those applicable at lower levels of defense in depth.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**BASIS:** GSR Part 1, Requirement 31, states: *"In the event that risks are identified, including risks unforeseen in the authorization process, the regulatory body shall require corrective actions to be taken by authorized parties."*
(2)	**BASIS:** SSR 2/2, paragraph 5.9, states: *"Arrangements for accident management shall provide the operating staff with appropriate systems and technical support in relation to beyond design basis accidents…."*
(3)	**BASIS:** NS-G-2.15, paragraph 2.12, states: *"In view of the uncertainties involved in severe accidents, severe accident management guidance should be developed for all physically identifiable challenge mechanisms for which the development of severe accident management guidance is feasible; severe accident management guidance should be developed irrespective of predicted frequencies of occurrence of the challenge."*
R6	**Recommendation:** NISA should ensure that in the Secondary Assessment the provisions for mitigation of severe accidents should be addressed more comprehensively. Such an assessment should form a basis for medium and long term implementation plans of the licensees.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**BASIS:** GSR Part 1, paragraph 3.4, states: *"The regulatory body shall require appropriate corrective actions to be carried out to prevent the recurrence of safety significant events."*
G3	**Good practice:** Based on NISA instructions and commitments of the licensees, feasible accident management measures were promptly implemented in nuclear power plants in Japan and their effectiveness was verified by NISA through independent assessment and plant walkdowns.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**BASIS:** GSR Part 1, Requirement 15, states: *"The regulatory body shall make arrangements for analysis to be carried out to identify lessons to be learned from operating experience and regulatory experience, including experience in other States, and for the dissemination of the lessons learned and for their use by authorized parties, the regulatory body and other relevant authorities."*
G4	**Good practice:** By observing the European stress tests NISA is demonstrating its commitment for further enhancing nuclear safety by sharing experiences with other countries.

Procedures and Guidelines for Accident Management

In accordance with the IAEA Safety Standards, in particular safety requirements for operation of NPPs (SSR-2/2) an accident management programme shall be established for dealing with beyond design basis accidents including severe accidents. The details of the accident management programme are outlined in the IAEA Safety Standard NS-G-2.15. The programme should consist of the preventive domain covered by the Emergency Operating Procedures (EOPs), and of the mitigative domain, covered by the Severe Accident Management Guidelines (SAMGs), with adequately specified entry and exit symptoms and transition between both domains.

In accordance with NISA instructions of 21 July 2011, the Comprehensive Safety Assessments in Japan should also address relevant operating procedures and guidelines. As stated by Ohi NPS in the review report and demonstrated during the site visit in Ohi NPS, the NPPs in Japan seem to have symptom based EOPs adequately composed of both scenario independent and scenario dependent procedures. In connection with the stress tests and implementation of additional emergency safety measures, these procedures were updated accordingly. Development of SAMGs is not currently required by the existing Japanese legislation, but certain components of the SAMGs were prepared as well.

However, in order to achieve full compliance with the IAEA Safety Standards, in the future a comprehensive accident management programme should be systematically developed fully covering the stage of mitigation of severe accidents until achieving a long-term stable state. The programme should cover instructions for utilization of any available equipment (including instrumentation) and the technical and administrative measures to mitigate the consequences of an accident as well as organizational arrangements, communication networks and training necessary for the implementation of the programme. Possible damage of fuel both in the reactor core and in the spent fuel pool should be considered.

Arrangements for accident management shall provide the operating staff with appropriate systems and technical support with additional consideration for long term actions within the emergency response arrangements.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**BASIS:** SSR-2/2, Requirement 19, states: *„The operating organization shall establish an accident management programme for the management of beyond design basis accidents."*
(2)	**BASIS:** NS-G-2.15, paragraph 2.6, states: *"At the top level, the objectives of accident management are defined as follows:* … *—Maintaining the integrity of the containment as long as possible;* *—Minimizing releases of radioactive material;* *—Achieving a long term stable state.* *To achieve these objectives, a number of strategies should be developed."*
R7	**Recommendation:** In the medium and long term following the stress tests NISA should require the licensees to develop comprehensive accident management programmes in compliance with recently issued IAEA Safety Standards in the area of severe accident management.

Organization and Arrangements to Manage Accidents

The IAEA Safety Guide NS-G-2.15 requires among the important elements in development of an accident management programme the integration of the accident management programme within the emergency arrangements for the plant. The need for broader considerations of accident management are also reflected in the IAEA methodology for assessment of NPP vulnerabilities against site specific extreme natural hazards as well as in specification of the scope of the European stress tests.

Such considerations should include in particular:

- Organization of the operators to manage the accident;
- Possibility to use existing equipment; and
- Evaluation of factors that may impede accident management and respective contingencies.

More details on the above list can be found in the *Post-Fukushima "Stress tests" of European Nuclear Power Plants – Contents and Format of National Reports*, ENSREG, 3 October 2011.

Importance of the overall arrangements was also recognized in Japan in the instructions issued by NISA directing each electric utility to implement the following items:

- Secure the working environment in the main control room;
- Secure the means of communication inside the nuclear power plant premises in case of emergency;
- Secure supplies and equipment such as high-level radiation protective gear, and develop a system

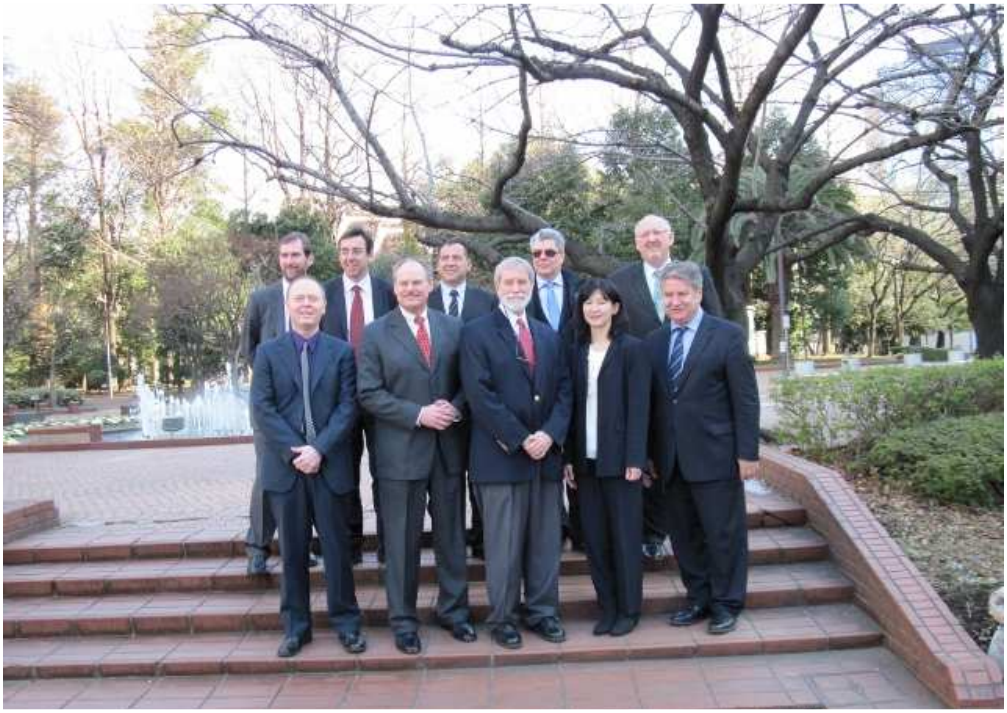
for radiation dose management;

- Establish measures to prevent hydrogen explosion; and
- Deploy heavy machinery for removing rubble.

Attention paid by NISA to these issues was demonstrated in the document *Regarding Verification Results of the State of Implementation of Preparatory Measures for Response to Severe Accidents in Other NPSs Taking into Account the Accident at Fukushima Dai-ichi NPS Verification* issued by NISA on 18 June 2011 and confirmed by the *Review Report on the Comprehensive Assessment (Primary Assessment) of the Safety of Units 3 and 4 in Ohi Power Station of the Kansai Electric Power Co. Inc*. Many suggested considerations listed above were adequately addressed by the Comprehensive Safety Assessments of the NPPs in Japan, as also demonstrated during the exercises observed by the IAEA team during the Ohi NPS visit.

Nevertheless it is recommended to compare thoroughly the components of the organization and arrangements to manage accidents expressed in the IAEA Safety Requirements GS-R-2 and SSR-2/2, IAEA Safety Guide NS-G-2.15 and *A Methodology to Assess the Safety Vulnerabilities of Nuclear Power Plants against Site Specific Extreme Natural Hazards* with the scope of the Comprehensive Safety Assessments in Japan and if found appropriate, to adjust the scope of the Secondary Assessment accordingly.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
(1)	**BASIS:** SSR-2/2, paragraph 5.8, states: *"… The accident management programme shall also include organizational arrangements for accident management, communication networks and training necessary for the implementation of the programme."*
(2)	**BASIS:** SSR-2/2, Requirement 18, states: *"The operating organization shall prepare an emergency plan for preparedness for, and response to, a nuclear or radiological emergency"*, with further details given in paragraph 5.2-5.7.
(3)	**BASIS:** NS-G-2.15, paragraph 3.8, states: *"Additional important elements that should be considered in the development of an accident management programme include: … (4) Integration of the accident management programme within the emergency arrangements for the plant;…"* with further guidance provided throughout the document.
S4	**<u>Suggestion</u>:** For the Secondary Assessment, NISA should consider closer integration of accident management and on-site emergency preparedness measures by verification of additional components, taking into account the relevant IAEA Safety Standards as well as lessons learned from the European stress tests.



APPENDIX I – LIST OF PARTICIPANTS

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IAEA STAFF MEMBERS:		
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7. MAKOVICKY, Kyoko	Project Assistant International Seismic Safety Centre (ISSC) / NSNI	K.Makovicky@iaea.org

APPENDIX II – MISSION PROGRAMME

Sunday, 22 January 2012		**VENUE**
16:00 – 19:00	Opening team meeting	IAEA Office
Monday, 23 January 2012		
09:30 – 17:30	➢ Official opening meeting ➢ NISA's presentation on the NISA instruction on comprehensive assessment ➢ Presentation by NISA on its review and assessment process to evaluate the comprehensive assessment results ➢ IAEA Review Team's presentation of the preliminary review comments on NISA's instruction for the comprehensive assessments ➢ Presentation by KEPCO on the stress test of Ohi NPS unit 3 and 4 ➢ Summary of NISA's assessment of the results of the licensee's assessment ➢ Questions and answers	NISA
17:30 - 18:00	Press interview	NISA
Tuesday, 24 January 2012		
09:00 – 19:30	Technical discussion in two groups: External Hazards / SBO, LUHS and SAM	NISA
Wednesday, 25 January 2012		
09:00 – 11:00	Clarification and discussions with NISA/JNES on review process	NISA
11:30 – 18:30	Travel to Obama-shi/Fukui	
20:30 – 22:00	Team discussion	HOTEL
Thursday, 26 January 2012		
09:00 – 10:00	➢ Opening speech by IAEA/NISA/KEPCO ➢ KEPCO's presentation on the schedule for the site visit ➢ NISA's presentation on its inspections at the site and its input to the review and assessment	Ohi NPS
10:30 – 15:00	Field observation in two groups: Seismic and Tsunami / SBO, LUHS and SAM	Ohi NPS
15:00 – 16:00	Plenary meeting	Ohi NPS
16:00 – 16:30	Press interview	Ohi NPS
16:30 – 22:30	Return to Tokyo	

Friday, 27 January 2012		
09:00 – 12:00	Meeting with NISA	NISA
13:00 – 16:00	Team discussion on report	IAEA Office
16:00 – 19:00	Report writing by each expert	HOTEL
21:00 – 01:30	Report compilation	HOTEL
Saturday, 28 January 2012		
09:00 – 19:00	Team discussion on draft report	IAEA Office
19:00	Submission of draft summary report to NISA	IAEA Office
Sunday, 29 January 2012		
08:30 – 21:30	Team discussion on draft report	IAEA Office
17:30	Submission of revised summary report to NISA	IAEA Office
21:30	Submission of draft full report to NISA	IAEA Office
Monday, 30 January 2012		
10:00 – 12:00	Discussions on report with NISA/JNES	NISA
14:00 – 16:00	Review of summary report	IAEA Office
Tuesday, 31 January 2012		
10:30 – 11:00	Handover of summary report to DG-NISA	NISA
11:30 – 12:30	Press conference	Foreign Press Center

APPENDIX III – LIST OF COUNTERPARTS

NUCLEAR AND INDUSTRIAL SAFETY AGENCY (NISA):	
Mr. KUROKI, Shinichi	Deputy Director-General for Nuclear Power
Mr. NAKAMURA, Koichiro	Deputy Director-General for Nuclear Safety
Mr. ICHIMURA, Tomoya	Director, Nuclear Safety Regulatory Standard Division
Mr. TAGUCHI, Tatsuya	Assistant Director, Nuclear Safety Regulatory Standard Division
Mr. URANO, Munekazu	Director for Safety Examination
Mr. NAGAE, Hiroshi	Safety Examiner
Mr. NAGURA, Shigeki	Safety Examiner
Mr. SUGIHARA, Yutaka	Safety Examiner
Mr. SATO, Yuichi	Section Chief
JAPAN NUCLEAR ENERGY SAFETY ORGANIZATION (JNES):	
Mr. HIRANO, Masashi	Associate Vice-President
Mr. EBISAWA, Katsumi	Associate Vice-President
Mr. SATO, Shohei	Director-General, Nuclear Energy System Safety Division
Mr. YAMASHITA, Masahiro	Deputy Director-General, Nuclear Energy System Safety Division
Mr. OGURA, Katsunori	Senior Counselor, Nuclear Energy System Safety Division
Mr. FUJIMOTO, Haruo	Director, Probabilistic Safety Assessment Group, Nuclear Energy System Safety Division
Mr. OGINO, Masao	Principal Staff, Severe Accident Evaluation Group, Nuclear Energy System Safety Division
Mr. ASAKA, Hideaki	Senior Officer, Thermal Hydraulics Evaluation Group, Nuclear Energy System Safety Division
Mr. UCHIDA, Tsuyoshi	Senior Officer, Probabilistic Safety Assessment Group, Nuclear Energy System Safety Division
Mr. HORINO, Satoshi	Director-General, Seismic Safety Division
Mr. TAKAMATSU, Naotaka	Deputy Director-General, Seismic Safety Division
Mr. FUKUNISHI, Shiro	Assistant Director-General, Seismic Safety Division
Mr. SUZUKI, Kenichi	Assistant Director-General, Seismic Safety Division

Mr. MOTOHASHI, Shohei	Senior Counselor
Mr. IIJIMA, Toru	Director, Equipment and System Evaluation Group, Seismic Safety Division
Mr. MAEKAWA, Yukinori	Deputy Director-General, Policy Planning and Coordination Division
Mr. NAKAGAWA, Masaki	Director, Emerging Nations Training Center, Office of International Programs
Mr. YAMAMOTO, Yoshio	Senior Staff, International Cooperation Group, Office of International Programs
Ms. YANAGISAWA, Miyuki	Chief, Planning Group, Office of International Programs
KANSAI ELECTRIC POWER CO., INC. (KEPCO):	
Mr. URATA, Shigeru	Chief Manager, Nuclear Safety Engineering Group
Mr. YOSHIHARA, Kensuke	Manager, Nuclear Accident Management
Mr. TAKAGI, Hiroaki	Manager, Nuclear Power Generation Group

APPENDIX IV – RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

AREA	R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
1. REGULATORY REVIEW AND ASSESSMENT PROCESS	S 1	**Suggestion:** NISA should seek to identify, document and implement lessons from the experience gained during early assessments and reviews to confirm or improve its guidance and to maximize consistency for subsequent reviews.
	R 1	**Recommendation:** NISA should clarify its guidance regarding the expectations for conducting and reviewing Comprehensive Safety Assessments.
	R 2	**Recommendation:** NISA should ensure that if any future actions by the licensees are needed for its safety decision, then they are documented and subjected to follow-up inspection as appropriate. Otherwise, NISA should confirm that interim measures are implemented prior to facility operation, as applicable.
	G 1	**Good Practice:** NISA conducted an independent plant walkdown of emergency measures implemented by the licensee. This walkdown was appropriate and enhanced the confidence that actions postulated by the licensee could be performed.
	S 2	**Suggestion:** NISA should ensure that the Secondary Assessments are completed, evaluated and confirmed by regulatory review with appropriate timescales.
	G 2	**Good Practice:** NISA demonstrated a notable level of transparency and interested party consultation related to the Comprehensive Safety Assessment and its review process.
	R 3	**Recommendation:** NISA should engage interested parties near the nuclear facilities that are subject to Comprehensive Safety Assessment, in addition to those activities already undertaken.

AREA	R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
2. EXTERNAL HAZARDS, EVALUATION OF SAFETY MARGINS	R 4	**Recommendation:** NISA should ensure that the definition of the safety margin capacity with appropriate confidence level is specified and communicated to the licensee to be used in the Comprehensive Safety Assessment.
	R 5	**Recommendation:** NISA should ensure that the seismic safety margin assessment includes the system walkdowns for checking completeness of the basic safety function success path, and the seismic/flood capability walkdowns for identification of interactions and collecting as-built and as-operated information to be used in safety margin calculations.
	S 3	**Suggestion:** NISA should consider requiring the licensees to confirm the effectiveness of safety improvements by conducting Seismic and Tsunami Probabilistic Safety Assessment (S-PSA and T-PSA) using methodologies consistent with IAEA Safety Standards and international practice.
3. SEVERE ACCIDENT MANAGEMENT	R 6	**Recommendation:** NISA should ensure that in the Secondary Assessment the provisions for mitigation of severe accidents should be addressed more comprehensively. Such an assessment should form a basis for medium and long term implementation plans of the licensees.
	G 3	**Good Practice:** Based on NISA instructions and commitments of the licensees, feasible accident management measures were promptly implemented in nuclear power plants in Japan and their effectiveness was verified by NISA through independent assessment and plant walkdowns.
	G 4	**Good Practice:** By observing the European stress tests NISA is demonstrating its commitment for further enhancing nuclear safety by sharing experiences with other countries.

AREA	R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
3. SEVERE ACCIDENT MANAGEMENT	**R 7**	**<u>Recommendation</u>:** In the medium and long term following the stress tests NISA should require the licensees to develop comprehensive accident management programmes in compliance with recently issued IAEA Safety Standards in the area of severe accident management.
	S 4	**<u>Suggestion</u>:** For the Secondary Assessment, NISA should consider closer integration of accident management and on-site emergency preparedness measures by verification of additional components, taking into account the relevant IAEA Safety Standards as well as lessons learned from the European stress tests.

APPENDIX V –NISA/JNES/KEPCO REFERENCE MATERIAL USED FOR THE REVIEW

1	Presentation: Briefing Material for IAEA Review Mission Regarding Stress Tests (Jan 23, 2012, NISA)
2	Appendix 1: Request to the NISA to report on Comprehensive Safety Review of Existing Nuclear Power Plants Based on the Lessons Learnt from the Fukushima Dai-ichi NPS Incident (July 6, 2011, Nuclear Safety Commission)
3	Appendix 2: Confirmation of the Safety of Nuclear Power Stations in Japan (Introduction of safety assessments using stress tests as a source of reference, etc.) (July 11, 2011)
4	Appendix 3: Assessment Procedures and Implementation Plan Regarding the Comprehensive Assessments for the Safety of Existing Power Reactor Facilities Taking into Account the Accident at Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co. Inc. (July 21, 2011, NISA)
5	Appendix 4: Regarding the Implementation of Comprehensive Assessments for the Safety of Existing Power Reactor Facilities Taking into Account the Accident at Fukushima Dai-ichi Nuclear Power Station, Tokyo Electric Power Co. Inc. (Direction) (July 22, 2011, NISA)
6	Appendix 5: Hearings Regarding the Comprehensive Assessment for the Safety of Nuclear Power Reactor Facilities
7	Appendix 6: Progress of Stress Test (NISA Website)
8	Appendix 7: Opinions of the Committee members and Insights about the Opinions
9	Appendix 8: Comments on the Stress Test (Mr. Hiromitsu Ino)
10	Appendix 9: Review Perspective Related to Stress Tests (Primary Assessment) (Draft)
11	Appendix 10: Report of the Result of Comprehensive Assessments for Safety of Ohi unit 3 Taking into Account the Accident at Fukushima Dai-ichi Nuclear Power Plant (Preliminary Assessments) (October 2011, The Kansai Electric Power Co., Inc.)
12	Appendix 11: List of Major Issues in Assessment of Comprehensive Assessment for the Safety of Nuclear Power Reactor Facilities
13	Appendix 12: Regarding the Site Investigation Report of Ohi Power Station
14	Appendix 13: Review Report on the Comprehensive Assessment (Primary Assessment) of the Safety of Units 3 and 4 in Ohi Power Station of The Kansai Electric Power Co., Inc. (Draft) (January 18, 2012, NISA)
15	Appendix 14: Outline of Additional Questions to Operators and Actions Taken by Operators
16	Comprehensive Safety Assessments of Nuclear Power Reactor Facilities (July 2011, NISA)
17	"Background and history (Major events for AM)", submitted to OECD/NEA Workshop on Implementation of Severe Accident Management Measures (ISAMM-2009) in Bottstein, Switzerland, on October 26-28, 2009, entitled as "Circumstances and Present Situation of Accident management Implementation in Japan"
18	Accident Management for Severe Accidents at Light Water Power Reactor Installations (NSCRG: L-AM-II.01, NSC, May 1992)
19	Article 19(4), Procedures for responding to operational occurrences and accidents (Government of Japan, reported to Convention on Nuclear Safety National Report of Japan for the Fifth Review Meeting, September 2010)
20	Measures against Severe Accidents at Light Water Nuclear Power Reactor Facilities (NSC, October 20, 2011)
21	Regarding the Implementation of Emergency Safety Measures for the Other Nuclear Power Stations considering the Accident of Fukushima Dai-ichi and Dai-ni Nuclear Power Stations (March 30, 2011, NISA)

22	Regarding Reliability Assurance of External Power Supply to Nuclear Power Stations and Reprocessing Facilities (April 15, 2011, NISA)
23	Regarding the Confirmed Results for the Implementation of the emergency safety measures for other Nuclear Power Stations Based on the Accident in Fukushima Dai-ichi Nuclear Power Station (May 6, 2011, NISA)
24	Regarding Implementation of Preparatory Measures for Severe Accidents in Other NPSs Taking into Account the 2011 Accident at Fukushima Dai-ichi NPS of Tokyo Electric Power Co. Inc. (June 7, 2011, NISA)
25	Regarding Verification Results of the State of Implementation of Preparatory Measures for Response to Severe Accidents in Other NPSs Taking into Account the Accident at Fukushima Dai-ichi NPS (June 18, 2011, NISA)
26	Exposure Paths for Main Control Room Habitability Assessment
27	Ageing Management of Nuclear Power Plants
28	KEPCO's answer to the question from NISA and JNES; questions at the hearing for the review on the stress test report of KEPCO Ohi units 3 and 4
29	Safety of Ohi Nuclear Power Plant Unit 3&4 (KEPCO)
30	Pamphlet (Ohi Nuclear Power Station) (KEPCO)
31	Schedule for IAEA’s Site Verification Visit to Ohi NPS (KEPCO)
32	Ohi Power Station guide route (Earthquake- and tsunami- proof related) (KEPCO)
33	Ohi Power Station guide route (SBO related) (KEPCO)
34	Notice in the premises of the nuclear power plant (KEPCO)
35	Walkdown in Stress Tests (KEPCO)
36	Questions List (from IAEA 1/26 AM) (KEPCO)
37	Personnel and activity items for station blackout (at the time of coincidence of an earthquake and tsunami) (KEPCO)
38	Method and result of setting the acceleration obtained from functional tests of the inverter panel (KEPCO)

APPENDIX VI – IAEA REFERENCE MATERIAL USED FOR THE REVIEW

1	INTERNATIONAL ATOMIC ENERGY AGENCY, Review and Assessment of Nuclear Facilities by the Regulatory Body, IAEA Safety Guide No. GS-G-1.2, IAEA, Vienna (2002)
2	INTERNATIONAL ATOMIC ENERGY AGENCY, Regulatory Inspection of Nuclear Facilities and Enforcement by the Regulatory Body, IAEA Safety Guide No. NS-G-1.3, IAEA, Vienna (2002)
3	INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Fuel Handling and Storage Systems for Nuclear Power Plants, IAEA Safety Guide No. NS-G-1.4, IAEA, Vienna (2003)
4	INTERNATIONAL ATOMIC ENERGY AGENCY, Design of Emergency Power Systems for Nuclear Power Plants, IAEA Safety Guide No. NS-G-1.8, IAEA, Vienna (2004)
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